

**Consideration of Comments on 2<sup>nd</sup> Posting of Determine Facility Ratings, System Operating Limits and Transfer Capabilities Standard**

**Background**

The Balance Resources and Demand Standard Drafting Team (BRD SDT) thanks all those who submitted comments with the second posting of the standard. The standard was posted from June 2–July 2, 2004, and the drafting team received comments from 98 individuals in 61 different companies. These commenters collectively represent all NERC Regions and 8 of the 9 Industry Segments.

After careful review and consideration of all comments received, the drafting team modified the standard and is posting two versions of the standard **for information only**. There is a red line version in the same format as the last posting of the standard – and a clean version, which reflects NERC’s adoption of a new format and numbering scheme.

Based on the comments received, the drafting team has done an **initial** modification of the standard. The drafting team is working on a validation of the methodologies for developing limits proposed in this standard and then will be conducting a preliminary field test. The drafting team will post the results of its validation and field test results in the ‘related files’ section of this standard. The drafting team will then make conforming modifications to the standard and will post it for industry comment.

Commenter	Organization	Industry Segment								
		1	2	3	4	5	6	7	8	9
“I” indicates a comment submitted by an individual  “G” indicates a comment submitted by one of the groups listed at the end of the table										
Dan Boezio	AEP	X		X			X			
RajRana	AEP	X		X			X			
Scott Moore	AEP									
Gary Hermon	AES	X								
Dale McMaster	AESO		X							
Ken Githens	Allegheny Energy Supply					X				

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Dave Acton	Alliant	X								
Ken Goldsmith	Alliant Energy	X								
Chuck Abell	Ameren	X								
Robert Blohm	Applied Statistician								X	
Peter Burke	ATC	X								
Deanna Phillips	BPA						X			
Fran Halpin	BPA						X			
Rich Ellison	BPA	X								
Dick Spence	BPA	X								
Jeff Newby	BPA	X								
Ed Riley	CAISO		X							
Wayne Kemper	CenterPoint Energy	X								
Doug Hils	Cinergy	X								
Alan Gale	City Of Tallahassee			X						
Bob Remly	Clay Electric Cooperative			X						
George Carruba	EKPC	X		X		X				
Howard F. Illian	Energy Mark, Inc.								X	
Jason Smith	Entergy	X								
Nat Stephens	Entergy	X								
Jerry Stout	Entergy	X								
Ed Davis	Entergy Services, Inc	X								

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Mark Henry	ERCOT		X							
Sam Jones	ERCOT		X							
Don McInnis	FPL	X								
Linda Campbell	FRCC		X							
Patti Metro	FRCC		X							
Mark Bennett	Gainesville Regional Utilities			X						
Roger Westphal	Gainesville Regional Utilities			X						
Dick Pursley	Great River Energy		X							
Darrel W. Richardson	Illinois Power Company	X		X						
Don Tench	IMO		X							
P.D. Henderson	IMO		X							
Russ Mills	IPL	X								
Peter Brandien	ISO-NE		X							
Ted Hobson	JEA	X								
Mike Gammon	KCPL	X								
Ben Sharma	Kissimmee Utilities Authority			X						
John Horakh	MAAC		X							
Gerry Arnason	Manitoba Hydro	X								
Robert Coish	Manitoba Hydro		X							
Joe Knight	MAPPCOR		X							
Chuck Whitley	MECS/METC	X								

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Gary Garfoot	MGE	X									
Paul Koskela	Minnesota Power		X								
Bill Phillips	MISO		X								
Al Riddle	MNPower	X									
John Swanson	Nebraska Public Power District		X								
Kathleen Goodman	NE-ISO		X								
Alan Adamson	New York State Reliability Council		X								
Guy Zito	NPCC		X								
Alan Boesch	NPPD	X									
Karl Tammar	NYISO		X								
Michael C. Calimano	NYISO		X								
Todd Gosnell	Omaha Public Power District		X								
Tom Washburn	Orlando Utilities Commission			X							
Tom Calabro	Orlando Utilities Commission			X							
Don Davenport	OTP	X									
Lee Kittelson	OTP	X									
Larry Larson	OTP	X									

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Bruce Balmat	PJM		X							
Joseph Willson	PJM		X							
Mark Kuras	PJM		X							
Albert DiCaprio	PJM		X							
Mignon Clyburn	Public Service Commission of South Carolina									X
Elizabeth B. Fleming	Public Service Commission of South Carolina									X
G. O'Neal Hamilton	Public Service Commission of South Carolina									X
John E. Howard	Public Service Commission of South Carolina									X
Randy Mitchell	Public Service Commission of South Carolina									X
C. Robert Moseley	Public Service Commission of South Carolina									X
David A. Wright	Public Service Commission of South Carolina									X
Philip D. Riley	Public Service Commission of South Carolina									X
Steve Wallace	Seminole Electric Cooperative				X					
Roman Carter	SGEM						X			
Joel Dison	SGEM						X			
Tony Reed	SGEM						X			
Lucius Burris	SGEM						X			
Clifford Shepard	SGEM					X				
Dan Becher	SIPC and HEC	X								
Marc Butts	Southern Company Services	X								

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Mike Hardy	Southern Company Services	X								
John Lucas	Southern Company Services	X								
Doug McLaughlin	Southern Company Services	X								
Roger Green	Southern Generation					X				
Carl Monroe	SPP		X							
Robert Rhodes	SPP		X							
Sydney L. Niemeyer	TxGenco					X				
Ed Miska	USACoE					X				
Darrick Moe	WAPA		X							
Howard Rulf	We Energies			X	X	X				
Tony Jankowski	We Energies			X	X	X				
Martin Trencce	Xcel Energy		X							
Michael McMullen	XcelEnergy	X								

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1. Do you agree with the change to Requirement 301 to keep CPM-1 and eliminate any second CPM?

**Summary Consideration:** Most industry commenters were in agreement that one measure is all that is needed. Some commenters suggested that CPS2 is a better 'limit' than CPS1. However, the work done by Nasser Jaleeli and Lou Van Slyck setting up the original CPS measures, indicated that for frequency control, CPS1 is the better measure – CPS2 was intended as a limit on the % of the time that ACE could be outside of defined limits, and was primarily intended to protect transmission, not frequency. This standard is limited to addressing frequency, and only CPS1 will bound frequency. CPS2 does not in any way bound frequency.

Commenter	Yes	No	Comments
<p>Kathleen Goodman; ISO-NE; #2</p> <p>Alan Adamson: NYSRC; #2</p> <p>Guy Zito (Group of 12); NPCC-CP9; #1,2</p>			<p>ISO-NE (NPCC) (NYSRC) disagrees with the fundamental premise that the Balancing Standard is frequency only. Large net unscheduled flows into and out of Control Areas due to large ACE values can have an adverse reliability effect on the transmission systems of other Control Areas.</p> <p>CPS 2 has been a far more relevant criterion than CPS 1 from an empirical point of view. While some have found it to be undesirable on a theoretical basis, we now have a large empirical compliance violation database to determine which criterion is, in fact more, effective. There is a need to include empirical verification, as well as the theoretical.</p> <p>CPS2 has been far more 'limiting' than CPS1.</p> <p>Some analyses have indicated that the CPS 2 constraint would assist frequency performance more than 80% of the time. While these short studies are anecdotal and not conclusive, they are probably indicative of what CPS 2 is achieving, and it agrees with intuition. Further analysis is needed. This concept is used to good advantage in the alternative metrics proposed in the attached.</p>
<p>The Balance Resources and Demand SAR established the scope for this standard. During the refinement of the SAR, industry commenters indicated the standard should be limited to frequency. Unscheduled flows should be addressed in other standards. The BRD SDT has asked the SDT for the Operate Within IROL standard to verify that either the IROL Standard or the SAR for an SOL Standard will provide incentive to minimize large net unscheduled flows between Balancing Authorities. This work may indicate a need for another SAR to place limits on ACE when frequency error is low but other reliability concerns are an issue.</p> <p>CPS2 was intended as a limit on the % of the time that ACE could be outside of defined limits, and was primarily intended to protect transmission, not frequency. This standard is limited to addressing frequency, and only CPS1 will bound frequency. CPS2 does not in any way bound frequency.</p>			

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<p>Bart McManus; BPA (Group of 6); #1,5,6</p>	<p>x</p>	<p>On an overall note, we do not understand why NERC would propose to relax industry requirements to balance resources and demand, and thereby maintain system frequency, particularly in light of the problems shown in the Eastern Interconnection leading to the August 14<sup>th</sup> Blackout.</p> <p>We request that no comments be thrown out due to not being associated with frequency. This standard is not simply a frequency standard; it covers much more than just frequency (this is in reference to responses to some comments in the last posting).</p> <p>In specific, we understand that this standard will be, in effect, replacing the CPS1, CPS2 and DCS from the NERC Operating Manual, Policy 1. However, throughout this standard there is no mention of the need for operating reserves, spinning or non-spinning. We feel that the ramifications of deleting all existing NERC requirements to carry Contingency Reserves and Spinning Reserves should be more fully evaluated on an industry wide basis before deciding to get rid of these basic requirements for reliable power system operations. If reserves are no longer required, economic drivers would result in many companies carrying fewer (if any) Contingency Reserves or Spinning Reserves; thereby degrading system reliability. Additionally, all of the historic frequency data showing recovery from contingencies was gathered from interconnections in which the minimum amounts of available Spinning Reserves and Contingency Reserves are regulated by NERC Requirements. If these historic levels of Contingency and Spinning Reserves are no longer maintained in each, then the historically gathered frequency data can no longer be counted on as a guide to us in our efforts to determine the Interconnection specific Frequency Abnormal Limits (FAL), Frequency Trigger Limits (FTL) and Frequency Relay Limits (FRL) upon which all of the Compliance Measures in this Balance Resource and Demand Standard are dependent. Given that the Western Interconnection is electrically so much smaller than the Eastern Interconnection, we have found that we are dependent upon Frequency responsive reserves being the key factor that arrests the frequency declines associated with disturbances; thereby keeping it from dropping 'too low.' Reliable operation of the WECC in response to a system disturbance is also dependent upon the Frequency Responsive Reserves within the interconnection to respond instantaneously; thereby enabling the frequency within the WECC to "rebound" back into an acceptable operating range. In the extreme case, in which few if any Frequency Responsive Reserves are being carried in the WECC, a relatively small single contingency could lead to extremely low system frequency, and potentially under frequency load dropping.</p> <p>CPM-1 is a very long-term performance measure. It does not do anything for contingency conditions. This is because the one year time frame upon which this measure is based is so long that the effects upon this measure of large deviations in ACE that were allowed to continue over prolonged periods of time would be "diminished",</p>
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		<p>“washed-out”, and otherwise masked by the overwhelming number of other timeframes also captured in the measure. Therefore, we feel that CPM-1 must be supplemented with a measure that gets at the shorter-term issue of “did the party experiencing the disturbance proactively do that which is necessary to recover in the necessary time frame. The second standard, BAAL vs. FTL, allows a company to not recover from a contingency. We understand the desire to have two fairly simple limits for balancing resources and demand, but contingency conditions are outside the realm of normal operations and need to be treated differently. Therefore, we strongly recommend bringing back the concept of a separate Disturbance Control Standard type of measure as a part of Standard 300 in order to insure all Balancing Authorities fully recover from contingencies immediately after they occur, rather than riding the ties and waiting for the next scheduling window before taking actions to recover.</p>
<p>The SDT does not intend to relax the existing requirements for balancing resources and demand. The intent of the new measures in the proposed standard is to have more technically justifiable measures than the measures currently used. During the development of the SAR for this standard, industry commenters indicated that this standard should not include a reserve requirement. The expectation is, however, that some Regions will establish more specific reserve requirements that are applicable to their Regions. As you suggested, the reserve requirement for WECC may be very different than a reserve requirement for ERCOT.</p> <p>If there is a significant frequency impact to a contingency, then the BA should exceed one of its BAALs, and must recover to a point within its BAAL in time less than BAAL <math>T_v</math>. If the BA doesn't recover within BAAL <math>T_v</math>, then the BA is in violation and must report its poor performance to its Compliance Monitor.</p> <p>There were several commenters who indicated a concern with CPM1 being a 'long-term' measure rather than a 'short-term' measure. The SDT will ask the industry if there is support for having CPM1 compliance be measured on a monthly basis as well as a 12 month rolling average basis.</p> <p>BAAL is intended as a short term measure with specific recovery requirements (return to within BAAL within BAAL <math>T_v</math>) from all abnormal ACE operations that adversely impact frequency, including contingency events. The sanction associated with operating outside BAAL should provide Balancing Authorities with incentive to operate close to their CPM-1 boundaries, with some extra 'operating space' to allow for the swings that occur with load shifts caused by things such as large steel mills coming on/off line. This was intended to be a measure that would replace DCS. The challenge is to encourage the use of the benefits if interconnected operations by not punishing a Balancing Authority that has steel mills or similar loads, while also encouraging each Balancing Authority to make a good faith effort at using the resources at its discretion to minimize the adverse impact of those load swings on the rest of the interconnection. The targeted research and field testing for this standard should provide definitive answers to the question of whether operating within BAALs is a better or worse performance measure when compared to DCS.</p> <p>DCS is problematic because DCS requires the BA to take action for every contingency, even if those actions hurt frequency, while at the same time ignoring ACE deviations that do hurt frequency but aren't associated with contingency events such as the ramps associated with 16 hour energy blocks.</p> <p>The operational and financial impacts of unscheduled flows should be addressed by other standards since they do not directly impact the reliability focus of this standard, which is on controlling frequency.</p>		

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Al DiCaprio; MAAC (Group of 4); #2		x	MAAC supports the concept that BAs should maintain control that ‘averages’ near zero over time. Using the CPM requires at least two measures. MAAC supports the concept of using a 60 minute MW-Hz metric. The 60 minute averaging period would provide the added ability to cross check metered values with billing meter values.
Most industry commenters indicated that one measure is all that is needed. The SDT would have accepted a CPM-60 measure if there were sufficient industry consensus, but there is little support for CPM-60 at this time.			
Howard F. Illian; Energy Mark, Inc.; #8	x		The second CPM was intended to enforce something called a frequency profile. Research completed since the development of the “frequency profile” concept has demonstrated that the enforcement of a profile will not improve reliability, but may affect economic equity. Therefore, the inclusion of a second CPM in a reliability standard is inappropriate.
Most commenters agreed with your position, and the standard will have only one CPM.			
Linda Campbell; FRCC (Group of 12): #1,2,3,4	x		We agree since there is a change to variable BAAL limits.
Most commenters agreed with your position, and the standard will have only one CPM.			
Ed Davis; Entergy Services; #1	x		<p>One CPM is adequate to specify a performance curve in a normal distribution. It seems that in the future, the distribution could become skewed by various market-clearing time frames and by market-compensation mechanisms that inadvertently provide incentive to always under-schedule or over-produce, but for the next 3 or 4 years this should be adequate. Probably a study should be commissioned every year to validate that the distribution has remained “normal”.</p> <p>Overall, our interpretation of the new process is that it will drive long-term ACE averages to the lowest economic generation plus penalties values to, or just greater than, FTLlow, or epsilon-1. Also, we expect the new process will result in a profile with greater variation than that using today’s measures.</p>
The suggestion to do an annual review of the performance curve is good – and should be handled by the Resources Subcommittee. We have forwarded your suggestion to them.			
It isn’t clear if having one CPM will drive long-term ACE averages to a lower level than experienced today. There is little expectation that a single CPM will decrease the variation in frequency error unless the epsilon 1 limit used in the CPM calculation is lowered. The SDT expects			

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that having BAs comply with BAAL limits will provide better frequency control on a short term basis because as the frequency error gets larger, BAALs change to become more constraining on ACE.			
Robert Blohm; Applied Statistician; #8	x		(See Attachment 1)
(See responses to Attachment 1)			
Karl Tammar; ISO-RTO (Group of 9); #2	x		<p>The IRC is in agreement that the second CPM measure is not required.</p> <p>The IRC strongly supports the SDT's recommendation (Introduction, page 14) regarding field testing. The IRC recommends that the standard have both a passive field test and an active field test prior to full implementation and compliance measurement. The passive field test would actually monitor against the new standard while keeping the current CPS1 and 2 criteria in effect for compliance monitoring. This would allow NERC and the industry to examine the new standard data and make empirical judgments as to whether the standard requirements were at the correct thresholds/requirements. Based upon the passive test results the measures should be revised if necessary to reflect data analysis. The active monitoring would have the new standard in place (with the revised measurements/requirements if necessary), but continue to monitor the CPS1, CPS2 and DCS standards passively. Once all data is collected and reviewed, then the standard should be implemented for compliance with any adjustments made based upon the analyzed data.</p>
Extensive field testing will be needed for this standard. Having both a passive (monitoring of new measures while controlling with old measures) and an active field test can be accomplished with most BAs using the old standard and a small set of BAs using the new standard. The SDT will develop a field test plan with acceptance criteria and post this for comment before it is implemented.			
P.D. Henderson; IMO; #2	x		<p>a)The IMO is in agreement that the second CPM measure is not required. It is recommended that the standard have both a passive field test and an active field test prior to full implementation and compliance measurement. The passive field test would actually monitor against the new standard while keeping the current CPS1 and 2 criteria in effect for compliance monitoring. This would allow NERC and the industry to examine the new standard data and make empirical judgments as to whether the standard requirements were at the correct thresholds/requirements. Based upon the passive test results the measures should be revised if necessary to reflect data analysis. The active monitoring would have the new standard in place (with the revised measurements/requirements if necessary), but continue to monitor the CPS1, CPS2 and DCS standards passively. Once the field test is completed and data analyzed, then the</p>

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		<p>standard should again be reviewed. The final implementation should only be made upon a thorough review based on agreed consensus.</p> <p>b) Sufficient time needs to be allotted to allow the required software changes before the testing or implementation can go ahead.</p>
<p>Most commenters agreed with your position, and the standard will have only one CPM.</p> <p>Extensive field testing will be needed for this standard, however specific requirements have not yet been developed. Having both a passive (monitoring of new measures while controlling with old measures) and an active field test can be accomplished with most BAs using the old standard and a small set of BAs using the new standard. The SDT will develop a field test plan with acceptance criteria and will post this for comment before it is implemented.</p> <p>Note that the SDT did use some existing data to run some 'simulations' to see what affect the new BAALs would have on BAs. This data is posted in the "related files" section of the Balance Resources and Demand Standard on the NERC web site. Targeted research will be performed to validate the concepts and formulas used in the standard prior to field testing.</p> <p>Note that with this standards development process, balloting does not take place until after all field testing has been accomplished, and the results of the field tests have been analyzed to determine if changes are needed to the standard. The results of all field testing, and any changes to the standard made as a result of the field testing, are posted for industry review prior to balloting. When each standard is balloted, an 'Implementation Plan' is posted with the ballot. The implementation plans allow time for the development of any necessary tools and for any necessary training before compliance will be enforced. The software changes needed for field testing are not expected to be extensive. Software for CPM1 already exists – so the only additional software needed is for the calculation of BAAL.</p>		
<p>Michael C. Calimano; NY-ISO; #2</p>	<p>x</p>	<p>The NYISO strongly supports the Standard Drafting Team's ("SDT") recommendation (Introduction, page 14) regarding field testing. Both passive and active field tests should be done prior to full implementation and compliance measurement. Monitor new standard while keeping the current CPS1 and CPS2 criteria in effect for compliance would allow NERC and the industry to examine the new standard's data and judge the adequacy of the requirements and thresholds.</p> <p>The NYISO has reservations with the fundamental premise of a Balancing Standard that is frequency based only. Tie line biasing is designed to define an appropriate proportional contribution to interconnections frequency control. ACE monitoring gives a clear indication of which balancing areas are contributing to a frequency error. In addition, large net unscheduled flows into and out of control areas due to large ACE values can have an adverse reliability effect on the transmission systems of other control areas.</p>

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<p>Extensive field testing will be needed for this standard, however specific requirements have not yet been developed. Having both a passive (monitoring of new measures while controlling with old measures) and an active field test can be accomplished with most BAs using the old standard and a small set of BAs using the new standard. The SDT will develop a field test plan with acceptance criteria and will post this for comment before it is implemented.</p>			
<p>The Balance Resources and Demand SAR established the scope for this standard. During the refinement of the SAR, industry commenters indicated the standard should be limited to frequency. Unscheduled flows should be addressed in other standards. The BRD SDT has asked the SDT for the Operate Within IROL standard to verify that either the IROL Standard or the SAR for an SOL Standard will provide incentive to minimize large net unscheduled flows between Balancing Authorities.</p>			
Ed Riley; CA-ISO; #2	x		We agree with elimination of a second CPM, but we are in favor of retaining a metric similar to CPM-60 rather than CPM-1.
<p>Most industry commenters indicated that one measure is all that is needed. There was little industry support for CPM-60 and this is not being actively considered by the SDT at this time.</p>			
John Horakh; MAAC; #2	x		A second CPM seems to have very limited usefulness
<p>Most industry commenters indicated that one measure is all that is needed and the standard will include just one CPM.</p>			
Ken Goldsmith; Alliant Energy; #1	x		The second CPM doesn't gain anything over the one-minute CPM
<p>Most industry commenters indicated that one measure is all that is needed and the standard will include just one CPM.</p>			
Roman Carter; SCGEM (Group of 6); #5,6	x		
Doug Hils; Midwest ISO (Group of 15) #1	x		
Marc Butts; Southern Co Svcs (Group of 4); #1	x		
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Raj Rana (Group of 2); AEP; #1,3,6	x		

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Lloyd Linke (Group of 10); MAAP; #2	x		
Ken Githens; Allegheny Energy; #5	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
George Carruba: EKPC: #1,3,5	x		
Robert Rhodes; SPP ORWG (Group of 6); #1,2	x		
Alan Boesch; NPPD; #1	x		
Darrel W. Richardson; IL Power; #1,3	x		
Howard Rulf (Group of 2); We Energies; #3,4,5	x		

2. Do you agree with Requirements in 301?

**Summary Consideration:** Many commenters indicated that documenting instances of exceeding a BAAL for more than 30 seconds would be too much documentation – the 30 seconds was intended to eliminate telemetry errors or other false readings. Many commenters seem to think that there will be many instances of exceeding a BAAL, but the SDT expects that a BA won't have more than a few instances in a month – and there should be NO instances of exceeding BAAL for time greater than BAAL  $T_v$ . The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where  $T_v$  is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be any instances of exceeding BAAL for time greater than  $T_v$ , some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.

Commenter	Yes	No	Comments
Raj Rana (Group of 2); AEP; #1,3,6			Conceptually, we agree. However, the limits in Section 305 & 306 need to first be developed before agreeing 100% with this requirement.
Agreed. At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.			
Michael C. Calimano; NY-ISO; #2		x	The NYISO agrees with the requirement that holds a BA in violation if it exceeds an ACE or Frequency limit for more than thirty minutes. Data retention and recording requirements should only be required once the violation threshold has exceeded 30 minutes, not 30 seconds. Perhaps an alternative proposal for reporting and recording could be developed based upon field tests as described in question #1.
The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. The BA should operate so that it does not exceed either of its BAALs by the associated BAAL $T_v$ . BAs are expected to be able to maintain control so that they don't have any instances of exceeding their BAALs by time greater than $T_v$ for most months of each year. The SDT did modify the data retention requirement so the only type of documentation needed for a BAAL Event where $T_v$ is not exceeded, is the type of documentation you would normally have 'automatically' collected with some other type of automatic recording (date, time, magnitude and duration of event).			
Alan Boesch; NPPD; #1		x	The requirement to document each time the Area Control Error limit is exceeded for more than 30 seconds is onerous and without merit. It is a burden on those Control Areas (Balancing Authorities) with non-conforming load.
The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would			

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<p>normally have 'automatically' collected with a frequency chart or some other type of automatic recording (date, time, magnitude and duration of event).</p>		
<p>Bart McManus; BPA (Group of 6); #1,5,6</p>	<p>x</p>	<p>Each interconnection must be allowed to modify the ACE calculation in any way desired; as long as all BAs' ACEs in the interconnection sum to zero.</p> <p>As specified in this document, a BA's Frequency Bias is considered a single number, which is not the case for BA's that operate to variable frequency bias, as allowed by present NERC policy. Therefore, in order to be generally applicable to ALL BAs, the requirements for calculating CF must be modified, as required, to accurately reflect how to determine the specific Frequency Bias component that BAs operating to a variable frequency bias should use in their CF compliance measure. Should these BAs use the average of the frequency bias per minute be used? Or the average frequency bias for the year? Or some other value?</p>
<p>Interconnections must go through a formal approval process to modify reporting ACE (control ACE may be modified by individual BAs) calculations as was done (is being done) by WECC when implementing automatic time error correction. Furthermore, the sum of the ACEs within an Interconnection is not necessarily equal to zero (because of frequency bias); although the sum of the inadvertent must be equal to zero.</p> <p>The requirement for determining a BA's frequency bias and the formula for CPM1 in the proposed standard are both technically identical to existing operating policy. In the formula for CPM1, when determining CF<sub>1</sub>, the BA's frequency bias is the one minute average of frequency bias for that BA.</p>		
<p>Linda Campbell; FRCC (Group of 12); #1,2,3,4</p>	<p>x</p>	<p>We understand the intent of 301(a)(1) and the use of the word awareness. However, awareness can be very subjective and hard to really measure (see our response to next question).</p> <p>In 301(a)(2)(ii), The reporting of each violation could be burdensome to some entities that have a large industrial load capable of causing large ACE swings. In addition, with the time element of 30 seconds, smaller control areas will have very frequent documentation requirements, not just due to relatively large loads but also due to unit losses. To report all of these even when there is not a detriment to reliability may not be the best solution.</p> <p>Also, there is a requirement to report to the Compliance Monitor within 5 business days. Why 5 days? Is something expected to be done or is monthly just as good? Also, why wouldn't this be reported to the Reliability Authority?</p>
<p>The standard has been revised to eliminate the reference to maintaining 'awareness'.</p> <p>The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. BAs are not expected to exceed their BAAL T<sub>v</sub>, and most BAs will not exceed BAAL T<sub>v</sub> at any time in a year – so</p>		

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the requirement to report these instances shouldn't be overly burdensome. The SDT agrees that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where  $T_v$  is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be **any** instances of exceeding BAAL for time greater than  $T_v$ , some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.

The requirement to report to the Compliance Monitor within 5 business days rather than 5 days was to clarify what was intended – the entity filing the report has 5 business days rather than 5 calendar days. Exceeding a BAAL  $T_v$  is an extremely unusual event – most BAs are not expected to have any instances of exceeding a BAAL for time greater than  $T_v$ .

The RA should already be aware of any instance of a BA exceeding a BAAL for any length of time - so reporting any type of BAAL event to the RA shouldn't be necessary.

Robert Rhodes; SPP ORWG (Group of 6); #1,2		x	Real-time is capitalized in the first sentence in (a) (1). It should be lower case as in the rest of the standard. Systems cannot control fast enough to meet the continuous 30-second requirement in (a)(2)(i).
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Real-time is a defined term. The definition is being established in Standard 100 – Coordinate Operations. All uses of the term in this standard should have the first letter of the word capitalized.

BAs should be controlling so that the BAAL  $T_v$  is never exceeded. The '30 seconds' was intended to serve as a threshold for eliminating the need to report events that may be related to telemetry errors or other false readings, not as a time constraint for achieving balance.

Darrel W. Richardson; IL Power; #1,3		x	Comments: In 301 (2) (i) the limit of 30 seconds would seem to be to onerous. If the limit is at 30 seconds it would, in most cases, catch any time a piece of equipments is lost, a unit trips or possibly tie line excursions.
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The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' collected (date, time, magnitude and duration of event).

Karl Tammar; ISO-RTO (Group of 9); #2		x	The IRC agrees that the BA must monitor its control as a function of its BA limit, and that a BA is in violation if it exceeds that limit for more than thirty minutes. The data reporting and recording requirements are overly burdensome. Data retention and recording requirements should only be required once the violation threshold has been hit for more than 30 minutes and not 30 seconds. An alternative proposal for reporting and recording should be based upon field tests as described in question #1.
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The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. BAs are not expected to exceed their BAAL  $T_v$ , and most BAs will not exceed BAAL  $T_v$  at any time in a year –

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<p>so the requirement to report these instances shouldn't be overly burdensome.</p> <p>The SDT agrees that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be any instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p> <p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings.</p>		
Ken Githens; Allegheny Energy; #5		x See comment for question 15.
<p>See response to question 15.</p>		
Al DiCaprio; MAAC (Group of 4); #2		x MAAC does not agree that the BA shall be required to maintain documentation of every 30 second violation of its BAAL. If the definition of a BAAL has an associated 30 minute time requirement, then the measure should be directly linked to the 30 minutes not to 30 seconds.
<p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' collected with a frequency chart or some other type of automatic recording (date, time, magnitude and duration of event).</p>		
George Carruba: EKPC: #1,3,5		x We believe that requiring the BA to document each instance of exceeding a BAAL for 30 seconds or longer will present an undue burden on the BA. We have a steel mill that causes our ACE to fluctuate in magnitude suddenly during normal operation. Depending on frequency, we could see the situation where we are documenting multiple BAAL Events hourly with no impact on reliability of the bulk electric power system.
<p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' collected with a frequency chart or some other type of automatic recording (date, time, magnitude and duration of event).</p> <p>Nonconforming load that moves a BA's ACE outside of a BAAL may adversely impact the frequency performance of the Interconnection. The SDT is aware that there are many BAs with nonconforming loads, and part of the SDT's targeted research and field testing will analyze different types of BAs to see if the proposed standard would adversely impact different types of BAs, such as those that are very small, or those with nonconforming loads. The results of both the targeted research and field testing will be publicly posted for industry review.</p>		

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P.D. Henderson; IMO; #2		x	<p>The data reporting and recording requirements are overly burdensome. Data retention and recording requirements should only be required once the violation threshold has been hit for more than 30 minutes and not 30 seconds. An alternative proposal for reporting and recording should be based upon field tests as described in question #1.</p> <p>Requirement (a) (2) only requires a BA to take actions to balance resources and demand following its BAAL violation. Depending on the BA size, it could encourage large sustained <math>\pm</math> ACE (e.g. reference to "Introduction to the Balance Resource and Demand Standard – East BAAL Example" assuming a BAAL with frequency bias of -300 MW for a frequency deviation of 0.03 Hz the BA could have -1000 MW ACE and be within the BAAL limits)</p>
<p>The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p> <p>Requirement (a)(2) You are correct – this is not forbidden but the standard does not prohibit this. Requirement (a)(2) does allow BAs to operate with large imbalances as long as there is no impact to Interconnection Frequency. However CPM1 and the proposed inadvertent standard should motivate the BA to avoid operation with large imbalances. This combination of requirements should encourage the BA to operate with its ACE near zero.</p>			
Howard Rulf (Group of 2); We Energies; #3,4,5		x	<p><math>T_v</math> should be inversely proportional to size of BA or a fixed limit for all BA's in the interconnect.</p>
<p>BAAL <math>T_v</math> will be a fixed number for all BAs in the interconnection.</p>			

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<p>Peter Burke; ATC; #1</p>		<p>x</p>	<p>Why is the statement “maintain awareness” in this requirement? If “maintain awareness” is a requirement, why is failure to maintain awareness not among the definitions of non-compliance? This unfortunate choice of words unnecessarily complicates this standard.</p> <p>Suggested rewrite:</p> <p>“The BA shall perform real-time monitoring of its ACE and frequency.” (The reason not to include “maintain awareness” is that requirement 2 and 3 require that the BA maintain the ACE and frequency within all limits. Additionally, the reason why the first requirement is established is to require only that the BA monitor ACE and frequency in real-time.)</p> <p>Requirement 2 “real time” should be Real-time to maintain consistency in the standard.</p> <p>Why must the BA report exceeding an ACE limit to the compliance monitor? Shouldn't the BA report that to the RA who should be able to assist the BA in solving the problem?</p>
<p>The requirement to 'maintain awareness' has been modified so that only monitoring is required. This supports your suggestion.</p>			
<p>Real-time will be capitalized in the next version of this standard.</p>			
<p>The BA is reporting to the Compliance Monitor on an after the fact basis, not during the event. During the event, the RA should know that the BA is operating outside its BAAL because the RA is required to monitor each of its BA ACEs.</p>			

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Ed Davis; Entergy Services; #1	x	<p>Many of the Requirements contained in this standard are contained in the Measures and are more detailed in the Measure section requirement. We suggest:</p> <ul style="list-style-type: none"> <li>• Replacing the existing Requirement 3 with Measures 4 and 5 since Measures 4 and 5 are really Requirements.</li> <li>• Replace the existing Requirement (2) and (2)(i) with all of the Measure 2.</li> <li>• Replace the existing Requirement (2)(ii) with Measure 3 and add the 5-day reporting requirement to the new Requirement.</li> </ul> <p>Tv limited to 30 minutes is arbitrary. Tv should be determined using a study that should analyze the impact of Tv on reliability of the Bulk Power System rather than arbitrary limiting it to 30 minutes. Similarly there does not appear to be a justification of 30 seconds for BAAL. If there are going to be penalties imposed for exceeding the BAAL limits for more than certain limits these limits should be set based on the impact these limits will have on the reliability of the system rather than selecting them arbitrarily or as we had them in the past.</p> <p>Definitions of terms Balancing Authority Area Control Error Limit Event and Balancing Authority Area Control Error Limit Tv should not have limits included in them. The limits should be included in the measures and not in the definitions.</p>
<p>There is some confusion on where the 'details' belong. The original intent was to have the 'requirement' be a high level statement of the required performance, with a more detailed description of the desired performance in the 'measures' section. As this standards development process has evolved from industry comments, the distinction between the two sections of the standard has become increasingly less distinct. The Director-Standards has been informed of this situation, and the SDT will wait to make changes, based on his response.</p> <p>The targeted research should identify <math>T_v</math> – 30 minutes is just a 'best guess' at this time. <math>T_v</math> is the time that the probability of a second unit trip reaches 50%. It is interconnection-specific and will be determined by targeted research.</p> <p>The SDT decided to leave the 30-minute upper bound on <math>T_v</math> to be consistent with the IROL standard and to keep the reference to 30 seconds in the definition of BAAL Event. This keeps these definitions in alignment with definitions for the IROL Standard.</p>		
Ed Riley; CA-ISO; #2	x	
Guy Zito (Group of 12); NPCC-CP9; #1,2	x	
Kathleen Goodman; ISO-NE; #2	x	

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Alan Adamson; NYSRC; #2		x	
			<p>I wholeheartedly support the BAAL measure as the real-time half of a compact 2-measure set of the CPM-1 and BAAL balancing standards based on the common unifying principles of "covariance" and "bias share" which fully capture the "diversity" benefits of interconnected operations.</p> <p>I congratulate the drafting team for responding constructively to the criticism, made by Energy Mark/Howard Illian, myself and others, of the of the DEM for being ill-defined and interfering with CPM-1, and of the need to make the limit, applied to the AOM, bias-share and frequency dependent without needing any further "diversity factor" and of the need not to set the limit close to the CPM-1 limit nor have it take effect too suddenly. The currently proposed BAAL is such a limit, with the respective <math>T_v</math> allowance for enough time to adjust. This is the true innovation in this Balancing Standard, extending to real time the frontier of the methodology underlying CPM-1.</p>
Robert Blohm; Applied Statistician; #8	x		
<b>We appreciate your support.</b>			
Roman Carter; SCGEM (Group of 6); #5,6	x		
Doug Hils; Midwest ISO (Group of 15) #1	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Ken Goldsmith; Alliant Energy; #1	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Howard F. Illian; Energy Mark, Inc.; #8	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		

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Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
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3. Do you agree with the Measures in 301?

**Summary Consideration:** Several commenters indicated a degree of discomfort with these measures, and several modifications have been made. The measure associated with real-time monitoring has been modified. The measure that required documentation of all instances of exceeding a BAAL for longer than 30 continuous seconds has been modified – the only documentation required is that which is normally captured automatically – the date and time and magnitude and duration of the event. The requirement to report the actions taken to resolve each instance of exceeding a BAAL is only required if BAAL  $T_v$  is exceeded, and most BAs will not exceed BAAL  $T_v$ , so this should not be burdensome.

Commenter	Yes	No	Comments
Raj Rana (Group of 2); AEP; #1,3,6			Cannot fully endorse at this time. Sections 305 & 306 need to be completed first. The 30 second timing requirement may prove problematic, depending on the limits to be defined in 305 & 306.
The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings. Targeted research and field testing will need to be conducted before the limits defined in 305 and 306 can be finalized. At this point, the SDT is seeking endorsement of the concepts.			
Michael C. Calimano; NY-ISO; #2		x	Refer to the comment in Question 2.
See response to comment on Question 2.			
Alan Boesch; NPPD; #1		x	The measurement for documentation for exceeding Area Control Error for 30 seconds which includes actions taken to mitigate the event is without merit and is a burden for those entities that serve non-conforming load.
The documentation is associated with instances of exceeding a BAAL – not for exceeding ACE. The '30 seconds' was set to eliminate the need to document any event that may be associated with a telemetry error. There were so many commenters who indicated that this documentation requirement would be burdensome, that the SDT has changed the standard to reduce the type of documentation needed for instances of exceeding BAAL. In the revised standard, only the date, time, magnitude and duration of the event need to be documented – as long as the event is resolved within BAAL $T_v$ . Most entities have this data automatically recorded – the requirement to document the actions taken to resolve the event has been eliminated from the revised standard. Nonconforming load that moves a BA's ACE outside of a BAAL may adversely impact the frequency performance of the Interconnection. The SDT is aware that there are many BAs with nonconforming loads, and part of the SDT's targeted research and field testing will analyze different types of BAs to see if the proposed standard would adversely impact different types of BAs, such as those that are very small, or those with nonconforming loads. The results of both the targeted research and field testing will be publicly posted for industry review.			

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<p>Bart McManus; BPA (Group of 6); #1,5,6</p>		<p>x</p>	<p>Noncompliance with Operating within BAALs is too lenient. As described, the <math>T_v</math> is limited to 30 minutes; the chance of having a second contingency within 30 minutes is negligible so 30 minutes will probably end up being the <math>T_v</math> for all interconnections. Therefore, a BA can ride the interconnection for up to 30 minutes prior to being subjected to a level 1 noncompliance. This is too long of a time when one looks at how large that ACE can be for different frequency levels as shown in the graphs in the introduction.</p> <p>Noncompliance with the CPM requirement is also too lenient. This measurement is very easy for all BAs to meet the 100%; we feel that if a BA drops below 100% for their CPM-1, they should automatically be in Level 4 noncompliance with Levels 1-3 being not applicable for this.</p> <p>We also recommend that you revisit a measure concerning large ACE versus inertia overloads.</p>
<p>The targeted research should identify <math>T_v</math> – 30 minutes is just a ‘best guess’ at this time. <math>T_v</math> is the time that the probability of a second unit trip reaches 50%. It is interconnection-specific and will be determined by targeted research.</p> <p>The levels of non-compliance for CPM-1 were copied from the existing Operating Policy and its associated Compliance Template. Because most of the requirements and associated measures in this standard may change as a result of either targeted research or field testing, the SDT did not ask the industry for specific comments on non-compliance.</p> <p>The SDT is trying to establish a technical basis for establishing <math>T_v</math> – if you have a technical basis for establishing a different value or methodology for determining <math>T_v</math>, please provide your suggestion to the SDT during the next posting of this standard.</p> <p>This standard is limited to focusing on frequency; addressing overloads is outside the scope of this standard.</p>			
<p>Linda Campbell; FRCC (Group of 12); #1,2,3,4</p>		<p>x</p>	<ol style="list-style-type: none"> <li>1. As mentioned in our response to question 2, awareness seems hard to measure. 301(b)(1) seems to try and measure the awareness, but just getting someone to describe something may not really tell anything. Isn't the proof of the awareness really determined in the performance that is measured in the other areas of this standard? There is no specific non-compliance level associated with this measure so is this one really needed?</li> <li>2. 301(b)(3) states that the BA will report each instance of exceeding the BAAL for a time greater than <math>T_v</math>. Is this reporting within 5 business days as mentioned in 301(a)(2)(ii)? If so, we have the same questions identified in our response to question 2.</li> <li>3. We also have comments on the Compliance Monitoring Process for 301. In 301(d)(2) the retention period is unclear. The words say ..”for one calendar year (January-December) plus the current year.” We believe the intention is for the preceding calendar year and the current years data. The way it is written, one calendar year, could be any year selected by the BA. Also 301(d)(3)(iv) seems to be overly burdensome and not really serve any reliability purpose.</li> </ol>

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			<p>4. For 301(e)(2) how was the 15, 30 and 45 minute time limits over Tv chosen? Some of the supporting information for a Tv of 30 minutes, said anything over 30 increases the risk to the interconnection. What is the justification for the 15 minute intervals chosen?</p> <p>5. For 301(e)(3), for all 4 levels, don't they really apply to the 12 month rolling average of the one minute CPM?</p>
<p>The standard has been revised to eliminate the reference to maintaining 'awareness'.</p>			<p>The measure has been revised to indicate the BA is required to 'have' a report - this is the same report that must be sent to the Compliance Monitor within 5 business days of exceeding a BAAL's Tv. (See additional information provided with response to comment for question 2.)</p> <p>Your suggestions for improving the compliance monitoring will be adopted.</p> <p>The levels of non-compliance were revised, and the 15, 30, etc time limits were omitted. With the revisions made to the standard, these time periods are no longer relevant. Originally, these time intervals were intended to provide greater sanctions for events that persisted for a longer period of time – this reflects the increased threat to the reliability of the interconnection.</p> <p>For all 4 levels of CPM noncompliance do apply to the 12 month rolling average of one minute CPM.</p> <p>The SDT revised section 301(d)(3)(iv) to conform to the changes made to the associated requirement and measures. The revised text indicates that the BA must have documentation of the date, time, maximum magnitude and duration of each Balancing Authority Area Control Error Event.</p>
<p>Howard Rulf (Group of 2); We Energies; #3,4,5</p>		<p>x</p>	<p>Measures (1): Being able to answer a question does not demonstrate active real time monitoring. Demonstrating tools to calculate and monitor ACE and demonstrating being able to follow procedures/processes for monitoring BA ACE limits does. Measure (4) should be a one month rather than a 12 month CPM-1 with &lt;100% being non compliant and the levels of non compliance should reflect a one month CPM-1 not a 12 month rolling average.</p>
<p>The standard has been revised to eliminate the reference to maintaining 'awareness'. The revised standard does not require the Compliance Monitor interview the real-time system operators, but does require a demonstration of real-time monitoring.</p>			<p>Several entities recommended using a one-month rather than a 12 month CPM-1 and the SDT will include this in its field testing. For now, the 12 month rolling average will remain in the proposed standard, subject to change following the results of field testing and industry feedback.</p>
<p>Robert Rhodes; SPP ORWG (Group of 6); #1,2</p>		<p>x</p>	<p>Measures (1)(i) and (ii) are not clear in just what is being requested. Does this mean that ACE should, be within BAAL limits and interconnection frequency within frequency limits? If not, what are you looking for? These measures need clarification.</p> <p>What does the documentation of corrective actions taken, as measured in (2), add to the determination of whether you are operating within BAAL limits?</p> <p>See the response to Question 2 concerning the continuous 30-second measure in (2).</p>

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			<p>(Systems cannot control fast enough to meet the continuous 30-second requirement in (a)(2)(i).)</p> <p>What are the bounds on CPM-1? Knowing these limits will help in understanding the 100% requirement in Measure (4).</p>		
<p>ACE should be within BAAL and Interconnection Frequency should be within the Frequency Trigger Limits. The intent of this measure was to ensure that the BA had someone performing real-time monitoring of the current status of ACE with respect to its BAALs, and to monitor Interconnection Frequency with respect to the associated frequency limits.</p> <p>Documentation of corrective actions provides information that could be useful in determining how well this standard is working to motivate entities in controlling their portion of Interconnection Frequency. The SDT did modify the data retention requirement so the only type of documentation needed for a BAAL Event where <math>T_v</math> is not exceeded, is the type of documentation you would normally have 'automatically' collected with some other type of automatic recording (date, time, magnitude and duration of event).</p> <p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings.</p> <p>CPM-1 is a function of ACE times frequency error. The ACE values for which a BA will achieve 100% CPM compliance can be calculated from the CPM using the CF calculation found in this standard.</p> $CF_{1\text{-minute}} = \left( \frac{ACE_i}{-10 B_i} \right)_{1\text{-minute}} * \left( \frac{\Delta F_{1\text{-minute}}}{\epsilon_{1\text{-minute}}^2} \right)$ <p>Set CF = 1 and calculate the value of ACE for the frequency error range you are interested in , i.e. +/- 100 millihertz.</p>					
<p>Karl Tammar; ISO-RTO (Group of 9); #2</p>		<p>x</p>	<p>The IRC agrees that the BA must monitor its control as a function of its BAAL limit, and that the BA is in violation if it exceeds that limit for more than 30 minutes. The IRC believes that the 30 second reporting and recording requirement are onerous and requires further review based upon active and passive field testing as described in question #1.</p>		
<p>The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p>					

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Ken Githens; Allegheny Energy; #5		x	See comment for question 15.
See response to question 15.			
P.D. Henderson; IMO; #2		x	The IMO believes that the 30 second reporting and recording requirement are onerous and requires further review based upon active and passive field testing as described in question #1.
<p>The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p>			
Al DiCaprio; MAAC (Group of 4); #2		x	<p>Documentation of mitigation action associated with 30 second violations (301.b.2.i) is not relevant or even possible (reactions require minutes not seconds).</p> <p>The measures in 301 are HOWS (i.e. very specific regarding documentation requirements for reporting actions), but the levels of compliance seem to relate to WHAT (i.e. duration of violations). The measures and levels of compliance should be better linked.</p> <p>MAAC does not agree that there is a need to measure the Monitoring capabilities of a BA. Certification should ensure that the capability is there. MAAC does not believe that NERC needs a measure for monitoring 'Monitoring' and suggests that Measure 1 be eliminated.</p>
<p>The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p>			
<p>The SDT modified the requirement, measures and levels of non-compliance to try and improve their linkage.</p>			
<p>Certification does not measure any real-time activities – its focus is on whether an entity can demonstrate the 'capability' to operate reliably. The requirement to monitor was modified to remove the language that indicated the RA needed to 'maintain awareness'.</p>			
Peter Burke; ATC; #1		x	Measure 1: The wording of this measure is unclear about whether compliance would be

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		<p>determined through reporting or auditing. That uncertainty might be cleared up in the definition for non-compliance but this measure is not addressed among the definitions of non-compliance, which suggests this is possibly not a measure or a requirement. Compliance to this measure might be best determined through an audit by the Compliance Monitor.</p> <p>Measure 2: The requirement states that the BA has to document only that it exceeded an ACE Limit for greater then 30 seconds continuously. The Measure adds that actions performed must be documented. The measure, then, exceeds the requirement. This could be remedied by removing the words “to support its actions”.</p> <p>It’s worth considering whether the standard should include requirements for reporting and documentation. These requirements can be burdensome for the BA. As an alternative, the standard could rely on “evidence” instead of “documentation.” This would be consistent with a standard that measures performance of operations as opposed to a standard that measures performance of document preparation. If the purpose of the standard is to establish documentation requirements, then the compliance sections of the standard should be similarly focused on documentation.</p>
<p>Measure 1 has been modified and no longer requires interviewing a system operator. This was intended to be measured through periodic audits or through triggered investigations.</p> <p>The documentation requirement and measure were changed so the only type of documentation needed for a BAAL Event where <math>T_v</math> is not exceeded, is the type of documentation you would normally have ‘automatically’ recorded (date, time, magnitude and duration of event). The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where <math>T_v</math> is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn’t be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified.</p>		

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Ed Davis; Entergy Services; #1		x	<p>The Measure in 301:</p> <p><b>“(b) Measures</b></p> <p>(1) The Balancing Authority shall demonstrate active real-time monitoring by being able to answer the following questions: (i) Describe Area Control Error in relation to Balancing Authority Area Control Error Limits. (ii) Describe interconnection frequency with respect to the Frequency Limits.”</p> <p>appear to be somewhat vague.</p> <p>How does being able to answer a question on the definition of ACE vs. BAAL <u>demonstrate</u> active real-time monitoring? It would seem that demonstration of active real-time monitoring would include active EMS alarms with correct setpoints, or clearly documented periodic ACE readings every 5 or 10 minutes in operator logs. The same concept would be true for frequency</p> <p>Measure 1 should include a demonstration of the ability of the BA to measure real-time ACE, frequency, and alarming of ACE with respect to BAAL and its respective limits.</p> <p>Measure 2 should measure how well the BA documents and reports his conformance with documentation and reporting requirements contained in Requirement 2.</p> <p>Measure 3 should measure if the BA calculates and reports CPM-1.</p> <p>Measure 4 should measure how well the BA maintains CPM-1.</p>
<p>The first measure was modified to include demonstration of real-time monitoring of ACE and Frequency. There were several commenters who did not agree with this measure, and it has been modified to omit the ‘questions.’ Because the standard doesn’t require alarming, the measure wasn’t modified to include a demonstration of alarming. How monitoring is done is up to each BA.</p> <p>There is a measure to calculate and report CPM-1.</p> <p>There is a measure of how well the BA maintains CPM-1.</p>			
Ed Riley; CA-ISO; #2		x	

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Kathleen Goodman; ISO-NE; #2		x	
Guy Zito (Group of 12); NPCC-CP9; #1,2		x	
Alan Adamson; NYSRC; #2		x	
Robert Blohm; Applied Statistician; #8	x		<p><i>Simple derivation of the BAAL formula from the CPM-1 formula.</i> The BAAL formula is derived from the following formula for the CPM-1 limit curve:  <b>CPM-1 Limit:</b> <math>Avg_{1\text{-year}}(ACE \times \Delta F) = -10 \times Bias \times \epsilon^2</math>  by doing three things to it:  1. Substituting <math>(FTL - F_{\text{scheduled}})</math> for <math>\epsilon</math>, and plugging in <math>FTL_{\text{high}}</math> to get the upper curve and <math>FTL_{\text{low}}</math> to get the lower curve;  2. Making it a 1-minute "real" time measure by removing the 1-year averaging;  3. Dividing both sides of the equation by <math>\Delta F</math>.  Accordingly, the BAAL formula is:  <b>BAALimit:</b> <math>ACE = -10 \times Bias \times (FTL - F_{\text{scheduled}})^2 / \Delta F</math> .</p> <p>This makes for an elegant set consisting of the CPM-1 limit curve and the BAAL curve unified by the same underlying "bias share" and "covariance" principles.</p> <p>Page 6, (e) (3). Non-compliance with CPM-1 Requirement is mathematically ungrammatical and should be rewritten in this format:</p> <ul style="list-style-type: none"> <li>(i) Level 1: 95 % &lt; The one-minute Control Performance Measure &lt; 100</li> <li>(ii) Level 2: 90 % &lt; The one-minute Control Performance Measure ≤ 95%</li> <li>(iii) Level 3: 85 % &lt; The one-minute Control Performance Measure ≤ 90%</li> <li>(iv) Level 4: The one-minute Control Performance Measure &lt; 85%</li> </ul> <p>Page 5, (d) (3). BA should have documentation available within 5 days of a request as part ALSO of a spot review.</p>
<p>Your presentation of the derivation of the BAAL formula is correct.  The terminology in the levels of non-compliance have been modified as suggested and combined with other suggestions.</p>			

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A Spot Review is an abbreviated audit and doesn't seem appropriate for these requirements.			
			<p>The measures in 301 require continuous control to be provided to maintain frequency within an acceptable distribution of error, CPM-1. In those cases where the error distribution is unlimited, the distribution tails, the BAAL overrides the CPM-1 measure insuring that the frequency error remains within a reliable region of operation at an acceptable level of risk. These two measures together provide a very simple and very effective measure of the quality of frequency control. Together they guarantee interconnection reliability with respect to resource and demand imbalances as long as all of the participants continue to meet the measures.</p> <p>The current draft of the standard requires a BA that exceeds its BAAL only to return its ACE to within its BAAL within time Tv. It leaves the enforcement of how long a BA can have a large ACE that does not exceed its BAAL to CPM-1. If the industry shows significant concern about the elimination of the old Disturbance Control Standard (DCS), then this standard can be changed to require a BA to return within their CPM-1 = 100% limit within time Tv. This will make a BAAL violation response appear to be similar to the old DCS response to disturbances. This would make the BAAL similar to the old DCS, but would have the advantage that it would apply to all large ACE errors (ACE errors that exceed the BAAL), not just those errors that are caused by the loss of a large resource(s). This inequity in the application of the old DCS has long been considered a limitation of that measure and is corrected by the new BAAL.</p>
Howard F. Illian; Energy Mark, Inc.; #8	x		
Following field testing, the standard may be modified as suggested.			
Darrel W. Richardson; IL Power; #1,3	x		If the response to Question 2 is addressed.
See response to question 2.			
Ken Goldsmith; Alliant Energy; #1	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
George Carruba: EKPC: #1,3,5	x		

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Roman Carter; SCGEM (Group of 6); #5,6	x		
Doug Hils; Midwest ISO (Group of 15) #1	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		

**4. Do you agree with SDT that given August 14, the RA should be held accountable for achieving results, not just for taking some actions?**

**Summary Consideration:** While most industry commenters indicated support for this change, there are still several entities that do not want to hold the RA accountable when entities under the RA's control do not act as directed.

Commenter	Yes	No	Comments
Doug Hills; Midwest ISO (Group of 15) #1			The non-compliance levels aren't clear on what the BAs are required to do to "support" frequency on average. If all BAs except for one are on the "good" side of the BAAL curve, will they be required by the RA to take additional action?
The standard has been revised to clarify that the RAs in an interconnection need to coordinate their actions so that the RA Area with the BA(s) operating outside their BAALs will be directed to act first – and other BAs that are operating on the 'good' side of their BAAL curve will not be asked to make changes except in extreme situations.			
Bart McManus; BPA (Group of 6); #1,5,6		x	This should have gone back out for comment as was previously posted in order to give the industry the option of commenting on it.
The intent in asking this question was to do just that – to obtain industry comment to guide the SDT's direction. The SDTs try to coordinate their actions with other SDTs, and since August 14, most industry commenters have indicated that the RA should be held accountable for preserving the reliability of the interconnected grid.			
Linda Campbell; FRCC (Group of 12): #1,2,3,4		x	We do not completely agree with this until such time that the RA has direct physical control of all BA facilities in their RA area. The RA should be measured only against the actions they can actually control. The BA's should have the appropriate measures and sanctions to ensure they follow through with the directives of the RA.
Some RAs may never have direct physical control over all BA facilities in their RA Area. The RA does have other 'tools' available for controlling frequency – as an example, the RA could direct TOPs to shed load to support interconnection frequency. BAs should be sanctioned under other requirements in this standard.			
Although the RA may not have control over all its BAs, the RA does have authority over all its BAs and TOPs. The RA should have agreements in place (as part of RA Certification) with all these entities to specify that those entities must act in accordance with the RA's directives.			
Ed Davis; Entergy Services; #1		x	The RA has no generation, nor ability to directly control generation, nor direct control over load with which to preserve frequency. Entities should be held accountable for what they can control. Therefore, we disagree with holding the RA responsible for preserving interconnection frequency.  The RA should be held accountable for actions he can control as delineated in the Functional Model, like monitoring, identifying, communicating, directing, etc. The RA should be held responsible and accountable for performing the actions he is required to

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			perform in “preserving interconnection frequency”. The RA should be measured and penalized for not performing the actions under his control to preserve interconnection frequency.
<p>Some RAs may never have direct physical control over all BA facilities in their RA Area. The RA does have other ‘tools’ available for controlling frequency – as an example, the RA could direct TOPs to shed load to support interconnection frequency. BAs should be sanctioned under other requirements in this standard. Although the RA may not have control over all its BAs, the RA does have authority over all its BAs and TOPs. The RA should have agreements in place (as part of RA Certification) with all these entities to specify that those entities must act in accordance with the RA’s directives.</p> <p>The revised standard does sanction the RA for not taking actions, and also sanctions the RA for not achieving the desired goal of controlling frequency so it stays within limits.</p>			
Peter Burke; ATC; #1		x	<p>The RA should be held accountable for directing and verifying that the BA is maintaining the proper ACE and frequency. It’s overreaching for this standard to hold the RA responsible to preserving interconnections frequency. It’s the BA’s responsibility to maintain and direct, within its area, the balance of load to generation. It’s also the BA’s responsibility to order the Load Serving Entity and / or the Distribution Provider to shed load.</p> <p>The RA needs to be held accountable for monitoring ACE and frequency for the wider area, and the RA should be held accountable for directing and assisting the BA to maintain its area ACE and frequency, but the RA does not have the responsibility or the power to control its area ACE and frequency without working through the BA. It would be a misplacement of responsibility to hold the RA accountable for failures on the part of the BA.</p>
<p>Some RAs may never have direct physical control over all BA facilities in their RA Area. BAs should be sanctioned under other requirements in this standard. The RA does have other ‘tools’ available for controlling frequency – as an example, the RA could direct TOPs to shed load to support interconnection frequency. The BA doesn’t know how much its performance is affecting interconnection frequency – only the RA has the information needed to determine which BA’s performance, if any, is impacting interconnection frequency in a manner that requires immediate attention. Each individual BA will know whether its ACE performance is within its BAALs, but if the performance is outside BAALs, the BA won’t know if its performance is being offset by other BAs or not.</p> <p>The RA has to issue directives and maintain an active awareness of the resolution of any problem. If the RA directs BAs to take actions and the BAs aren’t able to achieve the required results, then the RA must take other actions, up to and including directing the TOP to shed load/have the DP shed load.</p> <p>Under the Functional Model, the BA may not have transmission data and may not be in a position to order the DP to shed load. Under many scenarios, the BA asks the RA for assistance, and the RA directs the TOP to shed load/have the DP shed load.</p>			
Howard Rulf (Group of 2); We Energies; #3,4,5		x	Frequency is the primary responsibility of a BA. The RA is responsible to direct the BA that is contributing to the FTL excursion to take corrective action and it is the BA’s responsibility to take corrective action.

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<p>The BA only sees interconnection frequency and its own ACE – the BA doesn't see the ACE values of other BAs in its Interconnection. Only the RA has data to show both Interconnection Frequency and the ACE values of all the BAs in the Interconnection.</p>			
Raj Rana (Group of 2); AEP; #1,3,6		x	The RA can only issue directives. The RA has no actual control over the frequency. The RA should be held accountable for issuing proper and clear directives. The BA should be held accountable for implementing those directives.
<p>The RA has to issue directives and maintain an active awareness of the resolution of any problem. If the RA directs BAs to take actions and the BAs aren't able to achieve the required results, then the RA must take other actions, up to and including directing the TOP to shed load/have the DP shed load.</p>			
George Carruba: EKPC: #1,3,5		x	
Howard F. Illian; Energy Mark, Inc.; #8	x		These standards and measures as written provide not only for the RA to take action when reliability is threatened, but they also provide a technical basis for the RA to intervene on an anticipatory basis when the limits are being approached but not exceeded. This is provide by the BAAL limit which is based on maximum proportional risk. However, great care must be taken when the RA is evaluated as a super BA (the net sum of the ACEs of its BAs) as it is in the draft standard. Care must be taken because evaluating the RA as a super BA can result in hidden requirements that are unintended. One such requirement could encourage the RA to instruct its BAs to take a preventive action to mitigate a potential compliance penalty, when the appropriate action may be to wait while the offending BA is given the opportunity to correct the problem. Hidden requirements resulting from evaluating the RA as a super BA could result in over-reaction to interconnection disturbances and frequency instability.
<p>The standard has been revised to remove the language that referenced the 'sum of the BA ACEs'. Additional language has been added to more clearly specify the conditions under which the RA can direct a BA to take actions. The revised standard does give the BA a chance to correct its ACE up to the point where BAAL Tv has been exceeded.</p>			
Kathleen Goodman; ISO-NE; #2	x		Both parties need to have a certain level of accountability.
<p>Agreed.</p>			
Robert Blohm; Applied Statistician; #8	x		The RA can arrange through contracts to pass through to (offending) constituent BAs the costs incurred for being an RA, including accountability for results.
<p>Agreed.</p>			
Robert Rhodes; SPP ORWG (Group of 6); #1,2	x		Providing the BA follows the RA's directives.
<p>If the BA does not follow the RA's directives, the BA will be sanctioned under requirement 303.</p>			
Karl Tammar; ISO-RTO (Group of 9); #2	x		The IRC agrees that the RA should be held accountable for results and not just for taking actions. However, the standard must specify which entities within the functional model

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			<p>(including the RA) hold which responsibilities. The council is also concerned that the standard either does not focus on, or is not coordinated with, other standards with regard to an entity taking unilateral action to correct a frequency problem that they did not cause. Taking unilateral action could have unwanted results. Instead, the offending party must take all actions up to an including load-shedding to correct the problem created within its footprint. Areas external to the problem should not take independent action to correct the problem, but rather offer its assistance, and be required to provide assistance if requested. This is a concept that is clear in the existing NERC policies, and should be clear within this standard or coordinated with another appropriate standard as well through a cross reference.</p> <p>The IRC recommends that this issue be reviewed with the developers of the Coordinate Operations Standard.</p>
<p>All of the new standards are being written with the assuming the existence of relationships between functions as described in the Functional Model, so restating the responsibilities from the Functional Model isn't necessary.                  The SDT modified the standard to clarify that the RA should not take unilateral actions for situations involving the entire Interconnection.                  The SDT has asked the IROL SDT to investigate coordination with this standard.</p>			
Al DiCaprio; MAAC (Group of 4); #2	x		MAAC agrees that the RA should be held accountable for results and not just for taking actions.
<p>This supports this standard.</p>			
Ken Goldsmith; Alliant Energy; #1	x		There needs to be a caveat in the wording "RA continues to direct actions to return interconnection frequency to within its Frequency Trigger Limits." The BA's need to have the same responsibility, to insure they take the appropriate action. The non-compliance levels aren't clear on what the BA's are required to do to "support frequency" on average. If all BA's except one are on the good side of the BAAL curve will they be required by the RA to take additional action?
<p>The requirements, measures and levels of non-compliance have all been modified to clarify the conditions under which the RA directs its BAs to take actions. The phrase, 'to support frequency' has been removed from the revised standard.</p>			
Guy Zito (Group of 12); NPCC-CP9; #1,2	x		Both parties need to have a certain level of accountability.
<p>Agreed – and this is what the standard tries to do.</p>			

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P.D. Henderson; IMO; #2	x		The IMO agrees that the RA should be held accountable for results and not just for taking actions. However, the standard must specify which entities within the functional model (including the RA) hold which responsibilities. The IMO is also concerned that the standard either does not focus on, or is not coordinated with, other standards with regard to an entity taking unilateral action to correct a frequency problem that they did not cause. Taking unilateral action could have unwanted results. Instead, the offending party must take all actions up to an including load-shedding to correct the problem created within its footprint. Areas external to the problem should not take independent action to correct the problem, but rather offer its assistance, and be required to provide assistance if requested. This is a concept that is clear in the existing NERC policies, and should be clear within this standard or coordinated with another appropriate standard as well through a cross reference.
All of the new standards are being written with the assuming the existence of relationships between functions as described in the Functional Model, so restating the responsibilities from the Functional Model isn't necessary. The SDT modified the standard to clarify that the RA should not take unilateral actions for situations involving the entire Interconnection. The SDT has asked the IROL SDT to investigate coordination with this standard.			
John Horakh; MAAC; #2	x		The RA should be responsible for preserving frequency by taking all actions possible
Agreed – this philosophy is supported in this standard.			
Alan Adamson; NYSRC; #2	x		Both parties need to have a certain level of accountability.
Agreed – this philosophy is supported in this standard.			
Alan Boesch; NPPD; #1	x		Your assumption about August 14 <sup>th</sup> is incorrect the RA is responsible for directing BAs to act, the BA is responsible for implementing corrective actions.
Most entities agreed with our statement that the RA should be held accountable for achieving results, not just for taking some actions.			
Michael C. Calimano; NY-ISO; #2	x		Both parties need to have a certain level of accountability. The Responsibility and accountability must be clearly defined. This issue should be reviewed and coordinated with the developers of the Coordinate Operations Standard.
Agreed that both parties need to have a certain level of accountability. The SDT has asked the IROL SDT to investigate coordination with this standard.			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		

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Ed Riley; CA-ISO; #2	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
Darrel W. Richardson; IL Power; #1,3	x		
Ken Githens; Allegheny Energy; #5	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		

5. Do you agree with the Requirements in 302?

**Summary Consideration:** Several commenters indicated a concern that this requirement lacked coordination between RAs. While the Coordinate Operations standard (requirement 103) does require RAs to coordinate actions with one another, the language in this standard has been clarified to identify the specific circumstances under which the RA must direct all its BAs to act, even if those BAs are not the cause of a frequency deviation. The revised standard indicates that the RA should direct its BA that is operating outside one of its BAALs for time greater than BAAL Tv to take actions to return ACE to within BAAL. The revised standard also includes language to clarify that when a FTL has been exceeded for time greater than FTL Tv or if a FAL has been exceeded for any length of time, each RA in the Interconnection should direct its BAs to take actions act in accordance with the action plan jointly developed with other RAs. Note that Standard 100 addresses, in more detail, coordination of actions between RAs.

Commenter	Yes	No	Comments
Peter Burke; ATC; #1			Change requirement 1 to read: The RA shall monitor ACE and frequency for all of the BAs within their area.  Regarding Requirement 4: who is the RA to report too?
			The RA needs to be cognizant of the actual interconnection frequency with respect to the associated high and low frequency trigger, abnormal and relay limits – these values are tied to the interconnection, not any individual BA. The RA needs to monitor its Interconnection Frequency, and the ACE for each of its BAs. The language in the proposed standard was simplified and is close to your suggestion. Requirement 4 was modified to state that the events need to be reported to the Compliance Monitor.
Michael C. Calimano; NY-ISO; #2		x	The NYISO agrees with the requirements except for section ii b, which may force some BAs to overgenerate. Direction by the RA to multiple BAs within the Reliability Authority Area to take action to support interconnection frequency must be clearly coordinated. Multiple BAs acting to correct frequency concurrently taking unilateral actions can be detrimental to the security of the Interconnection. This would be best addressed within the Coordinate Operations standard.
			The standard has been revised to add more specific language to indicate that for instances of exceeding a FTL for time greater than FTL Tv or for instances of exceeding FAL, the RA must follow the action plan jointly developed with other RAs. As revised, the standard clarifies that the only circumstance under which an RA may direct BAs operating within their BAALs to move their ACE to more conservative values, is in a declared emergency.  The Coordinate Operations standard is limited to coordination between two or more RAs and does not address coordination between BAs – so the SDT is assuming that you intended to indicate that it could be detrimental to the security of the interconnection to have multiple RAs acting unilaterally to correct a frequency deviation.
Linda Campbell; FRCC (Group of 12): #1,2,3,4		x	In 301(a)(2)(i), the RA must notify BA's in it's area that a FTL has been exceeded. This took us back to our question in 301 of why only the Compliance Monitor was notified when limits were exceeded. In 302(a)(2)(ii), the Frequency Trigger limit of Tv is mentioned. When reading this standard,

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			<p>one wonders where this <math>T_v</math> is set. Once you get to 305 we learn that the “Standards Developer” will establish this limit. We are uncomfortable with the idea of an undefined “Standards Developer” (see later comments).</p> <p>In 302(a)(2)(iii) the subject is the Frequency Abnormal Limit, but yet in ((c) and (d), the Frequency Trigger Limit is the subject. It looks like a copy and paste error needs to be corrected.</p> <p>In 302(a)(4), to whom does the Reliability Authority report the exceedences to?</p>
<p>The RA should have one or more EMS displays that show all its BAs’ real-time Ace values plotted against the associated BAALs. There should be no need for the BA to notify its RA that it has exceeded a BAAL – the RA should already know this.</p> <p>Under the Functional Model, the ‘Standards Developer’ is the entity that is responsible for developing standards, NERC.</p> <p>The intention was to take action at the Frequency Trigger Limit level to prevent ever exceeding a Frequency Abnormal Limit or Frequency Relay Limit.</p> <p>The standard has been revised to clarify that the RA reports exceedences to its Compliance Monitor.</p>			
Doug Hills; Midwest ISO (Group of 15) #1		x	<p>Clarification required regarding what the RA can direct. What if the RA frequency data indicates 30 continuous seconds however the BA’s does not.</p>
<p>The 30 seconds was intended to omit requiring actions for resolution of telemetry errors or other false readings. It is doubtful that within 30 seconds a system operator working for the RA will see the 30 second exceedance and have time to identify the offending BA and then contact that BA to direct that BA to take action.</p>			
P.D. Henderson; IMO; #2		x	<p>As detailed in question 4, the IMO is concerned that the party which caused a frequency deviation should be required to correct the deviation and if necessary request assistance in correcting the problem. Areas external to the problem should not take independent action to correct the problem, but rather offer its assistance, and be required to provide assistance if requested. This concept is a clearly specified within the existing NERC policies and should be carried forward in this standard.</p>
<p>Agreed. Several commenters made the same notation – and the standard has been revised to state more clearly the conditions under which an RA is to direct its BAs to take actions. The BA operating outside its BAAL will be directed to take actions to return its ACE to within BAAL. For instances of exceeding a FTL for time greater than <math>FTL T_v</math> or for instances of exceeding FAL, the RA must follow the action plan jointly developed with other RAs. As revised, the standard clarifies that the only circumstance under which an RA may direct BAs operating within their BAALs to move their ACE to more conservative values, is in a declared emergency.</p>			
Howard Rulf (Group of 2); We Energies; #3,4,5		x	<p>The role of the RA is to monitor the interconnect and the provide support and assistance to BA’s within its area. The RA should not be penalized except for not giving BA’s necessary direction. The RA monitors all BA’s ACE and directs those BA’s that are contributing to exceeding frequency limits to take corrective action. The RA should monitor frequency and BA’s real time ACE and not calculate all the BA real time limits. The RA should maintain only a record of frequency, BA ACE, direction given, and results of those directions. The RA should not be the official reporter of BA’s control performance.</p>

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<p>Under the Functional Model, the RA is responsible for ensuring the reliability of the interconnection – this requires more than just monitoring and providing assistance.</p> <p>To correct a frequency deviation, the RA may need to direct TOPs to take some actions, such as shedding load. The BA is not the only 'function' reporting to the RA.</p> <p>One of the important responsibilities of the RA that has been highlighted in this post-August 13 period, is the RA's responsibility to monitor beyond its immediate boundaries and be prepared to assist other RAs in preserving the reliability of the interconnection. If an RA sees interconnection frequency is outside its FTL, the RA should take action to determine which RA Area(s) is(are) causing the deviation and coordinate actions with that (those) RA(s) to resolve the frequency deviation. (This coordination is mandated under the Coordinate Operations standard.)</p> <p>The RA needs to see each of its BAs' ACE plotted against its BAALs – otherwise the RA can't determine which of its BAs (if any) are contributing to a frequency deviation.</p> <p>The data to be collected and reported provides a record of the event – and part of that record is identifying which BAs were not controlling their BA Areas to their BAALs.</p>			
Kathleen Goodman; ISO-NE; #2		x	The direction by the RA to multiple BAs within the Reliability Authority Area to take action to support interconnection frequency has raised concern throughout the industry. It may be detrimental to the security of the Interconnection to have multiple BAs acting to correct frequency concurrently.
<p>Agreed. Several commenters made the same notation – and the standard has been revised to state more clearly the conditions under which an RA is to direct its BAs to take actions. (Note that the SDT believes your comment was intended to state that it may be detrimental to the security of the Interconnection to have multiple RAs acting to correct frequency concurrently.) The standard has been revised to add more specific language to indicate that for instances of exceeding a FTL for time greater than FTL T<sub>v</sub>, or for instances of exceeding FAL, the RA must follow the action plan jointly developed with other RAs. As revised, the standard clarifies that the only circumstance under which an RA may direct BAs operating within their BAALs to move their ACE to more conservative values, is in a declared emergency.</p>			
Guy Zito (Group of 12); NPCC-CP9; #1,2		x	Concern has been raised about the direction by the RA to multiple BAs within the Reliability Authority Area to take action to support interconnection frequency. It may be detrimental to the security of the Interconnection to have multiple BAs acting to correct frequency concurrently.
<p>Agreed. Several commenters made the same notation – and the standard has been revised to state more clearly the conditions under which an RA is to direct its BAs to take actions. (Note that the SDT believes your comment was intended to state that it may be detrimental to the security of the Interconnection to have multiple RAs acting to correct frequency concurrently.) The standard has been revised to add more specific language to indicate that for instances of exceeding a FTL for time greater than FTL T<sub>v</sub>, or for instances of exceeding FAL, the RA must follow the action plan jointly developed with other RAs. As revised, the standard clarifies that the only circumstance under which an RA may direct BAs operating within their BAALs to move their ACE to more conservative values, is in a declared emergency.</p>			
Karl Tammar; ISO-RTO (Group of 9); #2		x	The IRC agrees with the requirements except for section ii b, which may force some BAs to overgenerate. The IRC recommends that this be addressed within the Coordinate Operations standard.
<p>The Coordinate Operations standard does address coordination between RAs. This standard has been revised to state more clearly the conditions under which an RA is to direct its BAs to take actions, and provides a specific reference to the Coordinate Operations standard.</p>			

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John Horakh; MAAC; #2		x	The two reporting requirements in 302 (a) (4) should be added into their respective sections 302 (a) (2) (ii) and 302 (a) (2) (iii), showing everything that must be done for a particular condition in one place
There are many ways of organizing the requirements, and while your suggestion has merit, most commenters seemed to accept the sequence provided, thus the suggested revision wasn't adopted.			
Alan Adamson: NYSRC; #2		x	Reporting requirements need to be re-visited.
Please be more specific in identifying any objections to the reporting requirements.			
Ed Davis; Entergy Services; #1		x	Frequency Trigger Limit $T_v$ is an undefined term. Please provide a definition.
The SDT will post a definition with the next draft of this standard.			
Ken Githens; Allegheny Energy; #5		x	See comment for question 15.
See response to question 15.			
Robert Rhodes; SPP ORWG (Group of 6); #1,2		x	<p>For comment on the continuous 30-second requirement in (2)(ii) and (4), see the response to Question 2.</p> <p>The Frequency Trigger Limit <math>T_v</math>, in Requirement (2)(ii), is not defined and should be.</p> <p>Depending on the BAAL and frequency limits that are employed, these requirements may be appropriate but the concern is that the RA would then be directing the BAs to move away from their optimal operating points, including being within their BAAL limits, at their expense in support of an interconnection problem elsewhere.</p>
The 30 seconds was intended to omit requiring actions for resolution of telemetry errors or other false readings			
The SDT will provide a definition of FTL $T_v$ with the next draft of this standard.			
The standard was revised to clarify the conditions under which an RA may direct its BAs to take actions – the intent was for the RA that has BAs operating outside their BAALs to direct its BAs to take actions – only in an emergency would other RAs direct their BAs to also take actions.			
Ken Goldsmith; Alliant Energy; #1		x	Clarification is required concerning what the RA can direct. In the event of a difference in the data between the RA and BA, which takes precedence (ie: frequency data at RA indicates 30 continuous seconds, however the BA does not)?
The 30 seconds was intended to omit requiring actions for resolution of telemetry errors or other false readings. It is doubtful that within 30 seconds a system operator working for the RA will see the 30 second exceedance and have time to identify the offending BA and then contact that BA to direct that BA to take action.			

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Robert Blohm; Applied Statistician; #8	x	Same as comments as to question 2. Plus: <i>Missing definition.</i> Page 1. Insert a definition of FTL $T_v$ , in particular this one: "Frequency Trigger Limit $T_v$ : The maximum time that the Frequency Trigger Limit can be exceeded before non-compliance by the Reliability Authority for maintaining frequency within abnormal limits. FTL $T_v$ shall be limited to 30 minutes."
<b>The SDT will provide a definition of FTL <math>T_v</math> with the next draft of this standard.</b>		
Al DiCaprio; MAAC (Group of 4); #2	x	MAAC agrees that the BA must monitor its control as well as the system frequency; and that the BA must balance its system with BAAL limits.
<b>The SDT appreciates your support.</b>		
Raj Rana (Group of 2); AEP; #1,3,6	x	why 30 seconds? What is the basis for the 30 seconds?  The Frequency Trigger Limit $T_v$ , in Requirement (2)(ii), needs to be defined first before evaluating this requirement.  Depending on the BAAL and frequency limits that are employed, these requirements may be appropriate but the concern is that the RA would then be directing the BAs to move away from their optimal operating points, including being within their BAAL limits, at their expense in support of an interconnection problem elsewhere.
<b>The 30 continuous seconds was intended to exclude telemetry errors or other false readings.</b>		
<b>The SDT will provide a definition of FTL <math>T_v</math> with the next draft of this standard.</b>		
<b>The standard was revised to clarify the conditions under which an RA may direct its BAs to take actions – the intent was for the RA that has BAs operating outside their BAALs to direct its BAs to take actions – only in an emergency would other RAs direct their BAs to also take actions.</b>		
Lloyd Linke (Group of 10); MAAP; #2	x	
Phil Riley (Group of 8); PSC of SC; #9	x	
Howard F. Illian; Energy Mark, Inc.; #8	x	
Darrel W. Richardson; IL Power; #1,3	x	
George Carruba; EKPC; #1,3,5	x	
Roman Carter; SCGEM (Group of 6); #5,6	x	

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Marc Butts; Southern Co Svcs Group of 4); #1	x		
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Ed Riley; CA-ISO; #2	x		
Alan Boesch; NPPD; #1	x		
Bart McManus; BPA (Group of 6); #1,5,6	x		

6. Do you agree with the Measures in 302?

**Summary Consideration: Many commenters suggested that the measures be revised to clarify the expectations and this has been done.**

- For a frequency error that is associated with a single RA's Area, any BA that is outside its BAAL should have the opportunity to correct that problem first as long as the frequency is within FTLs.
- The RA should not intervene unless the RA determines the BA will not be able to resolve the issue within BAAL Tv.
- If the RA can't resolve within its RA Area, then the RA should contact other RAs (in accordance with Requirement 103 in the Coordinate Operations Standard).
- Instances of exceeding FTL Tv or FAL would be Interconnection-wide Emergencies.

Commenter	Yes	No	Comments
Peter Burke; ATC; #1			Please reference question 3 for comments about measure 1.
<b>See response to question 3.</b>			
Bart McManus; BPA (Group of 6); #1,5,6		x	<p>The measures need to define, in more detail, specifically what the RA needs to do to direct BA's to modify their generation, load, schedules, etc. in order to bring frequency and/or ACEs back within acceptable levels.</p> <p>In the table, we do not understand why one of the RAs should direct its BAs to 'modify ACE' if the sum of the BAs' ACEs supports system frequency. In this type of situation, an already bad low frequency situation would be exacerbated if BAs that happened to be overgenerating and supporting a low system frequency were to follow RA directives to reduce generation more quickly than those BAs that were ordered to raise their generation in support of system frequency. In this case, ordering BAs to reduce generation has a very real possibility of making the situation worse with little or no potential to actually increase power system reliability. Should the RA order the BAs to increase generation in order to support system frequency, the BAs are being order to overgenerate even more although they are already overgenerating. The RA should be working with the other RAs and making the BAs that are causing the frequency to exceed the FTL take action to mitigate the interconnection problems. As these BAs raise their generation and frequency recovers, the operation and controls systems of the BAs whose ACE deviations served to support system frequency would naturally respond as required to maintain load/resource balance.</p>
<p>Since there are many different types of BAs, adding more details to the types of directives an RA may give its BAs does not seem warranted. The performance goal of controlling performance may be achieved through any means available to the RA and its associated BAs.</p> <p>The standard was revised to clarify the conditions under which an RA may direct its BAs to take actions – the intent was for the RA that has BAs operating outside their BAALs to direct its BAs to take actions – only in a declared emergency would other RAs direct their BAs to also take</p>			

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actions.		
The Coordinate Operations standard (requirement 103) requires the RAs to coordinate their actions as you've suggested. By clarifying the conditions under which the RA should direct its BAs to take actions, the revised Balance Resources and Demand standard works more cooperatively with the Coordinate Operations standard.		
Linda Campbell; FRCC (Group of 12): #1,2,3,4		<p>in 301(b)(3), again it seems to be mixing the FAL and FTL. Shouldn't there be more detailed measures (similar to those in (b)(2)) for FAL violations if they are more severe than FTL violations?</p> <p>We also have comments on the Compliance Areas:</p> <p>For 302(d)(2), would it be more clear to say ...."data for the preceding calendar year, plus the current year..." rather than "one calendar year....."?</p> <p>302(d) does not have any compliance monitoring steps for instances of exceeding the Frequency Abnormal Limit. Should it be included as well?</p> <p>For 302(e)(1)(i), (ii) and (iii), the word interconnection should be added for the frequency that is compared against the FTLs, FALs, etc.</p> <p>For the chart in 302(e)(2), the second, third and fourth rows really are dependent only on the actions of the BA, not what the RA has directed them to do. As went with our earlier comment, this does not seem to be appropriate for the RA's that do not have direct control over all of the BA facilities in their RA area. Also, the earlier question on the selection of the 15 minute intervals applies to this table as well.</p>
<p>The impact of exceeding either FTL <math>T_v</math> or FAL is the same – the interconnection has been placed at an unacceptable risk.</p> <p>The suggested language change for the compliance monitoring section will add clarity and has been adopted.</p> <p>The Compliance Monitoring section was revised to add 'Frequency Limit Violation Reports' to the list of documents the RA must have available to show its Compliance Monitor.</p> <p>The word, 'interconnection' was added as suggested.</p> <p>The levels of non-compliance were modified and no longer use the table referenced in your comment.</p>		
Doug Hills; Midwest ISO (Group of 15) #1		<p>x</p> <p>Data collection is burdensome and will contain a time skew from the source data</p>
The SDT recognizes that the original data collection was burdensome, and the standard has been modified to minimize the amount of data that is collected. When the RA is looking collectively at all the BA ACE values, there may be some small delay in transmitting data – however, within each BA, the frequency and ACE data should be synchronized. Since compliance will be based on the data submitted by the BA, there should be no time skew within a BA's set of data. The SDT will recommend to the CERT SDT that criteria be added to both the RA and BA Certification standards to minimize time skew by requiring synchronization of data as part of certification.		
Ed Davis; Entergy Services; #1		<p>x</p> <p>See comments on Measure 1 in 301, above. The same suggestions hold true for the RA.</p>

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			<p>This penalty matrix seems to imply a requirement that was not obvious in the standard. Apparently, a BA that has average ACE during a “frequency trigger” event that is within its BAAL bounds but not on the side of zero to support frequency is noncompliant. Of course, this is an RA measure, but if all of the RA’s BAs have achieved average ACE within their BAALs, while still on the wrong side of 0 to support frequency, the RA fails this measure. Was that an intended result?</p> <p>There is an undefined term in the penalty matrix that is significant: In the left-hand column: “EVENT CHARACTERISTICS:”, the first entry says “Sum of BA ACEs is in a direction that does support frequency”. Does this mean “the sum of the average BA ACEs for the entire length of the event?” Hopefully it was not intended to take 1 minute averages, etc. Please clarify. It would seem that the RA would average each BA’s ACE for the event and then sum them. If the net is on the side of 0 to support frequency, then this part is passed.</p> <p>In addition, the penalty matrix holds the RA responsible for parameters he can not control. The RA has no generation nor ability to control generation or load with which to ensure the sum of the BA ACEs “supports frequency”. Entities should be held accountable for what they can control. Therefore, the RA should be accountable for monitoring, identifying, communicating, directing, etc.. The RA should not be held responsible for “Sum of BA ACEs is in a direction that does support frequency”. The penalty matrix should address whether the RA monitored, identified, communicated, directed, etc. properly.</p> <p>The penalty matrix steps of 15, 30, and 45 minutes seems arbitrary. These limits or steps should be determined by analyzing the system so that the reliability of the interconnected system is maintained. It may be that 15 minutes is not tolerable.</p>
<p>See response to comments on Measure 1 in 301.</p> <p>The standard was revised to clarify the conditions under which the RA directs its BAs to take actions. This should preclude a BA that is operating within its BAALs from being required to move its ACE except in a case of an emergency. The levels of non-compliance were modified to align with the changes in the requirement and measures.</p> <p>The penalty matrix has been omitted from this standard.</p> <p>Although the RA may not have control over all its BAs, the RA does have authority over all its BAs and TOPs. The RA should have agreements in place (as part of RA Certification) with all these entities to specify that those entities must act in accordance with the RA’s directives</p> <p>Agreed that the 15 minute intervals in the penalty matrix were arbitrary and have been removed.</p>			
Raj Rana (Group of 2); AEP; #1,3,6		x	Cannot fully endorse at this time. Sections 305 & 306 need to be completed first. The 30-second timing requirement may prove problematic, depending on the limits to be defined in 305 & 306.

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			Additionally, disagree that the RA should be held accountable for the actions they direct others to take. They can only be held accountable for what they directed, not what the BA did or did not follow through on.
<p>The 30 seconds was intended to exclude any event caused by a telemetry error or other false readings.</p> <p>Although the RA may not have control over all its BAs, the RA does have authority over all its BAs and TOPs. The RA should have agreements in place (as part of RA Certification) with all these entities to specify that those entities must act in accordance with the RA's directives</p>			
Ken Githens; Allegheny Energy; #5		x	See comment for question 15.
<p>See response to question 15.</p>			
Guy Zito (Group of 12); NPCC-CP9; #1,2 Kathleen Goodman; ISO-NE; #2		x	Reporting requirements need to be re-visited.
<p>The documentation requirements have been revised to minimize the amount of data that must be 'collected', but the reporting requirements have not been changed. There should be almost no instances of a BA exceeding FTL T<sub>v</sub> or any FAL in any calendar year.</p>			
Ken Goldsmith; Alliant Energy; #1		x	The data collection process is burdensome and will contain time skews from the source data.
<p>The documentation requirement has been revised to minimize the amount of data that must be 'collected'.</p>			
George Carruba: EKPC: #1,3,5		x	Again, the need for documenting each 30-second BAAL Event is in question.  Also, it seems there is some redundancy in both requirements and measures. The BA and RA seem to be monitoring and reporting the same things.
<p>The documentation requirement has been revised to minimize the amount of data that must be 'collected'.</p> <p>The RA is monitoring and controlling from a broader perspective than the BA.</p>			
Howard Rulf (Group of 2); We Energies; #3,4,5		x	Define what "support frequency" means. Measure (1) Again, being able to answer questions does not demonstrate active real time monitoring. The non-compliance table should be moved to 301 and aimed at the BA not the RA.
<p>The revised standard does not use the phrase, 'support frequency'.</p> <p>The questions have been removed from the standard.</p> <p>The RA is responsible for preserving the reliability of the interconnection. The BA doesn't have all the data needed to see its impact on interconnection frequency. The levels of non-compliance have been modified.</p>			
P.D. Henderson; IMO; #2		x	Reporting requirements are too bureaucratic and 30 second recording does not seem to add much value to the standard. The recording and reporting requirements should only require that the responsible party provide evidence that the event was recorded and that

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			actions were taken to correct the event that are documented.
<p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings.</p> <p>The SDT did modify the data retention requirement so the only type of documentation needed for a BAAL Event where Tv is not exceeded, is the type of documentation you would normally have 'automatically' recorded with some other type of automatic recording (date, time, magnitude and duration of event). The only time 'actions' must be documented is if FTL Tv, or FAL are exceeded.</p>			
Alan Adamson; NYSRC; #2		x	Although we are quite cognizant of the ability to monitor compliance, audit, etc, the documentation requirements being written into the draft Standards need to be carefully considered. It appears as though the requirements for documentation are being focused on more than the effectiveness of the actual actions taken. This is completely contrary to the NERC Standards process.
<p>The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' collected (date, time, magnitude and duration of event).</p> <p>Some of the data collection is needed to verify that the standard is working as intended and that the BAs and RAs are using the frequency limits and BAALs as intended. Once the industry is confident that the standard is working as intended, the data recording/retention requirements may be modified.</p>			
Robert Rhodes; SPP ORWG (Group of 6); #1,2		x	See responses to Question 3 regarding Measures (1) (i) and (ii), documentation of actions taken and the continuous 30-second measure.
<p>See response to Question 3 regarding Measures (1)(i) and (ii)</p>			
Karl Tammar; ISO-RTO (Group of 9); #2		x	The IRC is concerned with the vague definition of the sum of the BAs ACE values. Note that the events last for about 30 minutes, and that the sum of ACEs will result in different compliance treatment at different times during an event. The IRC seeks specific guidance concerning ACE summations over time to promote effective compliance evaluation.
<p>The term, 'sum of BA ACEs' is not used in the revised standard.</p>			
Al DiCaprio; MAAC (Group of 4); #2		x	<p>MAAC does not agree that there is a need to measure the Monitoring capabilities of an RA. Certification should ensure that the capability is there. MAAC does not believe that NERC needs a measure for monitoring 'Monitoring' and suggests that Measure 1 be eliminated.</p> <p>MAAC has the same concern about Measure 302.2 as it had for Measure 301.2 regarding the 30 second measuring requires for directives.</p> <p>MAAC would like some clarification for the Non-Compliance Table for 302. The ACEs values - are they "averages" over each period (i.e. 15 minutes, 15-30 minutes, 30-45 minutes...) or are they ACEs that continuously exceed not support frequency, for are they</p>

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			any ACE values that don't support frequency?
<p>The measure for monitoring has been revised to omit the questions, but the measure has been retained to provide a mechanism for periodic auditing of the monitoring capability relative to the requirements of this standard.</p> <p>The '30 seconds' was intended to eliminate the need to report any 'events' that were caused by telemetry errors or other false readings.</p> <p>The non-compliance table was removed from this standard and replaced with levels of non-compliance that align with the revised requirement and measures.</p>			
Robert Blohm; Applied Statistician; #8	x		Same comment as 1 <sup>st</sup> paragraph of my comment to question 2. Plus: The application of an RA compliance "matrix" now addresses my concern (Responses, pages 72, 179-81) for a temporal definition of Frequency Abnormal Operating Zone. Page 9, (d) (3) (ii). RA should have documentation available within 5 days of a request as part ALSO of a spot review.
<p>See response to earlier comment.</p> <p>The purpose of a 'Spot Review' is to determine without advance notice, how an entity is complying with a requirement. It isn't clear what benefit would be gained from a Spot Review of these measures.</p>			
Ed Riley; CA-ISO; #2	x		Measures should be simplified and justified theoretically and experimentally.
<p>Agreed. This is what we hope to achieve with the targeted research and field testing.</p>			
Michael C. Calimano; NY-ISO; #2	x		The definition of the sum of the BAs ACE values seems vague. Events that last for about 30 minutes, the sum of ACEs will result in different compliance treatment at different times during an event. Specific definition of ACE summations over time will allow effective compliance evaluation.
<p>The term, 'sum of the BAs ACEs' is not used in the revised standard. The levels of non-compliance have been adjusted to better align with the revised requirement and measures.</p>			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Alan Boesch; NPPD; #1	x		
Darrel W. Richardson; IL Power; #1,3	x		
Lloyd Linke (Group of 10); MAAP; #2	x		

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Howard F. Illian; Energy Mark, Inc.; #8	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		

7. Do you agree with the requirements in 303?

**Summary Consideration: There were several suggestions to modify this requirement and they are reflected in the revised requirement. The following changes were made:**

- **New language was added to clarify that if complying with the RA's directives will violate safety, equipment, or regulatory or statutory requirements, the Balancing Authority shall immediately inform the Reliability Authority**
- **New language was added to require the BA to notify the RA if the BA is unable to return its ACE to within its BAALs.**
- **A note was added to clarify that documentation (of actions taken in response to an RA's directives) can be any retrievable source.**

Commenter	Yes	No	Comments
Peter Burke; ATC; #1	<input type="checkbox"/>	<input type="checkbox"/>	Please see comments in question 15 under overall comments.
<b>Please see response to comments in question 15.</b>			
Ed Riley; CA-ISO; #2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The FAL and FRL limits should be perhaps combined together to form a single "no hit" hard limit (selected as the most limiting condition between FAL and FRL) supplemented by the soft FTL limit.
<b>The SDT deliberated over this – but thought that the interim limit, the FAL, would provide the system operator with a tool that can be useful in real time. As envisioned, unusual events may cause the FTL to be exceeded. The FAL was intended to give the real-time operations personnel some indication that frequency was close to its tripping limit – and the need is for immediate action. The FRL is a 'hard limit' – when frequency gets to that limit, frequency-related relays should begin to operate. When the standard is field tested, the need for all three limits should be reviewed. If the FAL is not useful to real-time operators, then it should be removed from the standard.</b>			
Bart McManus; BPA (Group of 6); #1,5,6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	As written, these requirements could put BAs in a situation of being forced to take an action, as ordered by an RA that is in conflict with regulatory, statutory, safety or other types of requirements that also govern their operation. Therefore, these requirements must be modified, as required, to clarify they types of situations in which a BA's obligation to meet "other requirements" becomes an acceptable reason for not complying with the RA's directives. If it is due to an emission constraint at powerhouses, water constraints at powerhouses, or a multitude of other problems that can be <u>foreseen</u> , the BA should follow the RA's directive. However, for most conditions the BA should have taken action before an RA directive is ever necessary.
<b>Agreed. The standard has been modified to add the additional language as suggested.</b>			
Doug Hills; Midwest ISO (Group of 15) #1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The directives should be only to deficient BAs. This requirement could allow an RA to direct a BA already pushing onto to the system supporting frequency, to push more. This should be tied to the entities exceeding BAAL only.
<b>Under most circumstances, the directives should only be to BAs that are operating outside their BAALs – however in an emergency, the RA may</b>			

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<p>need to direct all BAs with certain ACE characteristics to take immediate action to move ACE in a particular direction to preserve interconnection frequency. The standard has been clarified to indicate that such actions are only required in a declared 'emergency' situation.</p>		
<p>Alan Adamson; NYSRC; #2</p>	<p>x</p>	<p>See above comments. Within the New York Control Area, the RA and BA functions are performed by the same entity, i.e., the New York Independent System Operator (NYISO), and in some cases, the same individual within the NYISO. The NYSRC agrees that logs of actions taken are always of value, however, the extra information being sought in this Measure i and iii is of little or no value in this instance. Also, if there is sufficient proof that ACE and frequency deviations were minimized as much as practical in magnitude, then the BA and or RA are performing their functions appropriately in accordance with the standard.</p> <p>The NYSRC also questions the T<sub>v</sub> of 30 minutes and no mention made of immediately addressing the problem and taking the appropriate action.</p>
<p>The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL T<sub>v</sub> or FAL are exceeded – and this should happen only rarely – perhaps only once a year. T<sub>v</sub> may be shorter than 30 minutes and may not be the same for all Interconnections – targeted research is being done to determine what number this should be. Additional language was added to indicate that when a FTL has been exceeded the RA shall act, 'without delay', to ensure FTL T<sub>v</sub> and FAL are not exceeded.</p>		
<p>Kathleen Goodman; ISO-NE; #2 Guy Zito (Group of 12); NPCC-CP9; #1,2 P.D. Henderson; IMO; #2</p>	<p>x</p>	<p>Although we are quite cognizant of the ability to monitor compliance, audit, etc, the documentation requirements being written into the draft Standards need to be carefully considered. It appears as though the requirements for documentation are being focused on more than the effectiveness of the actual actions taken, which is completely contrary to the Standards process.</p>
<p>The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL T<sub>v</sub> or FAL are exceeded – and this should happen only rarely – perhaps only once a year.</p>		
<p>Ken Githens; Allegheny Energy; #5</p>	<p>x</p>	<p>See comment for question 15.</p>
<p>See response to question 15.</p>		
<p>Ken Goldsmith; Alliant Energy; #1</p>	<p>x</p>	<p>RA's directives should only be directed to the deficient BA's. The requirement, as written, could allow an RA to direct a BA already supporting the frequency by pushing onto the system, to push more. This requirement should be tied only to those entities that are exceeding their BAAL.</p>
<p>Under most circumstances, the directives should only be to BAs that are operating outside their BAALs – however in an emergency, the RA may need to direct all BAs with certain ACE characteristics to take immediate action to move ACE in a particular direction to preserve interconnection frequency. The standard has been clarified to indicate that such actions are only required in a declared 'emergency' situation.</p>		

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Howard F. Illian; Energy Mark, Inc.; #8	x		It is important that contracts exist between the RA and the BA that specify their relationship. I would suggest that NERC should provide a starting pro-forma example of an appropriate contract that will make this relationship workable from both reliability and an economic viewpoint. Without such contracts in place, there will be an incentive for BAs to disregard RA instructions for economic reasons.
The RA and BA Certification Standards (currently in draft form) both require that 'agreements' be in place that define the authority and responsibility of these entities in addressing real-time events. Addressing contracts that define economic elements is beyond the scope of NERC –but would be an appropriate element to be addressed by a NAESB Business Practice. We encourage you to suggest this to NAESB.			
Howard Rulf (Group of 2); We Energies; #3,4,5	x		The BA is responsible to control ACE. IF a BA is contributing to limits being exceeded, the BA is obligated to act to correcting its ACE. There should be measures and penalties associated with the BA's contributing to causing the FTL excursion.
If the BA is exceeding its BAALs, at the same time there is an FTL event, then that BA is contributing to the FTL event. Whenever there is an FTL event, there is at least one BA that is operating outside one of its BAALs.			
Michael C. Calimano; NY-ISO; #2	x		The documentation requirements being written into the draft Standards need to be carefully considered. The requirements for documentation must be focused only on the effectiveness of the actual actions taken.
The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL Tv or FAL are exceeded – and this should happen only rarely – perhaps only once a year.			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Linda Campbell; FRCC (Group of 12): #1,2,3,4	x		
Alan Boesch; NPPD; #1	x		
Robert Blohm; Applied Statistician; #8	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		

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Robert Rhodes; SPP ORWG (Group of 6); #1,2	x		
Darrel W. Richardson; IL Power; #1,3	x		
Karl Tammar; ISO-RTO (Group of 9); #2	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Raj Rana (Group of 2); AEP; #1,3,6	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Ed Davis; Entergy Services; #1	x		
George Carruba; EKPC; #1,3,5	x		

8. Do you agree with the Measures in 303?

**Summary Consideration: Several commenters indicated the amount of documentation may be excessive, and the measure was modified to indicate that the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL Tv or FAL are exceeded – and this should happen only rarely – perhaps only once a year.**

Commenter	Yes	No	Comments
Peter Burke; ATC; #1			Please see comments in question 15 under overall comments.
Please see response to question 15.			
P.D. Henderson; IMO; #2	x	x	<p>Although we are quite cognizant of the ability to monitor compliance, audit, etc, the measure being written into the draft Standards need to be carefully considered. It appears as though the measures for documentation are the focus of the standard rather than the effectiveness of the actual actions taken.</p> <p>The IMO agrees that logs of actions taken are always of value. However, the extra information being sought in this Measure i and iii is of little or no value in this instance. Also if there is sufficient proof that ACE and frequency deviations were corrected as required in the standard, then the BA and or RA should be found to be compliant with the standard.</p>
The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL Tv or FAL are exceeded – and this should happen only rarely – perhaps only once a year.			
Alan Boesch; NPPD; #1		x	Measure 1 suggests how the information should be documented (operators log). It would be better to require documentation and let the entity determine how he will document the information. "The Balancing Authority shall document the following information."
The revised measure indicates 'Documentation can be via any retrievable source.'			
Doug Hils; Midwest ISO (Group of 15) #1		x	<p>Should not add the implications of cascading events – not following a directive is significant no matter of whether something failed out of that process.</p> <p>If units are directed to increase and one trips, what is the implication of this measure?</p>
<p>The levels of non-compliance will be re-visited following the results of field testing.</p> <p>Whether a unit trips, the BA needs to take actions to achieve the directive issued by the RA. If the BA can't achieve the desired results, the BA has an obligation to tell the RA so the RA is in a position to take alternate actions, if needed, to preserve the reliability of the interconnection.</p>			

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<p>Guy Zito (Group of 12); NPCC-CP9; #1,2 Kathleen Goodman; ISO-NE; #2</p>		<p>x</p>	<p>See above comments. NPCC has existing Control Areas where the RA and BA functions are performed by the same entity, and in some cases, the same individual. ISO-NE agrees that logs of actions taken are always of value, however, the extra information being sought in this Measure (i) and (iii) is of little or no value in this instance. Also, if there is sufficient proof that ACE and frequency deviations were minimized as much as practical in magnitude, then the BA and or RA are performing their functions appropriately in accordance with the standard and reliable operations.</p> <p>ISO-NE also questions the T<sub>v</sub> of 30 minutes and no mention made of immediately addressing the problem and taking the appropriate action.</p>
<p>The SDT modified the data retention requirement so the only type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). Actions are only recorded to document instances when FTL T<sub>v</sub> or FAL are exceeded – and this should happen only rarely – perhaps only once a year.</p> <p>T<sub>v</sub> may be shorter than 30 minutes and may not be the same for all Interconnections – targeted research is being done to determine what number this should be. Additional language was added to indicate that when a FTL has been exceeded the RA shall act, 'without delay', to ensure FTL T<sub>v</sub> and FAL are not exceeded.</p>			
<p>Ken Githens; Allegheny Energy; #5</p>		<p>x</p>	<p>See comment for question 15.</p>
<p>See response to question 15.</p>			
<p>Ken Goldsmith; Alliant Energy; #1</p>		<p>x</p>	<p>The implications of cascading events should not be added – not following a directive is significant no matter of whether something failed in the process. If a unit is directed to increase and it trips off-line, what is the implication?</p>
<p>The levels of non-compliance will be re-visited following the results of field testing.</p> <p>Whether a unit trips, the BA needs to take actions to achieve the directive issued by the RA. If the BA can't achieve the desired results, the BA has an obligation to tell the RA so the RA is in a position to take alternate actions, if needed, to preserve the reliability of the interconnection.</p>			
<p>Bart McManus; BPA (Group of 6); #1,5,6</p>		<p>x</p>	<p>As has been seen and referenced often in different arenas, having a standard without the levels of noncompliance no longer works in this industry. Levels of noncompliance must be spelled out. Also, without specific penalties attached to the levels it is very difficult to see if they make sense.</p>
<p>Although the SDT did not solicit comments on the levels of non-compliance with this posting of the proposed standard, levels of non-compliance were included in the standard that was posted – and the levels of non-compliance in all standards are tied to the Sanctions table approved by the NERC BOT.</p>			
<p>Robert Blohm; Applied Statistician; #8</p>	<p>x</p>		<p>Page 12, (d) (1). The Compliance Monitor should be able to use ALSO spot reviews to determine compliance.</p> <p>Page 12, (d) (3). BA should have documentation available within 5 days of a request as</p>

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			part ALSO of a spot review.
<b>Spot reviews do not seem applicable to these requirements and were not added.</b>			
Michael C. Calimano; NY-ISO; #2	x		NYISO is an existing Control Area where the RA and BA functions are and will continue to be performed by the same entity. NYISO maintains historical data archives and logs of actions taken. The extra being sought in this Measure i and iii seems designed for RA's and BA's that are remote. In an integrated operation, historical data should yield sufficient proof that ACE and frequency deviations were minimized as much as practical in magnitude. Thus, the BA and or RA are performing their functions appropriately in accordance with the standard
<b>The documentation currently collected as you've described, would meet the revised requirement and measures. The documentation must be 'retrievable' but doesn't need to be specifically compiled by event, except in those rare situations where FTL T<sub>v</sub> or FAL have been exceeded.</b>			
Ed Riley; CA-ISO; #2	x		The RA has to come to an agreement with the BA's on a procedure to return the frequency within FTL
<b>The RA is responsible for ensuring that Interconnection frequency returns to a value that is within FTLs. The standard has been revised to emphasize the various options available to the RA under scenarios of varying severity. Under some cases, the RA may not have time to discuss action plans with its BAs, but the SDT agrees that wherever possible this is the best alternative but under emergency conditions directions issued by the RA must be followed without delay.</b>			
Linda Campbell; FRCC (Group of 12): #1,2,3,4	x		We do have comments on the section e, Levels of non-compliance. In 303(e)(3) we think some clarification is needed. We would recommend rewording to "Level three: Balancing Authority did not follow all Reliability Authority directives and no frequency-related, <b>no</b> unplanned tripping of load or generation; or no uncontrolled separation or cascading outages occurred."
<b>Agreed. The language has been changed as suggested.</b>			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Howard F. Illian; Energy Mark, Inc.; #8	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		

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Marc Butts; Southern Co Svcs Group of 4); #1	x		
Robert Rhodes; SPP ORWG (Group of 6); #1,2	x		
Darrel W. Richardson; IL Power; #1,3	x		
Karl Tammar; ISO-RTO (Group of 9); #2	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Raj Rana (Group of 2); AEP; #1,3,6	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Alan Adamson; NYSRC; #2	x		
Ed Davis; Entergy Services; #1	x		
George Carruba; EKPC; #1,3,5	x		
Howard Rulf (Group of 2); We Energies; #3,4,5	x		

9. Do you agree with Requirements in 304?

**Summary Consideration:** There were many questions about the details of the process for establishing a BA’s frequency bias. The process for establishing a BA’s frequency bias was copied, almost word for word, from existing Policy 1, Section C. Since this standard was started, Version 0 has picked up this requirement – and if Version 0 is adopted, then Requirement 304 will be removed from this standard.

Commenter	Yes	No	Comments
Howard Rulf (Group of 2); We Energies; #3,4,5			Is there a missing requirement (3)?
No – there was an error in the numbering of the requirements and this has been corrected.			
Peter Burke; ATC; #1			Please see comments in question 15 under overall comments.
Please see response to question 15.			
Alan Adamson: NYSRC; #2	x	x	Minimum technical standards for some degree of consistency and fairness are needed. What is a seasonally operating balancing authority, and, what about generation only BAs?
There are minimum technical standards for establishing consistency – and these are currently in Operating Policy 1.C. Requirement 304 was copied from Policy 1.C. 1% of peak period load is the minimum acceptable frequency bias for ‘traditional’ BAs – 1% of peak generation is used as the minimum for generation only BAs because they have no load. A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during ‘peak’ periods. The ‘seasonally operating’ phrase was changed in the revised standard to ‘generation only’ BA. All certified BAs will be held accountable for the requirements in this standard.			
Alan Boesch; NPPD; #1		x	What if there are not three disturbances that can be used to observe the frequency response characteristic.
The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. If this method of calculating frequency bias isn’t technically feasible, you can use another method – it is up to each BA to use whatever methodology is most suitable to that BA.			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5		x	We agree with (1) & (2), but not (4). The Balancing Authority should achieve an average Frequency Bias Setting that is within 100 to 110% of its natural frequency characteristic. Using the 1% of peak demand rule could result in a Bias setting that is 3 to 4 times the natural frequency response of the BA during off peak periods. This will result in an inaccurate ACE calculation that will contribute to control oscillations. For small Interconnections that have natural frequency movement of +/-0.06 Hz, the Bias setting must match the frequency response of the BA’s resources. If there is a concern over lack of adequate Primary Control from Resources, then a frequency response standard needs to be developed, which we strongly support.

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<p>The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. The 1% minimum frequency bias criteria was deliberately established to overbias the interconnection and return frequency to normal as quickly as possible in the event of a disturbance. Current information (2004) indicates that the 1% minimum rule will overbias the Eastern Interconnection by roughly a factor of '2'.</p> <p>The need for a frequency response standard is outside the scope of this standard, but is being pursued by the Resources Subcommittee.</p>			
Linda Campbell; FRCC (Group of 12): #1,2,3,4		x	<p>The introduction document that accompanied this draft standard indicated that NERC would be the Standards Developer. We are assuming this would be the Resource Subcommittee or some other similar group. Even though this is our assumption, we are uncomfortable having this written this way in the Standard. This needs to be clarified and made very clear who the BA will be submitting the Frequency Bias information to. Also, it appears that the numbering in section (a) needs to be corrected or something is missing.</p>
<p>Because NERC may change its name or the name of its subcommittees or working groups, the SDT used the term identified in the Functional Model – Standards Developer. NERC's VP – General Counsel advised the SDTs to avoid naming specific subcommittees, task forces or work groups in the standards.</p> <p>The numbering has been corrected.</p>			
Howard F. Illian; Energy Mark, Inc.; #8		x	<p>The minimum Frequency Bias setting is discriminatory because it favors Vertically Integrated Utility BAs by allowing them a lower minimum setting than the same generators and loads separated into generation only and load only BAs. If this discriminatory limit is modified to insure non-discriminatory application of the required minimum the remainder is acceptable.</p>
<p>The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. Most industry commenters supported this requirement as proposed, and the SDT will not pursue any changes to this requirement until after field testing has been completed.</p>			
Doug Hils; Midwest ISO (Group of 15) #1		x	<p>We agree with the methodology for a BA operating for the year. We do not understand the idea of a "seasonal" BA – are they only held to the Standards on a season-by-season basis?</p>
<p>An entity that is certified as a BA will be responsible for meeting all the requirements assigned to a BA, all 365 days each year.</p>			
Ken Goldsmith; Alliant Energy; #1		x	<p>Alliant Energy agree with the methodology for a BA operating for a year. We do not understand the idea of a "seasonal BA" – are they held to the standards on a seasonal basis? The annual methodology seems more logical.</p>
<p>An entity that is certified as a BA will be responsible for meeting all the requirements assigned to a BA, all 365 days each year.</p>			
Robert Blohm; Applied Statistician; #8		x	<p>Agree but only contingent on development of an acceptable Frequency Response Standard per the Standard Authorization Request prepared on April 7, 2004, by the NERC Resources Subcommittee pursuant to the Resources Subcommittee's supporting White Paper on the subject issued April 6, 2004. The concerns raised on this subject in my comments to the previous draft Balancing Standard (Responses to Comments, pages</p>

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			290-91) should be addressed in that forum. The Frequency Bias Setting requirement in this standard should explicitly be made subject to change, to correspond to the eventual Frequency Response Standard, and not stand as an obstacle to that Standard.
This SDT has no control over the development of any other standard. Any additional work done on frequency bias setting as part of the frequency response standard will supercede the requirements of this standard.			
P.D. Henderson; IMO; #2	x		The following terminologies: <b>disturbances</b> used to determine Fixed Frequency Bias Settings, BA that operates <b>year-round</b> , BA that operates <b>seasonally</b> and <b>maximum generation level</b> need to be defined. Also, the grammar in paragraph (2) (iii) need to be improved.
Most industry commenters supported this requirement as proposed, and the SDT will not pursue any changes to this requirement until after field testing has been completed. The SDT has tried to limit its 'defined' terms to those that, if left undefined, may lead to different interpretations that could impact compliance. This doesn't seem to be a strong need to define the terms you've identified. The typographical error has been corrected.			
Karl Tammar; ISO-RTO (Group of 9); #2	x		Seasonally operating Balancing Authorities are not defined and it is vague on how it applies in the context.
A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA. All certified BAs will be held accountable for the requirements in this standard.			
Michael C. Calimano; NY-ISO; #2	x		Seasonally operating Balancing Authorities should be defined.
A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA. All certified BAs will be held accountable for the requirements in this standard.			
Robert Rhodes; SPP ORWG (Group of 6); #1,2	x		Determining in (2)(iii) should be determine.
Agreed. This change is reflected in the revised standard.			
Raj Rana (Group of 2); AEP; #1,3,6	x		However, change "Standards Developer" to NERC.
The Functional Model uses the term, 'Standards Developer'. Because NERC may change its name or the name of its subcommittees or working groups, the SDT used the term identified in the Functional Model – Standards Developer. NERC's VP – General Counsel advised the SDTs to avoid naming specific subcommittees, task forces or work groups in the standards.			
Ed Riley; CA-ISO; #2	x		
Bart McManus; BPA (Group of 6);	x		

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#1,5,6			
Kathleen Goodman; ISO-NE; #2	x		
Darrel W. Richardson; IL Power; #1,3	x		
Ken Githens; Allegheny Energy; #5	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Guy Zito (Group of 12); NPCC-CP9; #1,2	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Ed Davis; Entergy Services; #1	x		
George Carruba; EKPC: #1,3,5	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		

10. Do you agree with the Measures in 304?

**Summary Consideration:** The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. Most industry commenters supported this requirement as proposed, and the SDT will not pursue any changes to this requirement until after field testing has been completed.

Commenter	Yes	No	Comments
Peter Burke; ATC; #1			Please see comments in question 15 under overall comments.
Please see response to comments in question 15.			
Alan Adamson: NYSRC; #2	x	x	<p>It is hard to evaluate a methodology when it is still a work in progress. Use of an average as in Section A 3 iv may not be correct. Note the Frequency Resource Subcommittee (FRS) white paper discusses significant differences in Interconnection frequency response as a function of time of day. A conservative or worst case value should be used.</p> <p>These details are important and should be coordinated with any emerging FRS standard.</p> <p>The NYSRC suggests that the drafting team ensure all the necessary attributes pertaining to this standard appear in the standard and not in any companion document. It seems that this is quite different from the Abnormal Operations Metric (AOM) in the first posting in that the diversity of ACE is not discussed. What assumptions apply? What would be typical FTL limits, so a comfort level for resulting BAALs in representative scenarios can be evaluated?</p>
<p>While this standard is a 'work in progress', requirement 304 came almost word for word from existing Operating Policy 1C. The SDT did not intentionally add or delete any element from the source document.</p> <p>The SDT does not have any control over the development of any other standard and at present, no SAR for an FRS standard has been posted for public comment.</p> <p>Because the frequency limits will be Interconnection-specific, and may vary over time, specific values for the frequency limits will not be included in this standard.</p> <p>The SDT attempted to include all assumptions utilized in this standard in the accompanying 'Introduction to the Balance Resources and Demand Standard'. It is not appropriate to include all supporting material in the body of the standard itself. These new standards have a different format from existing Operating Policies, and will not include all the 'introductions' and other background information.</p> <p>Field testing will be conducted, and the results of all field tests will be published so all entities can verify that the limits are appropriate.</p>			
Kathleen Goodman; ISO-NE; #2 Guy Zito (Group of 12); NPCC-CP9;	x	x	<p>Minimum technical standards for some degree of consistency and fairness are needed.</p> <p>What is a seasonally operating balancing authority, and, what about generation only</p>

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#1,2			BAs?
<p>A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA.</p> <p>All certified BAs will be held accountable for the requirements in this standard.</p>			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5		x	We agree with all but item (2), the 1% rule may cause an inaccurate ACE calculation.
<p>The criteria included in these measures is the same criteria in place today.</p>			
Ed Riley; CA-ISO; #2		x	Measures should be simplified and justified theoretically and experimentally.
<p>The criteria included in these measures is the same criteria in place today.</p>			
Bart McManus; BPA (Group of 6); #1,5,6		x	The frequency bias setting is an extremely important part of the ACE. One that is set too low will cause a BA to back generation down that has responded via governor action to a disturbance on the system. Therefore, the two conditions representing a Level 3 non-compliance should be Level 4, with Level 3 being not applicable. Also, for Level 1 non-compliance, we recommend including when an inaccurate methodology is used for determining frequency bias.
<p>The SDT did not ask for specific feedback on levels of non-compliance with this posting. We will ask the industry if these levels should be modified with the next posting of this standard.</p>			
Linda Campbell; FRCC (Group of 12); #1,2,3,4		x	<p>Same comment on the use of terminology "Standards Developer".</p> <p>Also, in section (e) the Levels of Non-Compliance, why are there levels 1-3 and not a 4. If what is included in Level three is to be the worst case, would it be better to make it Level 4 and make another N/A as was done in earlier sections?</p>
<p>Because NERC may change its name or the name of its subcommittees or working groups, the SDT used the term identified in the Functional Model – Standards Developer. NERC's VP – General Counsel advised the SDTs to avoid naming specific subcommittees, task forces or work groups in the standards.</p> <p>The SDT did not ask for specific feedback on levels of non-compliance with this posting. We will ask the industry if these levels should be modified with the next posting of this standard.</p>			
Doug Hils; Midwest ISO (Group of 15) #1		x	We agree with those that apply to a BA operating/reporting over the year.

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<p>A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA.</p> <p>All certified BAs will be held accountable for the requirements in this standard.</p>			
Ken Goldsmith; Alliant Energy; #1		x	Alliant Energy agrees with those that apply to a BA operating and reporting over a year time-frame as opposed to seasonal time-frames.
<p>A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA.</p> <p>All certified BAs will be held accountable for the requirements in this standard.</p>			
Howard F. Illian; Energy Mark, Inc.; #8		x	The minimum Frequency Bias setting is discriminatory because it favors Vertically Integrated Utility BAs by allowing them a lower minimum setting than the same generators and loads separated into generation only and load only BAs. If this discriminatory limit is modified to insure non-discriminatory application of the required minimum the remainder is acceptable.
<p>The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. Most industry commenters supported this requirement as proposed, and the SDT will not pursue any changes to this requirement until after field testing has been completed.</p>			
Robert Blohm; Applied Statistician; #8		x	Page 15, (d) (1). The Compliance Monitor should be able to use ALSO spot reviews to determine compliance. Page 15, (d) (3). BA should have documentation available within 5 days of a request as part ALSO of a spot review.
<p>The need for a spot review for this requirement doesn't seem to be warranted.</p>			
Karl Tammar; ISO-RTO (Group of 9); #2		x	See comments in 9.
<p>See response to question #9.</p>			
P.D. Henderson; IMO; #2		x	See comments in question #9 above.
<p>See response to question #9.</p>			
Michael C. Calimano; NY-ISO; #2		x	
Alan Boesch; NPPD; #1		x	
Robert Rhodes; SPP ORWG (Group of 6); #1,2		x	

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Darrel W. Richardson; IL Power; #1,3	x		
Ken Githens; Allegheny Energy; #5	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Raj Rana (Group of 2); AEP; #1,3,6	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Ed Davis; Entergy Services; #1	x		
George Carruba; EKPC; #1,3,5	x		
Howard Rulf (Group of 2); We Energies; #3,4,5	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		

11. Do you agree with Requirement 305?

**Summary Consideration:** Several commenters indicated that this requirement should have associated measures and compliance elements and the SDT will add those.

Commenter	Yes	No	Comments
Bart McManus; BPA (Group of 6); #1,5,6			See comments below under question 12
See response under question 12.			
Robert Rhodes; SPP ORWG (Group of 6); #1,2			We are not sure that we are knowledgeable enough to comment on these requirements. Comparisons between existing values and those associated with the new standard would be helpful.
At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.			
Peter Burke; ATC; #1			<p>The standard states that the "Standards Developer shall develop" both frequency limits and BAAL low and high limits. However, the NERC Functional Model does not include a requirement for the Standards Developer to perform those functions. This will have to be resolved.</p> <p>Requirement 305 defines requirements but no corresponding definitions of measures or compliance.</p> <p>The Standards Developer may, in fact, be the best choice for determining and updating the numerical limits for this standard. For so many requirements, though, it seems unreasonable that there would be no definitions of measures or of compliance.</p>
The Functional Model is a 'work in progress' and will continue to be refined to meet the industry's needs. At this point, the SDT is seeking industry consensus on the concept that there should be a standard for establishing frequency limits within each interconnection. This concept was not 'alive' when the Functional Model was developed.			
Agreed. There didn't seem to be a need for any measures. This requirement was only included in this standard to ensure that it would be performed as required, on a periodic basis.			
The Standards Developer (NERC, its Resources Subcommittees, or some successor organization or subcommittee) is the appropriate function to accomplish this requirement because it involves all Interconnections and other interested parties.			
Michael C. Calimano; NY-ISO; #2	x	x	<p>This standard is still a work in progress, making it difficult to fairly evaluate the methodology</p> <p>Use of an average as in Section A 3 iv may be inappropriate. There are significant</p>

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			<p>differences in Interconnection frequency response as a function of time of day. A conservative or worst case value may be best.</p> <p>The NYISO is concerned with ensuring that the values imposed as requirements are properly reviewed and that the process includes a clear methodology for updating and changing the metrics. The NYISO supports the concept of thoroughly field-testing this standard.</p>
<p>The preliminary results of targeted research should be ready in October, 2004 and will be publicly posted. The preliminary research should verify whether the methodology is sound and feasible.</p> <p>Targeted research includes validation of the specific methodology for determining interconnection frequency response. We expect it to identify the specific variability and sensitivity parameters that impact this behavior.</p> <p>Any modifications to these metrics will be accomplished through an open process.</p>			
Ed Riley; CA-ISO; #2	x	x	THE STD must develop the limits in consultation with the RAs and Bas.
<p>The Standards Developer is expected to use data from the RAs and BAs, but isn't required to 'consult' with those RAs and BAs in the determination of these limits.</p>			
Alan Boesch; NPPD; #1		x	What you have produced is not a requirement and should be kept in a companion document.
<p>According the NERC's VP – General Counsel, if we want a requirement to be followed in a specific manner, then it must be included in the standard. In addition, when this standard was posted the first time, many entities requested that this requirement be included in the standard, not in a supporting document.</p>			
Karl Tammar; ISO-RTO (Group of 9); #2	x	x	The IRC supports the SDT's concern for ensuring that the values imposed as requirements are properly reviewed and that the process includes a clear methodology for updating and changing the metrics. The IRC again supports the concept of thoroughly field-testing this standard. The IRC believes that the limit should be developed in consultation with the RAs and BAs.
<p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The Standards Developer is expected to use data from the RAs and BAs, but isn't required to 'consult' with those RAs and BAs in the determination of these limits.</p>			
Howard F. Illian; Energy Mark, Inc.; #8	x	x	I agree in principle with the concept. I believe that the specifics of the calculation need to be tied together with logic that supports a specific level of reliability instead of a seat-of-the-pants level contained in the current calculation of the Frequency Abnormal and Frequency Trigger limits. This should be the goal of the targeted research that is yet to be performed.

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<p>The current values for FTL and FAL are for demonstration purposes only and were never intended to be used for real-time operations. Targeted research will be conducted to validate the methodology and to define the specific limits for each Interconnection.</p>		
<p>Kathleen Goodman; ISO-NE; #2 Guy Zito (Group of 12); NPCC-CP9; #1,2</p>	<p>x</p>	<p>x</p> <p>It is hard to evaluate a methodology when it is still a work in progress.</p> <p>Use of an average as in Section A 3 (iv) may not be correct. Note the Frequency Resource Subcommittee (FRS) white paper discusses significant differences in Interconnection frequency response as a function of time of day. A conservative or worst case value should be used.</p> <p>These details are important and should be coordinated with any emerging FRS standard.</p> <p>ISO-NE (NPCC) suggests that the drafting team ensure all the necessary attributes pertaining to this standard appear in the standard and not in any companion document.</p> <p>It seems that this is quite different from the Abnormal Operations Metric (AOM) in the first posting in that the diversity of ACE is not discussed. What assumptions apply? What would be typical FTL limits, so a comfort level for resulting BAALs in representative scenarios can be evaluated?</p> <p>The Standards Developer (NERC) is identified to develop IFLs and FTLs</p>
<p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The SDT does not have any control over the development of any other standard and at present, no SAR for an FRS standard has been posted for public comment.</p> <p>The Standards Developer (NERC, its Resources Subcommittees, or some successor organization or subcommittee) is the appropriate function to accomplish this requirement because it involves all Interconnections and other interested parties.</p>		
<p>Linda Campbell; FRCC (Group of 12); #1,2,3,4</p>	<p>x</p>	<p>The concern of using the "Standard Developer" as an entity that must do something here is of even more concern than the use of the term in 304. This needs to be specifically identified. In 305(a)(3)(i), what and who will determined what is an "approved" Under Frequency Load Shed relay setting? What input will go into this determination?</p> <p>305(a)(3)(iv) states that the Interconnections frequency response will be based on an average of the prior 3 years of data. The frequency response of all 3 Interconnections have high standard deviations. Use of the average response would seem to expose the Interconnection to an undesirable risk. The drafting team should consider using either the lowest response or the average minus one standard deviation instead.</p> <p>Why are there not Measures, or Compliance related areas? How will the compliance monitors know if the requirements are met? Should this determination of Frequency</p>

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			Limits be a separate standard applicable to whoever the “Standard Developer” is. It causes concern to have such an unknown area be a part of this standard.
<p>The Standards Developer (NERC, its Resources Subcommittees, or some successor organization or subcommittee) is the appropriate function to accomplish this requirement because it involves all Interconnections and other interested parties. Because NERC may change its name or the name of its subcommittees or working groups, the SDT used the term identified in the Functional Model – Standards Developer. NERC’s VP – General Counsel advised the SDTs to avoid naming specific subcommittees, task forces or work groups in the standards.</p> <p>For the limits to be developed and used by all entities within an Interconnection, the UFLS relay settings need to be appropriate to all end users. Regional differences within an Interconnection relative to UFLS relay settings would need industry support to be approved as part of a standard. We understand that the high set point UFLS in FRCC is actually part of a special protection scheme required because of the unique ‘peninsular’ nature of the FRCC system. The decision to use this high set point UFLS for interconnection-wide standard setting should be made at the highest policy-setting levels of the industry. The SDT recommends that a high level task force be formed to address this issue.</p> <p>The SDT will add measures and compliance for this requirement.</p>			
Roman Carter; SCGEM (Group of 6); #5,6		x	<p>It is acceptable to have them included in the Standard. However, over and under frequency limits should not be established without input from the Generator Owners. Many units have under frequency protection and some have over frequency protections. Some of these could be on Nuclear reactor protection systems and it is critical that communication and agreement occurs prior being established.</p> <p>Also, Generating units with over-speed trip settings may vary from unit to unit.</p>
<p>Initially, the frequency limits will be set through targeted research, giving consideration to all aspects of interconnection operations, including generation. These values will be posted and field tested prior to being implemented. All industry segments are encouraged to participate in this open process by submitting comments on the draft standard, and its implementation plan.</p>			
Alan Adamson: NYSRC; #2		x	<p>The NYSRC does recognize that, as being developed, the standard is in fact addressing the core reliability issue related to high or low frequency deviations.</p> <p>BAAL could be developed for fixed limits that are not a function of prevailing frequency. Why not keep it simple for the operators? During the recovery from a loss of generation, their target will be moving around on them.</p>
<p>System Operators already react to ‘moving targets’ – such as dynamic ratings on transmission lines. During field testing, we should identify whether it is too challenging for system operators to respond to a BAAL that is dynamic. In addition, conservative operators could use the BAAL value at the point where it crosses the FTL. The BA should never have BAALs that are more constraining than these values during normal operating conditions.</p>			
Ed Davis; Entergy Services; #1		x	<p>We do not agree with these Requirements because we do not understand how the limits will be determined. In particular, a detailed explanation of how the “low and upper” Minimum Safe Megawatt Deadbands are determined based on “the number of allowable contingencies” is needed.</p>

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			We suggest the Operating Committee, rather than the Standards Developer, be the entity responsible to determine and/or coordinate the Frequency Bias Settings.
<p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The Standards Developer is currently NERC, and NERC may assign responsibility for this requirement to the Operating Committee –but it is beyond the scope of the SDT to assign this requirement to any Function not identified in the Functional Model. Because NERC may change its name or the name of its subcommittees or working groups, the SDT used the term identified in the Functional Model – Standards Developer. NERC's VP – General Counsel advised the SDTs to avoid naming specific subcommittees, task forces or work groups in the standards.</p>			
Raj Rana (Group of 2); AEP; #1,3,6		x	
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		Consideration of the Interconnection size will be necessary. ERCOT will probably/has reached the load shed frequency with just 2 contingencies. The 3 year average of frequency response will not protect the interconnection during off peak periods.
<p>The targeted research will address interconnection size. Field testing will show whether the limits work under varying conditions, including during on/off peak periods.</p>			
Ken Goldsmith; Alliant Energy; #1	x		Alliant Energy agrees with establishing the methodology within the standard and that targeted research should validate the values used.
<p>We appreciate your support of the SDT's direction.</p>			
Lloyd Linke (Group of 10); MAAP; #2	x		<p>Agree in concept, except that this Standards Drafting Team should manage the development of the requirements and limits proposed in 305 and 306. If this SDT does not follow through with the targeted research and trials implied for Section 305 and 306, and then incorporate those findings and recommendations into the final version of Standard 300, we will not be able to vote for this Standard. We believe it to inappropriate to vote for a standard based only upon general concepts. We will need to see the details first.</p> <p>In Section 305 (1) change "The Standards Developer" to "This Standards Drafting Team" and in Section 305 (2) change "The Standards Developer" to "NERC." In Section 306 (1 &amp; 2) change "The Standards Developer" to "This Standards Drafting Team." Also, do know which "authority" will be setting standards.</p>
<p>Targeted research and field testing will both be accomplished before this standard is finalized.</p> <p>Establishing and maintaining sets of limits is outside the scope of the SDT – once the standard is approved and adopted, the SDT's work is finished, and the team is disbanded.</p> <p>Under the FM, the Reliability Standards Developer includes NERC and the Regional Councils; however, the Functional Model is written to accommodate any organization that develops reliability standards.</p>			

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P.D. Henderson; IMO; #2	x	As detailed in previous questions, the IMO believes that the standard should undergo both passive and active field-testing prior to full implementation and compliance monitoring. This will allow the metrics to be evaluated and changed if appropriate in order to ensure successful full implementation.
<b>Agreed.</b>		
Howard Rulf (Group of 2); We Energies; #3,4,5	x	The method to determine the set of interconnected frequency limits must be in the standard along with how often they are to be updated.
<b>Agreed.</b>		
Robert Blohm; Applied Statistician; #8	x	<p>The words "verify that" should be replaced by "determine whether" in the three places that specify the field testing, in the box on page 16 (a) (3) of the Standard, as well as on page 14 of the Introduction where the word "validate" should also be so replaced by "determine whether", and on page 5 of the Responses to Comments on questions about the previous draft of the standard.</p> <p><i>Discussion.</i> The "testing" needs to be specified as scientific in the research mandate. NERC is basically a technical body that identifies the constraints that the objective laws of physics place on operation of the system at an agreed level of scientifically defined and measurable reliability.</p> <p>Scientific testing is not a process of "validation" or "justification" by means of "selecting" only "favorable" facts that support a pre-ordained conclusion, and ignoring unfavorable facts that "falsify" or contradict the proposition being tested. "Validation" is a process of religious or ideological faith, not of scientific knowledge. "Falsification" is the correct process of scientific testing, which actively seeks to undermine the proposition being tested by finding but a single counterexample. The proposition that cannot be eliminated in that testing process is said to be proved.</p> <p>As a basis for setting the FRLs, FALs, FTLs, and T<sub>v</sub>s the draft standard is proposing to determine a mathematical relationship between number of contingencies within what time and the likelihood of one event in ten years and even the validity of that likelihood as a reliability threshold. Significant work needs to be done to formulate a relationship, consistent with modern mathematical statistics and proven through "field testing" to represent the actual physical characteristics of the system.</p> <p>In my Comments on the previous version of the draft standard I summarized the groundbreaking work recently done by Energy Mark/Howard Illian for ERCOT in statistically relating operating reliability limits, like CPM-1□, to the once-in-ten-years statistical-frequency of an event, and in defining an "event" and such a statistical-frequency. I and others made some technical criticism of that work before ERCOT and the NERC Resources Subcommittee and Operating Committee, in my case when it comes to defining an event and allowing for the non-independence of disturbances.</p>

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			<p>While we're short of having anything close to a real-time Interchange Distribution Calculator state estimator of the entire interconnection, FRLs can so far still be based only on protecting a specific piece of equipment, not yet on protecting the interconnection. The challenge is to extend the probabilistic methodology to better define and justify the once-in-ten years, and set the deterministic FALs, FTLs and <math>F_{vs}</math> possibly, for example, by applying to contingencies a Poisson arrival process such as BPA's Warren McReynolds recommended in the June 16<sup>th</sup> technical conference call and by determining how it affects the overall likelihood of a once-in-ten-years type of event.</p> <p>Say "lower (upper)" Minimum Safe Megawatt Deadband instead of "low (high)" Minimum Safe Megawatt Deadband.          Say "lower (upper)" Minimum Safe Frequency Deadband instead of "low (high)" Minimum Safe Frequency Deadband          Say "lower (upper)" Interconnection Frequency Abnormal Limit instead of "low (high)" Interconnection Frequency Abnormal Limit</p> <p>BAAL <math>T_v</math> needs to be included in the list of limits to be researched on page 14 of the Introduction.</p>
<p>The SDT is not making revisions to the supporting documents until after the results of targeted research have been delivered.</p>			
Doug Hills; Midwest ISO (Group of 15) #1	x		We agree with establishing the methodology within the Standard and that targeted research should validate the values used.
<p>Agreed.</p>			
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Darrel W. Richardson; IL Power; #1,3	x		
Ken Githens; Allegheny Energy; #5	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		

12. Do you agree with the change made to the BAAL calculation?

**Summary Consideration:** Several commenters indicated that this requirement should have associated measures and compliance elements and the SDT will add those following the results of targeted research and field testing.

Commenter	Yes	No	Comments
Linda Campbell; FRCC (Group of 12); #1,2,3,4			The introduction needs to explain the logic behind the BAAL equation. The equation appears to have two disparities: If the Interconnection is at its FTL <sub>low</sub> , the equation still allows a BA to have a BAAL equal to its Bias. Second, if the scheduled frequency is less than 60Hz, the BAAL is initially higher then becomes smaller as the actual frequency approaches the FTL <sub>low</sub> . Why is this?
<p>The logic behind the BAAL equation was posted with the Consideration of Comments to the First Posting of the Balance Resources and Demand Standard – it was included as an attachment written by Mr. Illian. In hindsight, the SDT agrees this should have been included in the revised 'Introduction' and will add an explanation to the Introduction.</p> <p>Agreed - If the Interconnection is at its FTL<sub>low</sub>, the equation still allows a BA to have a BAAL equal to its Bias.</p> <p>BAAL is inversely related to frequency error so that it approaches zero as frequency error increases in either direction.</p>			
Robert Rhodes; SPP ORWG (Group of 6); #1,2			We are not sure that we are knowledgeable enough to comment on this question.
<p>Hopefully, the results of targeted research and field testing will make the standard clearer as time progresses.</p>			
Raj Rana (Group of 2); AEP; #1,3,6			Generally agree with the concept, but still need to see proposed calculations, which include yet-to-be established limits.
<p>Hopefully, the results of targeted research and field testing will make the standard clearer as time progresses.</p>			
Karl Tammar; ISO-RTO (Group of 9); #2	x	x	The council recognizes that, as developed, the standard is in fact addressing the core reliability issue related to high or low frequency deviations. Some IRC members expressed concern with eliminating the DCS, and all believe that an important part of the field trial is to determine if the DCS is still needed.
<p>The results of the field test are expected to show whether BAAL is an effective replacement for DCS. If BAAL is not an effective replacement for DCS, then other methodologies will be considered, including the continued use of DCS.</p>			
Michael C. Calimano; NY-ISO; #2		x	The NYISO recognizes that, as developed, the standard addresses the core reliability issue related to high or low frequency deviations. We are concerned that eliminating DCS leaves the responsibility to recover from a contingency too open ended.
<p>The results of the field test are expected to show whether BAAL is an effective replacement for DCS. If BAAL is not an effective replacement for DCS, then other methodologies will be considered, including the continued use of DCS.</p>			

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<p>If a contingency doesn't cause a frequency-based reliability problems, it isn't relevant to this standard.</p>		
<p>Ed Riley; CA-ISO; #2</p>	<p>x</p>	<p>In its new form the BAAL becomes frequency-dependent. Our next concern is that the frequency-dependent BAAL in combination with CPM-1 will lose the area and frequency control very significantly since the most limiting CPS2 standard is eliminated from the Balancing Resources and Demand Standard. This may aggravate the existing problems with the interconnection frequency.</p> <p>The frequency-dependent BAAL leaves the ACE virtually unlimited at near-nominal frequencies. Implications of this fact to system operations need to be carefully examined.</p> <p>Also, since BAAL set limits for the instantaneous values of the interconnection frequency error and ACE, a lot of variability can be expected for the current operating points at each EMS cycle</p>
<p>Field testing should show whether the proposed measures will be more or less effective than existing control performance measures with respect to frequency control.</p> <p>If ACE variations don't cause frequency-based reliability problems, they aren't relevant to this standard. If frequency error is near zero, there is no frequency-related reliability problem.</p>		
<p>Bart McManus; BPA (Group of 6); #1,5,6</p>	<p>x</p>	<p>We see the BAAL as being too large in WECC. We will need to spend more time crunching numbers to find what an acceptable calculation would be for the Western Interconnection.</p> <p>We agree with the principle in the introduction document that the Frequency Abnormal Limit should be an "interconnection limit that cannot be exceeded without exposing the interconnection to unacceptable risk". Our problem, however, is with the practicality of determining and implementing this type of measure; particularly for an interconnection as frequency responsive to losses of load or generation as the Western Interconnection.</p> <p>However, from an operational perspective, the "once in 10 year probability of load shed relay activity" seems to be unacceptable to our customers. Per definition, this means that we could "shed load once every 10 years without a problem". Experience has shown that this is not the case. Each time load is shed through underfrequency, undervoltage, or other protective action, customers and regulators clamor for an explanation of "why it happened" and a "solution to fix the problem" so that it does not happen again. Given this type of reaction, this does not seem to be an acceptable assumption to make for operating purposes.</p> <p>We also agree with the concept expressed in the Introduction document that each interconnection's FAL should be "at least 3 contingencies away from the highest approved</p>

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		<p>load shed relay set point". Though, as stated, this may be the case for the Eastern Interconnection, as FAL is presently specified, this is certainly NOT the case for the Western Interconnection.</p> <p>A given amount of generation or load loss, has a far greater impact upon the Dip Frequency of the Western Interconnection than it would the Dip Frequency of the Eastern Interconnection. Because of this, reliable operation of the Western Interconnection has been dependent upon the ability of the Frequency Responsive Reserves to respond immediately to provide a "recovery" such that the WECC Settling Frequency is high enough to ensure power system reliability. It is because of this reality that calculation of an appropriate FAL for the Western Interconnection would require taking into account additional considerations that may not be adequately accounted for in the present FAL related requirements.</p> <p>First of all, in order to meet the stated principle, any calculation of FAL for the Western interconnection would have to be based upon the Dip Frequency attained during a disturbance, not its Settling Frequency. Otherwise, Underfrequency relays could be undesirably set off while the interconnection is "recovering" from its Dip Frequency to its Settling Frequency.</p> <p>Secondly, given the amount that frequency is effected by disturbances in the Western Interconnection, it is theoretically quite probable that even a FAL of 60 Hz may not be 3 contingencies away from the highest approved Underfrequency loadshedding set point. This is why we feel so strongly that reliable operation of the Western Interconnection is dependent upon incorporating a requirement to recover from disturbances within a pre-defined time limit into the Balance Resources and Demand Standard. This is the only way that we can ensure that the system is properly re-positioned to be able to respond to the next contingency in a reliable manner.</p>
<p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The calculations provided were representative, and were never intended to be used in real-time operations. Both targeted research and field testing need to be accomplished to ensure that the limits are appropriate for each Interconnection. In addition, regional specific requirements may be added as required to satisfy WECC's needs as a Interconnection-wide Regional Difference. The SDT will consult with personnel from each Interconnection as part of the targeted research.</p> <p>The level of risk tolerance acceptable to the industry and its customers, will have to be determined through the comments submitted in this open process. The once in ten year criteria sited in the original draft of the standard, is a common 'rule of thumb' used in many system planning applications.</p>		

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<p>Dip frequency may be investigated as part of the targeted research and field testing. The frequency relay limit used in the standard is based on the relay settings themselves, not on any recovery point associated with unit contingencies.</p>		
<p>The SDT has designed the standard to accommodate Interconnection differences through the development of Interconnection –specific frequency limit settings and associated T<sub>v</sub>.</p>		
Alan Adamson; NYSRC; #2		x We concerned about the ease of use of variable MW limits during disturbance recovery.
<p>Variable limits should help system operators ensure that their actions improve frequency. During field testing, one of the items to be assessed, is the system operators' acceptance of variable BAALs.</p>		
Kathleen Goodman; ISO-NE; #2 Guy Zito (Group of 12); NPCC-CP9; #1,2		x ISO-NE (NPCC) does recognize that, as being developed, the standard is in fact addressing the core reliability issue related to high or low frequency deviations.  BAAL could be developed for fixed limits that are not a function of prevailing frequency. Why not keep it simple for the operators? During the recovery from a loss of generation, their target will be moving around on them.
<p>Conservative operators could use the BAAL value at the point where it crosses the FTL. The BA should never have BAALs that are more constraining than these values during normal operating conditions.</p>		
<p>The SDT believes that variable limits will help system operators achieve maximum benefits from interconnected operations while ensuring that their actions improve frequency. During field testing, one of the items to be assessed, is the system operators' acceptance of variable BAALs.</p>		
P.D. Henderson; IMO; #2		x The IMO recognizes that, as developed, the standard is in fact addressing the core reliability issue related to high or low frequency deviations, but cannot support a standard that allows large ACE to prevail for long periods of time(See comments detailed in question #2).  BAAL could be developed for fixed limits that are not a function of prevailing frequency. The standard should be simplified for the operators to comprehend during recoveries.  The IMO supports the retention of some form of the DCS.
<p>See response to question 2.</p>		
<p>Conservative operators could use the BAAL value at the point where it crosses the FTL. The BA should never have BAALs that are more constraining than these values during normal operating conditions.</p>		
<p>Field testing should show whether DCS should be returned to this standard.</p>		
Robert Blohm; Applied Statistician; #8		x I wholeheartedly support the BAAL measure as the real-time half of a compact 2-measure set of the CPM-1 and BAAL balancing standards based on the common unifying principles of "covariance" and "bias share" which fully capture the "diversity" benefits of interconnected operations.

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			I congratulate the drafting team for responding constructively to the criticism, made by Energy Mark/Howard Illian, myself and others, of the DEM for being ill-defined and interfering with CPM-1, and of the need to make the limit, applied to the AOM, bias-share and frequency dependent without needing any further "diversity factor" and of the need not to set the limit close to the CPM-1 limit nor have it take effect too suddenly. The currently proposed BAAL is such a limit, with the respective $T_v$ allowance for enough time to adjust. This is the true innovation in this Balancing Standard, extending to real time the frontier of the methodology underlying CPM-1.
<b>The SDT appreciates your support.</b>			
Al DiCaprio; MAAC (Group of 4); #2	x		MAAC supports the concept of a frequency-dependent BAAL.
<b>The SDT appreciates your support.</b>			
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Darrel W. Richardson; IL Power; #1,3	x		
Howard F. Illian; Energy Mark, Inc.; #8	x		
Ken Githens; Allegheny Energy; #5	x		
Ken Goldsmith; Alliant Energy; #1	x		
Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		
Ed Davis; Entergy Services; #1	x		
George Carruba; EKPC; #1,3,5	x		

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Howard Rulf (Group of 2); We Energies; #3,4,5	x		
Roman Carter; SCGEM (Group of 6); #5,6	x		
Doug Hils; Midwest ISO (Group of 15) #1	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		

13. Do you agree with Requirement 306?

**Summary Consideration:** Several commenters indicated they need to see the results of this requirement, and the SDT will post the results of its targeted research and field testing. The SDT will add measures and compliance elements to this requirement following the results of targeted research and field testing.

Commenter	Yes	No	Comments
Linda Campbell; FRCC (Group of 12): #1,2,3,4			(see above) Also, why are there no measures and compliance administration sections. See our comment on 305.
<b>The SDT will add these.</b>			
Alan Adamson: NYSRC; #2			<p>The NYSRC Reliability Rules are not inconsistent with or less stringent than the proposed NERC Standard, and the NYSRC has elected <u>not</u> to propose that NYSRC Reliability Rules be made part of this Reliability Standard.</p> <p>It is the NYSRC's position that (1) NERC specifies minimum standards, (2) a Region may establish more stringent standards for its members separate from the NERC standards, and (3) it is unnecessary to include these more stringent standards within the framework of the NERC standards.</p>
<b>Agreed.</b>			
Robert Rhodes; SPP ORWG (Group of 6); #1,2			We are not sure that we are knowledgeable enough to comment on this question.
<p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p>			
Peter Burke; ATC; #1			Please see comments under question 11.
<b>Please see the response to question 11.</b>			
Raj Rana (Group of 2); AEP; #1,3,6			Generally agree with the concept, but still need to see proposed calculations, which include yet-to-be established limits.
<p>Agreed. At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p>			

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Alan Boesch; NPPD; #1		x	What you have produced is not a requirement and should be kept in a companion document.
<b>This is a requirement and, as requested by many entities, measures and compliance elements will be added to the revised standard.</b>			
Bart McManus; BPA (Group of 6); #1,5,6		x	Agree in concept, but again, we need to run some more numbers to find what acceptable numbers would be in WECC.
<b>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</b>			
Ed Davis; Entergy Services; #1		x	We are not sure if we agree with Standard 306. At this time we need to understand how BAAL will impact reliability, frequency, and general operations. Therefore, we can only suggest NERC continue with this process development and proof testing. We also suggest the Operating Committee develop the BAALs.
<b>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</b>			
Howard Rulf (Group of 2); We Energies; #3,4,5		x	There needs to be a fixed floor (and ceiling) for the BAAL. Make the floor equal to the interconnects largest single generating unit (~1300 MW). The ceiling could be symmetrical or some other comparable criteria.
<b>If you require a floor for your operations, the SDT recommends using the BAAL value at the point where it crosses the FTL. The BA should never have BAALs that are more constraining than these values during normal operating conditions.</b>			
<b>Using BAAL @ FTL will ensure that frequency-based reliability is maintained – use of any other limit would be based on something other than frequency, and would be outside the scope of this standard.</b>			
Guy Zito (Group of 12); NPCC-CP9; #1,2 Kathleen Goodman; ISO-NE; #2 P.D. Henderson; IMO; #2		x	NPCC is concerned about the ease of use of variable MW limits during disturbance recovery.
<b>Field testing will show whether this is a problem or not.</b>			
Ed Riley; CA-ISO; #2		x	
Robert Blohm; Applied Statistician; #8	x		<i>Simple derivation of the BAAL formula from the CPM-1 formula.</i> The BAAL formula is derived from the following formula for the CPM-1 limit curve: <b>CPM-1 Limit:</b> $Avg_{1-year} (ACE \times \Delta F) = -10 \times Bias \times \epsilon^2$ by doing three things to it:

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			<p>1. Substituting <math>(FTL - F_{\text{scheduled}})</math> for <math>\epsilon</math>, and plugging in <math>FTL_{\text{high}}</math> to get the upper curve and <math>FTL_{\text{low}}</math> to get the lower curve;</p> <p>2. Making it a 1-minute "real" time measure by removing the 1-year averaging;</p> <p>3. Dividing both sides of the equation by <math>\Delta F</math>.</p> <p>Accordingly, the BAAL formula is:</p> <p style="text-align: center;"><b>BAAL</b>limit: <math>ACE = -10 \times \text{Bias} \times (FTL - F_{\text{scheduled}})^2 / \Delta F</math> .</p> <p>This makes for an elegant set consisting of the CPM-1 limit curve and the BAAL curve unified by the same underlying "bias share" and "covariance" principles.</p> <p>Substitute the terms "lower" and "upper" for "low" and "high".</p>
<p>Since 'High' and 'Low' are commonly used in the industry, and since there were no other commenters that indicated this should be changed, the SDT did not adopt this recommendation.</p>			
Roman Carter; SCGEM (Group of 6); #5,6	x		
Michael C. Calimano; NY-ISO; #2	x		
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	x		
Marc Butts; Southern Co Svcs Group of 4); #1	x		
Howard F. Illian; Energy Mark, Inc.; #8	x		
Darrel W. Richardson; IL Power; #1,3	x		
Karl Tammar; ISO-RTO (Group of 9); #2	x		
Ken Githens; Allegheny Energy; #5	x		
Al DiCaprio; MAAC (Group of 4); #2	x		
Ken Goldsmith; Alliant Energy; #1	x		

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Lloyd Linke (Group of 10); MAAP; #2	x		
Phil Riley (Group of 8); PSC of SC; #9	x		
John Horakh; MAAC; #2	x		

14. List any Regional Differences for this standard.

**Summary Consideration:** No specific Regional Differences have been identified, but there may be Regional Differences added as the standard is further developed.

Commenter	Comments
Howard F. Illian; Energy Mark, Inc.; #8	Comments by some regions indicate that there should be a frequency independent fixed limit on ACE similar to the current CPS-2. It can be shown that this type of limit does not work effectively in the central region of a meshed interconnection, but can be effective for a peninsular region. If such a limit is implemented, it should be implemented as a Regional Standard and apply only to specific regions, not the entire interconnection.
Any CPS2 type requirement would be based on reliability concerns that are not frequency-related and thus are beyond the scope of this standard. The SDT recommends that any such Regional Difference be implemented via the Operate within IROL Standard.	
Robert Blohm; Applied Statistician; #8	The numerical CPM-1 $\in$ limit and the frequency and relay limits.
There is a single set of limits for each Interconnection, and this is stated in the basic requirements – so there are no regional differences for regions or subregions within an Interconnection.	
Ed Davis; Entergy Services; #1	An interconnection composed solely of one BA should be exempted from this standard since the purpose of this standard is to ensure cooperation among multiple control entities within an Interconnection.
An Interconnection composed solely of one BA still needs to control frequency – so this standard was crafted to apply to them. Field testing of this standard will determine how well we met this goal.	
Roman Carter; SCGEM (Group of 6); #5,6	At the moment, we do not know of any Differences. However, as the Standard is implemented it is possible that some may develop.
Agreed.	
Bart McManus; BPA (Group of 6); #1,5,6	ACE calculation in WECC should be able to have the automatic time error correction term. We also have a more detailed methodology for determining frequency bias.
Interconnections must go through the formal NERC process to modify 'reporting ACE' (control ACE may be modified by individual BAs) calculations. This was not done by WECC for 'reporting ACE'. The changes made to ACE by WECC to accommodate automatic time error correction were made to the 'Controlling ACE', not the 'Reporting ACE'. (Controlling ACE may be used for compliance purposes within WECC, but not for NERC requirements.) Furthermore, the sum of the ACEs within an Interconnection is not necessarily equal to zero (because of frequency bias); although the sum of the inadvertent must be equal to zero.	

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<p>The requirement for determining a BA's frequency bias and the formula for CPM1 in the proposed standard are both technically identical to existing operating policy. In the formula for CPM1, when determining <math>CF_1</math>, the BA's frequency bias is the one minute average of frequency bias for that BA.</p>	
<p>Linda Campbell; FRCC (Group of 12): #1,2,3,4</p>	<p>There could be differences in Under Frequency Load Shed relay settings that are appropriate to different regions, especially depending on how the approval is contemplated in 305.</p>
<p>For the limits to be developed and used by all entities within an Interconnection, the UFLS relay settings need to be appropriate to all end users. Regional differences within an Interconnection relative to UFLS relay settings would need industry support to be approved as part of a standard. We understand that the high set point UFLS in FRCC is actually part of a special protection scheme required because of the unique 'peninsular' nature of the FRCC system. The decision to use this high set point UFLS for interconnection-wide standard setting should be made at the highest policy-setting levels of the industry. The SDT recommends that a high level task force be formed to address this issue.</p>	
<p>Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5</p>	<p>ERCOT is the RA and BA. Special considerations in setting FTL and FAL for ERCOT, due to its size, will be necessary.</p>
<p>Agreed.</p>	

15. Provide any other comments on this standard.

Commenter	Comments
Michael C. Calimano; NY-ISO; #2	The NYISO fully endorses the comments submitted by the ISO/RTO Council's Standards Review Committee.
Please see the consideration of the ISO/RTO Council's comments.	
Bart McManus; BPA (Group of 6); #1,5,6	<p>We will reiterate two things: 1) we do not understand relaxing requirements in light of the August 14<sup>th</sup> blackout and 2) we want the Disturbance Control Standard brought back into this as another part of Standard 300. We would like to have the standard include reserves necessary to be carried by BAs.</p> <p>We also believe that there may be a small fundamental problem in that all frequencies being used in this standard are settling frequencies, not dip frequencies. We realize that there is not a large difference in the Eastern Interconnection between these two, but it is very large in WECC. Underfrequency relays are normally set for 6 to 8 cycles, the frequency dip lasts much longer than that. Therefore, the settling frequency will not give you the necessary data to prevent underfrequency load drop.</p> <p>There must be a mechanism that stiffly encourages each BA to return to its nominal 60Hz operating schedule after a disturbance.</p>
<p>The SDT does not intend to relax the existing requirements for balancing resources and demand. The intent of the new measures in the proposed standard is to have more technically justifiable measures than the measures currently used.</p> <p>Field testing should show whether DCS should be returned to this standard.</p> <p>During the development of the SAR for this standard, industry commenters overwhelmingly indicated that this standard should not include a reserve requirement. The expectation is, however, that some Regions will establish more specific reserve requirements that are applicable to their Regions. As you suggested, the reserve requirement for WECC may be very different than a reserve requirement for ERCOT.</p> <p>During targeted research, the actual 'pick-up' of the frequency relays should be identified for consideration in validating the proposed calculations and in setting appropriate interconnection-specific frequency limits. The SDT makes no assumption about the 'B' or 'C' points in establishing limit-setting methodology, although some of the research done to support SDT activity did use the 'B' point on the frequency response curve.</p> <p>Sanctions associated with operating outside BAALs for time greater than BAAL <math>T_v</math> are expected to motivate BAs to control their operations so they stay within an 'acceptable' range with respect to frequency during all operating conditions, not just following a disturbance. No individual BA can control the frequency in an interconnection – the BA can control ACE, and the acceptable ACE limit is related to frequency through the BAAL. The <math>T_v</math> sets an upper limit on the length of time the BA can operate outside its BAAL.</p>	

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<p>Linda Campbell; FRCC (Group of 12): #1,2,3,4</p>	<p>We believe there is much improvement over Version 1 of the standard. The Standard Drafting team has done a very good job in reviewing and responding to industry concerns. However, we do think the standard is still fundamentally flawed by making frequency its sole focus.</p> <p>While SOL and IROL should protect the transmission system, the current draft of this standard allows the burden of compliance to these criteria to be shifted.</p> <p>As an example, if the frequency is high and a large unit is lost, the BA which loses the unit could take no action, yet the loss of the unit could cause a SOL or IROL to be exceeded. When a TLR is called, the BA which has not scheduled the power it is drawing will be unaffected while entities scheduling and paying for transmission will be cut. There is nothing to make a BA recover from its loss. The name of the standard, Balance Resource and Demand does not really match what is being monitored and required. Consideration should be given to changing to a more appropriate name.</p>
<p>The SAR for this standard limited this standard to focusing on frequency. The SDT has asked the IROL SDT to address the issues related to overloads. If the FRCC desires to modify this standard to address issues outside of frequency, then we suggest that FRCC submit a SAR to modify this Balance Resources and Demand SAR or standard.</p> <p>If a BA loses a large unit and this has an impact on frequency, then that BA's BAAL will motivate that BA to make adjustments to ACE to improve frequency. If the unit loss caused the BA's ACE to move outside its BAAL, then the BA would have to make adjustments to its ACE within BAAL <math>T_v</math>. The BA would be sanctioned if the 'correction' didn't take place within BAAL <math>T_v</math>. If the unit loss had no impact on frequency, then there is no frequency-related reliability reason to require the BA to make adjustments to its ACE.</p>	
<p>Darrel W. Richardson; IL Power; #1,3</p>	<p>Is 303 (e) (3) worded correctly. It would seem that the words "did not" should be removed and the word "occur" should be changed to "occurred".</p>
<p>Agreed – this was modified as suggested.</p>	
<p>Ken Githens; Allegheny Energy; #5</p>	<p>I am concerned about the amount of documentation required in the standard. I think the question we should be asking is "Will the documentation improve reliability?" If not, why should we collect it. Limits are set to alert system operators of problems and have them take corrective actions. I would suggest documenting only events where <math>T_v</math> is exceeded.</p>
<p>The SDT changed the documentation requirements and measures to simplify the data retention requirements. Note that in most cases, the type of documentation needed is the type of documentation you would normally have 'automatically' recorded (date, time, magnitude and duration of event). It is the expectation of the SDT, that the documentation process required for this standard may be automated, and thus reduce the burden on operations personnel.</p> <p>Because there shouldn't be <b>any</b> instances of exceeding BAAL for time greater than <math>T_v</math>, some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, these requirements and measures may be modified.</p>	
<p>Peter Burke; ATC; #1</p>	<p>The SDT did not ask about the Compliance Monitoring Process or the Non-Compliance sections of the document. So I have included those in this section.</p>

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	<p>Requirement 301.</p> <p>Levels of non-compliance.</p> <p>Remove level one and two and have only a level four, which would be the following:</p> <p>Level 4: Not monitoring either ACE or Frequency.</p> <p><i>Overall Comments</i></p> <p>The standard seems to lack a coherent flow throughout the document. The standard refers to several requirements and measures without assigning appropriate non-compliance levels or, in many cases, without assigning any non-compliance levels at all. (Some but not all of the standard's examples of this have been addressed in the above comments.) A requirement is truly a requirement only when it's linked with a measure and an appropriately defined level of non-compliance.</p> <p>The standard drafting team is on the right track but additional work and refinement needs to be done.</p>
<p>The SDT did not ask for feedback on the levels of non-compliance because the requirements and measures may be modified as a result of targeted research and/or field testing.</p> <p>The requirement for monitoring ACE and frequency was modified as were the associated levels of non-compliance. The SDT will wait for the results of targeted research and field testing before making any additional changes to the levels of non-compliance.</p> <p>Please be more specific in identifying where you feel the standard is missing appropriate levels of non-compliance. In some cases a single measure may be used to determine compliance for more than one requirement.</p> <p>The SDT agrees that this standard is still a 'work in progress.'</p>	
<p>Raj Rana (Group of 2); AEP; #1,3,6</p>	<p>Please help us and the industry better understand how the proposed Standard 300 is going to give us better frequency control. How do you plan on substantiating this improvement? We suggest a technical conference be held.</p> <p>The holding of one or more technical conferences would help in facilitating and reaching consensus on this proposed standard. Technical papers in support of the methodology being used in the standard would also help.</p> <p>The response time for data requests should be expanded from five days to 30 days.</p>
<p>The intent of this standard was to establish a technically defensible basis for the measures used to determine appropriate frequency control. There is no guarantee that this will result in 'better' or 'tighter' frequency control. So far, there is no indication that 'tighter' frequency control is needed for reliability.</p> <p>At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The only time data must be provided is following an event where either BAAL <math>T_v</math> or FTL <math>T_v</math> has been exceeded. The data being requested is data that should be readily available from automatic recordings and operator logs – and should be retrievable immediately following the event.</p>	

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P.D. Henderson; IMO; #2	The IMO does not support the standard in its present form.
Please see the SDT's consideration of your individual comments.	
Ed Davis; Entergy Services; #1	<p>Please add a definition for the term “Frequency Trigger Limit Violation Time (<math>T_v</math>)”.</p> <p>Please define “unacceptable risk” as used in each of the several locations throughout this Standard. How is “unacceptable risk” determined? Who defined what level of risk is acceptable, and to whom is it acceptable?</p> <p>Please define “reliability risk” in the BA ACE Limit. How is “reliability risk” determined? Who defined what level of risk is acceptable, and to whom is it acceptable?</p> <p>The requirement in “306 Balancing Authority Area Control Error Limits”, A.2 is not complete as stated. The formula for <math>BAAL_{Low}</math> is valid only for <math>F_A</math> less than <math>F_S</math>. The formula for <math>BAAL_{High}</math> is valid only for <math>F_A</math> greater than <math>F_S</math>. <math>BAAL_{Low}</math> and <math>BAAL_{High}</math> would not be limited when <math>F_A = F_S</math>. Presumably this formula will be implemented in EMS systems. As it is stated currently, the condition of <math>(F_A - F_S)</math> in the denominator of both formulas causes a divide-by-zero condition when actual frequency equals scheduled frequency. It would seem prudent that the standard should be explicit in it's treatment of this condition. If our comments above are added to the formulae, then neither formula would be calculated at <math>F_A = F_S</math> and the infinity would be resolved.</p>
<p>A definition for FTL <math>T_v</math> will be added with the next version of this standard.</p> <p>The level of risk tolerance acceptable to the industry and its customers, will have to be determined through the comments submitted in this open process. The once in ten year criteria sited in the original draft of the standard, is a common ‘rule of thumb’ used in many system planning applications. At this point we are trying to verify that an ‘acceptable risk’ can be identified for each Interconnection. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.</p> <p>The formula for BAAL Low is only valid for <math>F_A</math> less than <math>F_S</math> – this is intentional and reflects the non-symmetrical nature of BAAL limits which are constraining only when ACE adversely impacts frequency. This was not explicitly stated in the standard.</p> <p>In the case of <math>F_A = F_S</math>, there is no frequency error, therefore no frequency-related reliability reason for limiting ACE. From a programming standpoint, BAAL calculation is not defined at <math>F_A = F_S</math>.</p>	
Howard Rulf (Group of 2); We Energies; #3,4,5	BAAL is much different than CPS-2. A small control area may be outside of BAAL for very small MW values. A large BA can be thousands of MW out, causing a FTL excursion, and still be within BAAL. There needs to be fixed upper and lower limits to BAAL.
<p>Limits for a BA give consideration to individual BA's frequency bias and should treat all BAs fairly. Relative to CPS2, smaller BAs will have tighter requirements than the larger BA. However, unless reliability is being threatened by large frequency errors, BAAL should not be constraining for any BA.</p> <p>It is the intent of the standard that FTL cannot be violated without at least one BA operating outside its BAAL. Targeted research will validate</p>	

this concept.

**16. Reaching consensus is a difficult task. If you have any ideas on how the SDT can move the industry forward in reaching consensus on what constitutes an ‘acceptable risk to the interconnection’, please share your ideas with the SDT.**

**Summary Consideration:** The level of risk tolerance acceptable to the industry and its customers, will have to be determined through the comments submitted in this open process. The once in ten year criteria cited in the original draft of the standard as the threshold for an ‘acceptable risk to the interconnection’, is a common ‘rule of thumb’ used in many system planning applications. There was a suggestion to hold a workshop to collect ideas, and the SDT will strongly consider holding a workshop after completion of targeted research and/or after completion of initial field testing.

Commenter	Comments
Sydney L. Niemeyer; Performance, Disturbance and Compliance Working Group (Group of 3); #1,2,5	Primary Frequency Control increases an Interconnects acceptable risk tolerance. A Frequency Response Standard for a minimum BA frequency response would maintain a minimum level of Primary Control from the Resources.
Agreed, but this solution is outside the scope of the Balance SDT.	
Alan Boesch; NPPD; #1	If a violation a Area Control Error Limit is set at 30minutes then 15 minutes (not 30 seconds) would be a reasonable time for providing documentation.
The ‘30 seconds’ was intended to eliminate the need to report any ‘events’ that were caused by telemetry errors or other false readings.	
The documentation requirements have been modified so they are simpler.	
Bart McManus; BPA (Group of 6); #1,5,6	We recommend a two day workshop with invitees presenting their ideas as well as question answer during the presentations. All ideas could then be posted for comment for a one month period so industry representatives that did not make the workshop could add their ideas to the mix.
The SDT will strongly consider holding a workshop after completion of targeted research. However, (assuming the targeted research doesn’t identify any fatal flaws in the concepts or limits) the standard won’t be revised and re-posted for comment until after some preliminary field testing has been completed so there is some concrete data to evaluate.	

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Ed Davis; Entergy Services; #1	It would seem that NERC should commission a task force to specifically identify the reliability limits for frequency in an Interconnection. This standard seems to indicate that we will only manage frequency seriously when frequency declines to within one contingency of causing cascading outages. On a given day, the EI is probably 20 or more contingencies from causing UFLS relay operation. Shouldn't we be taking action earlier in the process? For instance, experience has proven that the EI can suffer more than a 100 milliHertz decline at 2200 on a routine day without a significant contingency. It seems prudent to maintain the frequency equivalent of the 5 largest generating units plus 100 milliHertz above the highest UFLS relay set point. A more rigorous method might be to determine what frequency margin above the highest UFLS relay set point would cause it to trip no more than 1 day in 10 years.
<p>This is within the scope identified for the Balance Resources and Demand SDT in the associated SAR. Targeted research is being conducted to validate the concepts and limits proposed in this standard. The results of this research will be publicly posted for all industry participants to review. Targeted research will be followed by field testing, the results of which will also be posted for public review.</p> <p>Any event that causes a movement in interconnection frequency will impact all BA BAALs and thus motivate BAs to control ACE in a direction that supports frequency.</p>	

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**17. The requirement for setting frequency limits requires the identification of the “. . .highest approved UFLS Relay setting for the interconnection” Do you have any ideas on how the Eastern interconnection could identify its highest approved UFLS Relay setting? Would it be OK to let the Standards Developer mediate this?**

**Summary Consideration:** For interconnection-wide limits to be developed and used by all entities within an Interconnection, the UFLS relay settings need to be appropriate to all end users. Regional differences within an Interconnection (relative to UFLS relay settings) would need industry support to be approved as part of a standard. The SDT has recommended that a high level task force be formed to address this issue.

Commenter	Comments
Alan Boesch; NPPD; #1	Do a Survey
The survey would only collect data, not help to resolve differences identified by the data. The real issue is how to resolve the differences of opinion that exist on what is the most appropriate UFLS setting.	
Bart McManus; BPA (Group of 6); #1,5,6	Direct all regions to query their control areas, etc. to find what the highest UFLS relay setting is in that region. Find out how that setting was approved from the entity that owns the relay.
The survey would only collect data, not help to resolve differences identified by the data. The real issue is how to resolve the differences of opinion that exist on what is the most appropriate UFLS setting.	
Al DiCaprio; MAAC (Group of 4); #2	MAAC suggests that a single interconnection limit be defined at the outset (either by directed research, or the value can even be set to be the highest UFLS setting today). MAAC is concerned that just using the highest level set by anyone during a given year leaves the path open for gaming.
For interconnection-wide limits to be developed and used by all entities within an Interconnection, the UFLS relay settings need to be appropriate to all end users. Regional differences within an Interconnection relative to UFLS relay settings would need industry support to be approved as part of a standard. The SDT has recommended that a high level task force be formed to address this issue.	
Raj Rana (Group of 2); AEP; #1,3,6	Each Region should know how UFLS relays are set in their Region, and if they don't, they should be charged with finding out. Who is the standards developer.
Agreed that each Region should know this information. The issue to be resolved is how to determine for the Interconnection, which setting is the most appropriate to use.	
P.D. Henderson; IMO; #2	<p>a)The NPCC document A-03 refers to set points that each area must be capable of carrying out Underfrequency Load Shedding . Viz.</p> <p><u>Automatic Underfrequency Load Shedding</u></p> <p>Each <b>Area</b> must be capable of carrying out the following:</p> <ul style="list-style-type: none"> <li>• Automatic <b>load shedding</b> of ten percent of its <b>load</b> at a nominal set point of 59.3</li> </ul>

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	<p>Hertz.</p> <ul style="list-style-type: none"> <li>• Automatic <b>load shedding</b> of an additional fifteen percent of its <b>load</b> at a nominal set point of 58.8 Hertz.</li> </ul> <p><b>Load shedding</b> steps above are intended to return frequency to at least 58.5 Hertz in 10 seconds or less and to at least 59.5 Hertz in 30 seconds or less, for a <b>generation</b> deficiency of up to 25% of the <b>load</b>.</p> <p>Alternatively, rate of change of frequency <b>load shedding</b> may be used when the requirements of the <b>Area</b> indicate that this method will achieve the intent of the <b>load shedding</b> program. Studies shall be performed by each <b>Area</b> to ensure satisfactory voltage and loading conditions after automatic <b>load shedding</b>.</p> <p>b)The Standard Developer could make recommendations with rationale preferably supported by studies.</p>
<p>While the above suggestions are valuable in establishing criteria for use in determining a minimum set of criteria for the setting of UFLS, there may be other criteria that may also be appropriate for use in setting some unique frequency-related relays.</p> <p>Agreed that the Standards Developer should work towards reaching consensus on which settings are most appropriate, and that targeted research should determine the validity of the concept of using UFLS relay settings.</p>	
<p>John Horakh; MAAC; #2</p>	<p>Survey the Regions to determine the highest setting used that is not a “one of a kind” or very different number</p>
<p>This may omit a very important ‘one of a kind’ relay setting, and while this technique may provide a good ‘starting point,’ the SDT is concerned that it may cause Regions with those ‘one of a kind’ relay settings to vote against this standard.</p>	
<p>Ed Davis; Entergy Services; #1</p>	<p>Each Region should have a list of UFLS relay settings. The task force mentioned in our comments on 16 could have a specific assignment to collect all of the UFLS relay settings and to establish a process for all Regions to collect these settings annually and forward them to a new NERC repository.</p>
<p>Collecting the relay settings is an important first step, but there may be some conflicts in opinions as to which relay settings are most appropriate for sue in this standard. Your concept of forming a task force has been adopted, and the SDT has requested that a high level task force be formed to determine which settings are the most appropriate for use in this standard.</p>	

### Attachment 1 – Robert Blohm Comments on question 1

#### Do you agree with the change to Requirement 301 to keep CPM-1 and eliminate any second CPM?

I wholeheartedly agree with the decision to eliminate CPM-60. CPM-60 unnecessarily complicates the balancing standard and is superfluous to CPM-1 which already captures "diversity" in the "covariance" of ACE with frequency error. CPM1 and BAAL together make a compact and powerful long and short term pair of balancing standards accomplishing the "diversity" benefit of interconnected operations captured in "covariance" and "bias share".

The SDT appreciates your support of the changes made to eliminate a second CPM. The following comments were offered by Mr. Blohm in response to his interpretations of the "Introduction to the Balance Resources and Demand Standard". Mr Blohm indicated that he did not want the SDT to respond to these comments, Mr. Blohm merely wanted to offer the SDT his version of improvements that could be made to the "Introduction to the Balance Resources and Demand Standard." The SDT does not intend to revise the "Introduction to the Balance Resources and Demand Standard" until after the results of Targeted Research and Field Testing have been accomplished. The SDT did not reject Mr. Marakhov's proposed revision of CPM-60; the SDT indicated that the concepts presented were incomplete and would need more development before being considered superlative to those already proposed within the standard.

*Filling 3 gaps in the Standard Drafting Team's reasoning.* I appreciate the Standard Drafting Team's acceptance of the logic of my and others' comments on this issue in the first draft of the standard. But there are three gaps in the Drafting Team's justification.

1. The "Frequency Profile" section of the Introduction (pages 4 & 5) to the draft standard could do a much better job of defending the team's decision. As written it is nonsense to a trained statistician, as explained in the rest of this comment. Accordingly, I have corrected/rewritten the "Frequency Profile" section and append it to the end of this comment as Footnote<sup>1</sup>.
2. Several of the drafting team's "Responses to Comments" made by me (pages 16, 18), Howard Illian (page 12) and NPCC (page 23) to the first question on the previous draft of the standard contradict the team's decision to eliminate CPM-60. In particular, the Response to parts 7, 8 & 13 of my answer applies faulty reasoning. It argues vainly that NERC adopted CPS2 as a second standard to enforce a frequency "profile" when it's mathematically impossible for CPS2 to do that. You can't then go and say that that failure by CPS2 to do an impossible job never intended by NERC now justifies adopting a standard to do that job.
3. No reasoning is given for rejecting Yuri Marakov's proposed revision of CPM-60 that is posted as Appendix 1 to the "Responses to Comments": I give more justification for this decision at the end of these comments on the first question.

*Corrections to 2 fundamental misunderstandings in the "Frequency Profile" section of the Introduction.*

1. **CPS1 allows for control less strict than average ACE = 0.** CPS1 does not limit control to average ACE = 0 as the "Frequency Profile" section incorrectly states. CPS1 is a limit on: average ACE "times"  $\Delta F$ . CPS1 limits this average "product" of two things to being less than  $-10 \times CA'sBias \times \epsilon^2$ . CPS1 already captures "diversity" by multiplying ACE times all the other ACEs incorporated in  $\Delta F$ , and sets a limit of  $\pm \epsilon \sqrt{-10 \times InterconnectionBias}$  -on-average on all the "simultaneous" ACEs.
2. **CPM60 does not control instantaneous ACE to a limit closer to ACE = 0.** CPM60 does set a tighter limit on average ACE measured over a longer scan rate. But in the longer scan, large short-scan ACEs are offset not by SMALLER ACEs (as the "Frequency Profile" section states) but by LARGE ACEs in the opposite direction! The large SIZE of short-scan ACEs allowed by CPS1 is not affected by CPM60. In fact a CPM60  $\in$  limit tighter than the CPM1  $\in$  limit "causes" short scan ACEs to be as large as ever, only in opposite directions from each other half the time, making short-scan ACEs not at all smaller, only more "variable". Increasing of variability does not reduce "diversity" which is handled by CPM1 control on "simultaneous" or "coincident" ACEs, but reduces any "patterns", "regularity", or "repeatedness" in the occurrence of ACEs, or in the coincidence of ACEs. The patterns, regularity, or repeatedness are called "auto-correlation" between ACEs. The reduction in auto-correlation between ACEs over time does not increase diversity between ACEs. This is already

captured by CPS1. The reduction in auto-correlation reduces the correlation over time of ACE with itself. This reduction in predictability of ACE regardless of size reduces control actions that are "predictable" and "unfair" to the control areas on the costly side of the predictable pattern who are supporting frequency by offsetting the errors that others are disproportionately or "routinely" causing.

*The Introduction contains more attempted reasoning against the decision to reject CPM-60 than justification for the decision.* Much of the "Frequency Profile" discussion on pages 4 & 5 of the Introduction does not provide justification for this good decision, but rather still seeks to justify CPM-60 and does so badly. The statement on page 5 of the Introduction that "The S[tandard] D[rafting] T[eam] does not believe that control [to a frequency profile] is necessarily a 'reliability' concern" accepts the idea supported by the published historical record that CPM-60 and "Frequency Profile" address an equity issue of randomness and "fair" distribution of control contribution, not reliability control per se to limits. Footnote<sup>2</sup> at the end of this comment lists the quotes to this effect from the published historical record, grouped under subject headings in red keyed to the red word(s) highlighted in each of the comments. No editing or in-depth explanation to be consistent with this seems to have been done in either the "Frequency Profile" section of the Introduction or the answers drafted in the "Responses to Comments" in reply to my and others' comments that objected to CPM-60 and that were given in answer to the 1st question about the previous, first draft standard.

*"Frequency Profile" is too advanced a statistical concept and the Introduction's 2-page discussion is hopelessly mixed up.* The "Frequency Profile" discussion is also pointless, since the draft standard itself now correctly excludes "frequency profile". The "frequency profile" concept is based on a piece of advanced statistical theory called "the Central Limit Theorem", and has proven too advanced a concept to be sufficiently explained, understood and agreed to by the industry. As an applied statistician, I find the attempted explanation and justification of "frequency profile" in the Introduction to this standard to be an excellent example of this fact. In the Response (pages 235-237) to NPCC's comment on question 18 about the previous draft standard in which NPCC states that frequency profile maintenance is not a reliability issue, the drafting team cites as the sole basis for a frequency profile the Standards Authorization Request (SAR) which merely uses the word "profile" without ever defining it beyond its ordinary meaning of a "limit". Since "profile" is a highly sophisticated mathematical statistical concept that even the draft standard has had enormous difficulty defining, there is no way mere mention of the word "profile" in the SAR mandated implementation of this concept still very ill-defined by the drafting team. Not only would a properly-explained "Frequency Profile" be hard for an untrained reader to understand, the Introduction's 2-page "Frequency Profile" discussion compounds the problem by being a "bobbing and weaving" hash of the following four basic "shell-game" mix-ups:

*Four basic mixups of technical concepts in the "Frequency Profile" section of the Introduction.*

**Mix-up #1.** *Mixing up ACE with  $ACE \times \Delta F$ ; mixing up counterclockwise "rotation" of a profile curve with upward "shift" of a profile curve.* The Policy 1 control performance objective is to control, not ACE to be near zero, but  $ACE \times \Delta F$  to be less than  $-10 \times \text{Bias} \times \epsilon^2$ , where  $\epsilon$  is some frequency error limit. The bogus claim that the objective is control of ACE alone (to be near zero), sets the stage for the next mix-up. Also, mixing up ACE with  $ACE \times \Delta F$  allows the writer

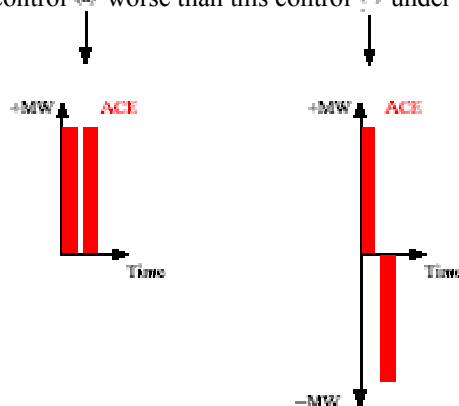
- (a) to mix up the job of CPS 2 (which is an ACE alone performance measure to limit not by how much but by how often ACE could exceed  $L_{10}$ , which is not near zero) with the job of CPS1 (which is an  $ACE \times \Delta F$  performance measure),
- (b) to claim that CPS 2 should have had some effect on  $ACE \times \Delta F$  when it couldn't have and, then,
- (c) to use this failure as an excuse to replace CPS-2 with a second  $ACE \times \Delta F$  measure known as CPM-60. Moreover, the mix-up causes the CPS-2 failure to be mischaracterized or misunderstood as a *deterioration* in the shape of the frequency profile "curve", in the form of a *flattening* or *rotation* of the curve, when it was instead a mere *shifting* upward of the entire unchanged frequency profile "curve" that a single appropriately set CPM-1 limit can stop!

**Mix-up #2.** (i) *Mixing up error sample-averaging interval (minutes) with performance period (1 year).* (ii) *Mixing up "reversal" in direction with "reduction" in size.* (iii) *Mixing up "Average of squares" with "Square of an average".*

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- (i) *Data scan/averaging interval, not performance period. "Reversal", not "reduction".* The longer the interval over which errors measured every few seconds are averaged (a 60-minute interval versus a 1-minute interval) the smaller the size of the average-error sampled. This is all that a "frequency profile" tells us. A tighter performance limit placed on a longer error sample-averaging interval forces huge errors sampled early in the averaging-interval to be followed by errors later in the interval that are "reversed" in the opposite direction, not "reduced" in size. Frequency PERFORMANCE, on the other hand, is assessed as the "square" of frequency error. Over the one-year performance period, huge 1-minute or 1-hour squared-errors have to be followed by smaller-magnitude squared errors (regardless of plus-or-minus direction of the errors) in order to fall within the one-year performance limit. In other words, excessive  $(\Delta F)^2$  "performances" (which are only positive) are "corrected" by smaller ones to comply with the long-term performance average. But big positive or negative  $\Delta F$  "data" samples are "reversed" by subsequent large errors of the same size but in the opposite direction to achieve a small enough average of data sampled over a longer interval to comply with the tighter limit on performance computed from data sampled over that longer-interval!
- (ii) *ACE  $\times$   $\Delta F$ , not  $(\Delta F)^2$ .* The "Frequency Profile" discussion in the Introduction to the standard mixes up ACE with frequency error and misapplies this reasoning about FREQUENCY PERFORMANCE to argue (regarding ACE) that a "longer" error sample-averaging interval (for CPM-60) is needed "to measure whether the shorter-interval ACE errors were **corrected**" or because "ACEs must be **corrected** in a reasonable time period", meaning subsequent errors must be "made smaller", not be "reversed", in other words not be of the same huge magnitude and not be in the opposite direction. So does the Response (page 15) to part 5 of my Comments to question 1 about the previous draft; the Response states erroneously that "The profile allowed control areas to **offset** [my emphasis] short-term large variations with long-term small variations in control performance". This mix-up gives the false impression that CPM-60 imposes a long-term restriction on the size of CPM-1 errors, and it does not. There is only one CPS performance period, and it is 1-year, whether it's CPM-1 or CPM-60. The tighter CPM-60  $\epsilon$ -limit comes into play only if frequency has deviated sufficiently in the wrong direction on average and, if that has happened, all CPM-60 does is to require "opposite" errors of the same magnitude, in other words "randomization" or "variability", but this has no effect on control which is exclusively focused on the "size" of ACE  $\times$   $\Delta F$ , or  $\Delta F \times \Delta F$ , not on the "direction" of ACE alone, of  $\Delta F$  alone, or of ACE  $\times$   $\Delta F$ . Indeed reliability has no answer to this question:

Why is this control (a) worse than this control (b) under CPM = ACE  $\times$   $\Delta F$ ?



It depends on which direction frequency error is. If there is no answer, CPM 60 is pointless. If frequency error is zero, (b) is fairer and pays for itself. Indeed, if there is underfrequency during both periods, then (b) is *worse* control because the second period completely undoes the frequency support given in the first period. This contradicts the drafting team's Response (page 13) to part 5 of Energy Mark's/Howard Illian's comment to the first question about the previous draft. The Response denies that rearview-mirror control harms reliability. CPM-60 addresses equity, not control, and can even harm control. The "suite" of two measures now being adopted is not CPM-1 "short-term" and CPM-60 "long term"; it is CPM-1 as the "long term" performance measure and

BAAL as the "short term" performance measure based on the same mathematical formula as CPM. Two pictures depicting the difference between data sample-averaging interval and performance period are appended as Footnote<sup>3</sup> at the end of this comment.

(iii) "*Average of Squares*"  $\geq$  "*Square of an Average*". That CPM-60 frequency performance falls within tighter mathematical bounds than CPM-1 frequency performance reflects the direct mathematical truth that A "*1-hour Average of Squares of 1-minute samples*" is greater than the "*Square of a 1-hour Average of 1-minute samples*". Mixing up data sample-averaging interval with performance period when measuring frequency performance is tantamount to mixing up the "Square of an (hour) Average" with a (1-hour) "Average of Squares". An "Average of Squares" of data is always greater than the "Square of an Average" of the same data as proven in Footnote<sup>4</sup> below. On average for any given hour, CPM-60 places a limit on the "Square of an Average" of one-minute data, not on an "Average of Squares" of one-minute data. Otherwise, **misapplying the CPM-60 limit to an "Average of Squares" imposes draconian control** in the form of reduction in size of one-minute errors, not merely reversal in direction of one-minute errors regardless of size. CPM-60 control is far looser than that. In fact, it is not control at all. CPM-60 only limits frequency drift because, as proven in Footnote<sup>5</sup> below, annual mean shift measured by one-minute data is identical to mean shift measured by one-hour averages of one-minute data. Frequency-drift is not a reliability issue but an equity/commercial issue because it makes reliability/control far more costly and much less fair but no less possible to maintain by tightening variability. [This contrasts with the drafting team's self-contradictory Response (page 12) to parts 1, 2, & 3 of Energy Mark's/ Howard Illian's comments on question 1 about the previous draft standard, in which the Response affirms that frequency drift within the CPS1 limit is a reliability issue addressed by CPM-60 and that targeted research would determine a safe limit.] That issue is addressed by proper economic rewards and penalties through the pricing of inadvertent interchange. Furthermore, since the derivation in Footnote<sup>4</sup> proves that the "Square of an Average" can never exceed an "Average of Squares", **the frequency profile of an interconnection can never be positively/upward sloped!** In other words, it is a *mathematical impossibility* that a  $(\Delta F)^2$  measure like CPM-60 could deteriorate to a level higher/worse than a  $(\Delta F)^2$  measure like CPM-1. Accordingly, there is no reliability need for CPM-60 and CPM-1 captures all the best information. On the other hand, the CPM profile of a BA can be any slope. But we know mathematically that the BA CPM profiles sum to an interconnection frequency profile that is never positively/upward sloping. Confusing the two sets up the next mix-up, of CPM-60 with the  $\pm \epsilon_1$  limit on the combined CPM-1 performances of all control areas at a given time, or of CPM-60 with the  $-10 \times \text{Bias} \times \epsilon_1^2$  limit on a given Control Area's CPM-1 performance over time.

**Mix-up #3.** *Mixing up having a second control measure CPM-60 with having an  $\epsilon$  limit on the long-term average "covariance" of  $ACE \times \Delta F$ .* Having a second control measure CPM-60 does not reduce the "risk of having all control areas maintaining ACEs at the higher value" of the spikes of a few of the control areas, or the risk of not controlling the magnitude of a control area's short term spikes from early highs to later lows to get within a limit on long-term average performance. The limit  $-10 \times \text{Bias} \times \epsilon_1^2$  on the "covariance"  $ACE \times \Delta F$  of CPM-1 controls that risk, and does so at all moments of time and over time, on average. This should be clear provided it is remembered that CPM-1 is a measure of "covariance"  $ACE \times \Delta F$ , not of ACE alone (Mix-up # 1 above). Mixing up the effect of CPM-60 on CPM-1 with the effect of  $\epsilon_1$  on CPM-1 sets the stage for the last, most confusing mix-up.

**Mix-up #4.** *Mixing up the "probability distribution" curve of frequency error data of a given sample size with the "profile" curve plotting the average frequency error of each data-sample population defined by a different length of sampling-interval.* The definition given defines "frequency profile...in terms of a probability distribution" curve. That definition is meaningless. The frequency profile is a curve that plots the CPM performance for each interval-length over which data scans are averaged. There is a separate statistical distribution curve of the population of data for each averaging interval (say 1-minute) of data scans. Each distribution plots the number of times different values of the data sampled/averaged at the interval length defining the data population occur, and each distribution has an average error which constitutes the CPM performance. The Response (page 13) to Energy Mark's/Howard Illian's 4th comment on the 1st question about the previous, first draft of the Standard is the most glaring evidence of mixing-up "profile curve" with "probability distribution" curve. *That Response mixes up the higher CPM1 performance limit  $\pm\epsilon$  with the  $-\epsilon$  limit on the average deviation in the left tail of a statistical distribution of  $\Delta F$  and mixes up the lower  $\pm\epsilon$  CPM-60 performance limit with the  $+\epsilon$  limit on the average deviation in the right tail of that same single statistical distribution of  $\Delta F$  on the erroneous basis that  $-\epsilon$  and  $+\epsilon$  may be of significantly different size from each other, in other words that somehow  $|-\epsilon| \gg |+\epsilon|$ !* The Response by the drafting team absurdly concludes "If the distribution of frequency errors formed a normal distribution (bell curve), then having a single point would be sufficient to

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characterize overall performance. However, if the distribution of frequency errors is asymmetrical, then at least two points are needed." This statement betrays lack of an elementary command of mathematical statistics. Furthermore a distribution of frequency errors over a year is effectively symmetrical, with infinitesimal asymmetry occurring in the tails as Energy Mark/Howard Illian discovered in a study of ERCOT's frequency performance.

2 comments on California ISO's proposed alternative to CPM-60 in Appendix 1 of the Responses to Comments. CA ISO doesn't question CPM-1, but rather proffers an "improvement" to the proposed CPM-60 standard. CA ISO does not provide justification for the two key points of (claimed improvement in) its proposal, by not answering the following two questions:

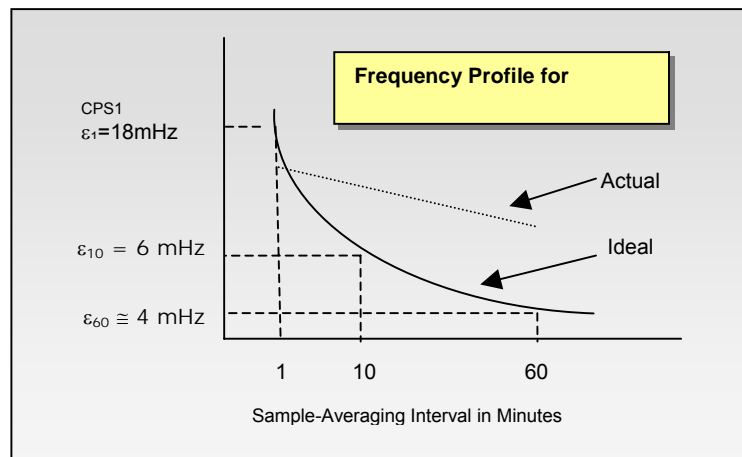
1. Why/how is a linear, absolute-value (first-moment) measure of variability (MAE) superior to the quadratic (second-moment) measure of variability (RMS) that we currently use and that has permeated the mathematics of statistical science? Why and how is it superior despite the contrary results of theoretical statistics' founders best efforts? In particular, CA ISO needs to offer a revision/replacement for the very powerful "moment generating function" that is the very foundation of modern statistics and physics, and define "linear" moments.  $\eta$  is just an ad hoc number to somehow bridge the gap between a convenient "mean average error" (MAE) measure and the "root of the mean of squared errors" (RMS) gateway to the body of statistical science.
2. Why is covarying individual performance with system performance, as we currently do, a bad way to assess performance, not a good way? Answering that would address the deep philosophical issue of performance "relativity" and why or why not to make assessment of individual performance relative to collective performance. While probability and relativity have been the hallmarks of modern physics, need we seek to make individual (say, BA) performance more "absolute" and less relative to "collective" (say system, frequency) performance? MAE allows for no covariance, no correlation. This excludes the whole area of diversity and benefit from interconnected operations, leaving MAE to provide control that is either too tight or too loose relative to the state of the system. Doing so in a social-technical system like the interconnected electric grid runs the risk of rejecting the progress of modern (relativistic and probabilistic) physics over classical (absolute) Newtonian physics in dealing with physical systems whose components strongly interact even more than in your run-of-the-mill social system.

Footnotes:

<sup>1</sup>Rewrite of Frequency Profile & Elimination of CPM-2 section of the "Introduction" to the draft standard:

### Frequency Profile:

*A frequency profile is the limit on the average annual control performances of an interconnection based on a spectrum of ever-longer data-scans of frequency error ( $Frequency_{actual} - Frequency_{scheduled}$ ).*



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Operating Policy 1 tries to control interconnection performance in balancing resources and demand through two requirements:

- By requiring each Control Area to maintain an average  $ACE \times \Delta F < -10 \times CA'sBias \times \epsilon^2$ .
- By requiring each Interconnection to control frequency so it stays within limits for high and low frequency

Requirement 1 (Maintain an average  $ACE \times \Delta F < -10 \times CA'sBias \times \epsilon^2$ ). Each Control Area has an obligation not to control ACE around zero, but over time to control  $ACE \times \Delta F < -10 \times CA'sBias \times \epsilon^2$ . The Industry was willing to accept short-term "ACE  $\times$   $\Delta F$ " values as long as they are within  $-10 \times CA'sBias \times \epsilon^2$ . The industry noticed the possibility of two measures: one data averaging, not performance averaging, period for shorter sampling periods (to measure the large ACE values) and a second data averaging period for longer sampling periods (to measure whether shorter-sample ACE error values were offset by enough shorter-sample error values of the same size but in the opposite direction), or of a curve relating short period and longer period data sample averaging periods to long term performance.

Requirement 2 (Control frequency so it stays within limits for high and low frequency). A single frequency-dependent performance number was adopted as the limit and was not a completely technically derived quantity but was set at a consensus-accepted level. The risk of too much bad-performance coincidence on average is controlled by a single limit on the covariance  $ACE \times \Delta F$  of ACE with frequency error. On the other hand, the industry did notice that different durations of (the data scan/averaging of) Interconnection frequency behavior, not durations of the "square" of frequency behavior, generate different performance numbers--a spectrum of values. Moreover, the Industry recognized the predictability of control errors (frequency was low during pickup periods and high during drop off periods) and such "coincidence" of control errors was an inherently unfair condition that could be discouraged by adoption of a second, tighter frequency-dependent performance limit based on a longer-duration data scan/average.

The Industry approved the use of two Control Performance Standards (CPS1 & CPS2) i.e. based on the concept of using two sliding average sampling periods of ACE – a one minute sliding average of ACE and a 10 minute sliding average of ACE. One measure required that the 1-year average of each 1 minute's average ACE times that minute's average frequency error be less than -10 times the Control Area's bias times the square of a predefined Interconnection frequency error ( $\epsilon_{1 \text{ minute}}$ ). But the other measure is an ACE-only measure requiring that 90% of the 10-minute averages of just a Control Area's ACE over one year be less than 16.5 times the square root of the product of the Control Area bias times the Interconnection bias times the maximum allowed (smaller) annual average of 10-minute scans of frequency error ( $\epsilon_{10 \text{ minute}}$ ), where  $\epsilon_{1 \text{ minute}}$  and  $\epsilon_{10 \text{ minute}}$  are obtained from the ideal Frequency Profile.

As previously proposed in this draft standard, the Control Performance Measure was based on statistical distributions of data samples of two different sizes, and measuring performance by CPM-1 and CPM-60 to capture the Interconnection Frequency Profile curve. The limiting profile curve itself, which was set by the limits on CPM-1 and CPM-60, was proposed to be updated annually. However, the control objective is to use only one performance measure and let control entities take advantage of the Interconnection's innate diversity as long as the control entity's "ACE  $\times$   $\Delta F$ " is less than  $-10 \times CA'sBias \times \epsilon^2$ .

Reality is that ACE can't be zero all of the time. Indeed there is no good reliability or economic reason for ACE to be zero all of the time. But how large can ACE be allowed to go? As large as  $\Delta F$  allows it to go so that  $ACE \times \Delta F$  is less than  $-10 \times CA'sBias \times \epsilon^2$ . The Industry has specified that history and scientifically justified good engineering judgment be used to define the  $\epsilon$  value.

The consensus of the industry is that ACEs can and are impacted by conditions outside the control of the control entity – and in those cases the entity should be able to take advantage of its interconnected system as a benefit of being interconnected. The industry also realized that if on average all entities were off at the same time in the same direction the reliability of the transmission system could / would be at unacceptable risk levels. CPS  $_{1 \text{ minute}}$  uses rapid-scan data to measure long-term performance in relation to the goal of the Interconnection (i.e. the  $-10 \times CA'sBias \times \epsilon^2$  value for the 1 minute sampling interval). By averaging performance over a one year period CPS  $_{1 \text{ minute}}$  becomes an indicator of the control entity's behavior.

CPS  $_{60 \text{ minutes}}$  requires that large ACEs be made in opposite directions in a reasonable (and measurable) time period. CPS  $_{60 \text{ minutes}}$  provides a fair and equitable interconnection target for longer data sampling/averaging intervals. So, in comments on this standard, the industry indicated it did not support a 60-minute CPM for reliability.

In terms of the interconnection, the interconnection can accept higher frequency spikes from a few control areas BECAUSE other entities in the interconnection have spikes averaging in the opposite direction and because the combined entities will be averaging within the  $\epsilon^2$  limit as time goes on. A single Control Performance Measure would not be at risk of having all control entities maintaining

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combined ACEs (and therefore frequency) at a value higher than  $\epsilon$ . The fact that all of them are at greater than their bias share of  $\epsilon$  means they are out of compliance with CPM-1. The "covariance" of ACE with  $\Delta F$  in the  $ACE \times \Delta F$  performance measure incorporates diversity and the benefits of interconnected operations.

The current version of CPS2 as an ACE-only measure has failed to limit  $ACE \times \Delta F$  based on longer-scan data samples. The Resources Subcommittee has evidence that the entire frequency profile has shifted upward. The CPS2 measure's use as its proponents wanted it used, i.e. to correlate only ACE and transmission congestion, fails to control frequency.

The SDT believes that control to a frequency profile is not a 'reliability' concern, but an equity concern, while in the SAR the word "profile" is used without any definition, leaving it to be interpreted as "limit". The SDT modified the standard to eliminate the CPM-60 as a second measure, but will ask the industry to confirm that a second point is not desired in this standard (10 minutes, 60 minutes, or some other data sampling/averaging period.)

The SDT believes that the combination of CPM-1 for long-term control and a frequency sensitive BAAL for short-term control will provide sufficient measures to motivate the Balancing Authority to operate within defined limits.

<sup>2</sup>*Quotes from the published literature on CPS arranged by subject [3 publications]*

### Randomness:

"The new standards attempt to make the time average of an ACE essentially **unpredictable** beyond some specified time period such that a control area uses interconnection short-time assistance only on a **random** basis." Sasaki, T. and Enomoto, K., "Dynamic Analysis of Generation Control Performance Standards", *IEEE Transactions on Power Systems*, Vol. 18, No. 2, May 2003, p. 100

"Consider average obligation over the next T minutes:

-If T is small, less than 5 to 10 minutes, or so, change in average obligation is difficult to accurately **predict**, and very difficult, or impossible, to match with generation changes.

-As T becomes larger, change in average obligation becomes less difficult to **predict**, and more easily matched by generation maneuvering.

Beyond some value of T, call it  $T_c$ , average ACE should be essentially **unpredictable** (even in sign), otherwise it indicates anticipated off-schedule operation.

Thus, T-minute average ACE should be **random** for any averaging interval greater than  $T_c$ . When this **randomness** is reasonably achieved,  $AVG_T\{ACE\}$ , for  $T > T_c$ , will be reasonably **non-coincident** with its counterpart  $AVG_T\{ACE\}$  in other areas of the interconnection." Jaleeli, N., and VanSlyck, L. "NERC's New Control Performance Standards", *IEEE Transactions on Power Systems* Vol. 14, No. 3, August 1999, p. 1093.

### Randomness and Equity:

"When ensuing ACE averages are non-predictable, a control area is using the interconnection's power exchange only on a **random** basis. On such a basis, interconnection assistance becomes **judicious and mutually** beneficial for all areas. When an area's ACE is typically off-zero in the same direction for the same hours of the day, the area has a **predictable** ACE structure. The daily cycle of time error which exists in all NERC interconnections is evidence of repetitious structure in ACEs. For interconnected operations to be **fair**, performance standards should be sensitive to **non-random** ACE averages." Jaleeli, N., and VanSlyck, L. "NERC's New Control Performance Standards", *IEEE Transactions on Power Systems* Vol. 14, No. 3, August 1999, p. 1093.

### Equity:

"Unfortunately, the culture of interconnected operation has failed to recognize the importance of controlling ACE averages beyond 10 minutes. The consequent **inefficiencies** of frequency control are not only costing many hundred millions of dollars per year but may also be allowing a **very unfair** distribution of interconnection benefits among areas.", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-15.

"However, to fully **minimize costs**, the sliding averages of  $\Delta F$  should be controlled on a priority basis to eliminate  $\Delta F$  oscillations having periods longer than a few tens of minutes.", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-15.

"Realization of the [target limit frequency profile] Curve 3, in comparison with [actual frequency profile] Curve 1, would **save many hundred millions of dollars** in regulating costs and would **fairly** disburse interconnection benefits among areas.", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-17.

"Since control of ACE averages beyond 10 minutes, and especially beyond one hour, **does not impose much stress** on generating units, such a target frequency should be very **attractive** to all areas. However, realization of such objective[sic] requires technical staff training and some modification of AGC software. Initially therefore, many areas may have some reservations about adopting such a target frequency." Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-18.

"Minimization of interconnection regulating **costs**, therefore, should not be enforced by design of performance criteria.", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-15.

"A concern of the authors is that if operating performance is not satisfactory under CPS1 and CPS2, there could be recommendations to reduce  $\epsilon_1$  or  $\epsilon_{10}$ . Adoption of a performance standard based on CPS60 would be far better in the authors' opinion. Maneuvering generation to comply with CPS60 would be far more practical than requiring more rapid and **costly** maneuvering to meet reduced one or ten minute  $\epsilon$  targets. Jaleeli, N., and VanSlyck, L. "NERC's New Control Performance Standards", *IEEE Transactions on Power Systems* Vol. 14, No. 3, August 1999, p. 1096

### Equity and Operating limits:

"the present culture of generation control is likely to shift the experienced frequency characteristic [profile] to curve (2) [upward to cross the new single  $\epsilon$  limit]" and "Sustained **scheduled** flow associated with this characteristics[sic] may be higher than the **secure** level for the transmission system. Under this scenario,

the rate of unscheduled energy **accumulation** may also be unacceptable", p. 3-19. "A secure level of long term averages of frequency error should be defined by detailed study if increased error levels are to be acceptable", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. E-15

"Hence, a defensible set of frequency based control performance criteria should limit short term frequency error averages based on reliability requirements, and long term frequency error averages based on constraining unscheduled **power flows** and their resultant unscheduled energy **accumulations**.", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 7-2

### Variability insensitivity:

"Figure 14 shows that CF1s of KEPCO vary due to the length of average period and this fact means that **larger average** periods **deteriorate the discriminating power** of CF1." Sasaki, T. and Enomoto, K., "Dynamic Analysis of Generation Control Performance Standards", *IEEE Transactions on Power Systems*, Vol. 18, No. 2, May 2003, p.104

"of **longer average sampling period** values **deprives CF1 of its discriminating** power." Sasaki, T. and Enomoto, K., " use Dynamic Analysis of Generation Control Performance Standards", *IEEE Transactions on Power Systems*, Vol. 18, No. 2, May 2003, p.105

### Single point control:

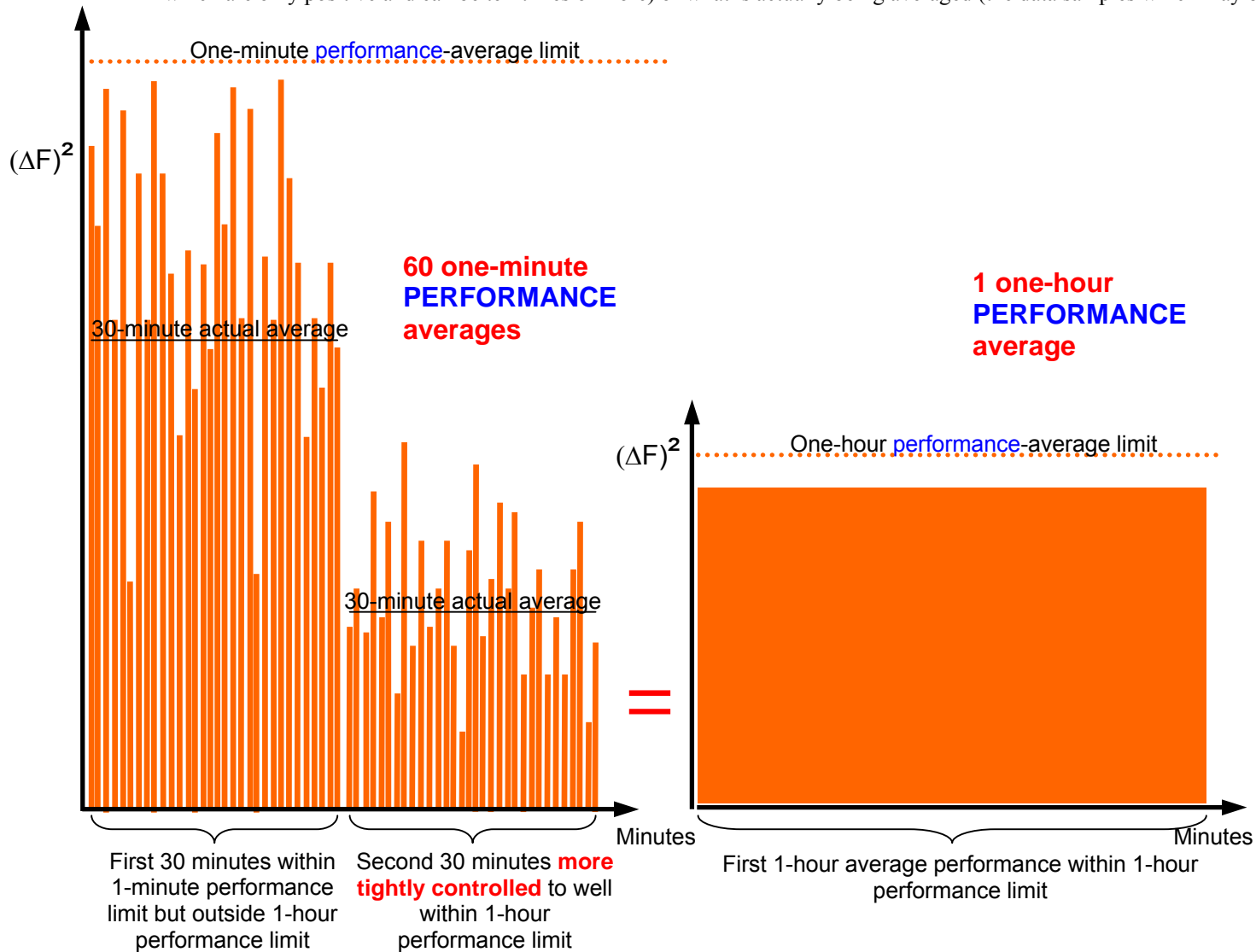
"For those who adopt the experienced frequency as the target, **one point** of the characteristic [profile], anywhere from one minute to 20 minutes, **is sufficient** for enforcement. If this point is chosen at **one minute**, then  $\epsilon = 8.5, 6.5,$  and 12 mHz, for the Eastern, WSCC, and ERCOT interconnections, respectively. In this case **no other point** would need to be enforced because with these  $\epsilon$  values it is **very unlikely for the tail of the characteristic [profile] to degrade!**", Jaleeli, N., and VanSlyck, L., *Control Performance Standards and Procedures for Interconnected Operation*, EPRI report RP 3555-10, Palo Alto (CA), August 1996, p. 3-18.

<sup>3</sup>Mixing up "Sample Average" [average  $\Delta F$ ] with "Performance Average" [average  $\Delta F$ ]<sup>2</sup>. Performances are much bigger deviations than samples because they are the "square" of samples: so the mixup exaggerates what CPM-60 is averaging over 60 minutes. In fact, 1-minute and 1-hour are the period of "Sample-

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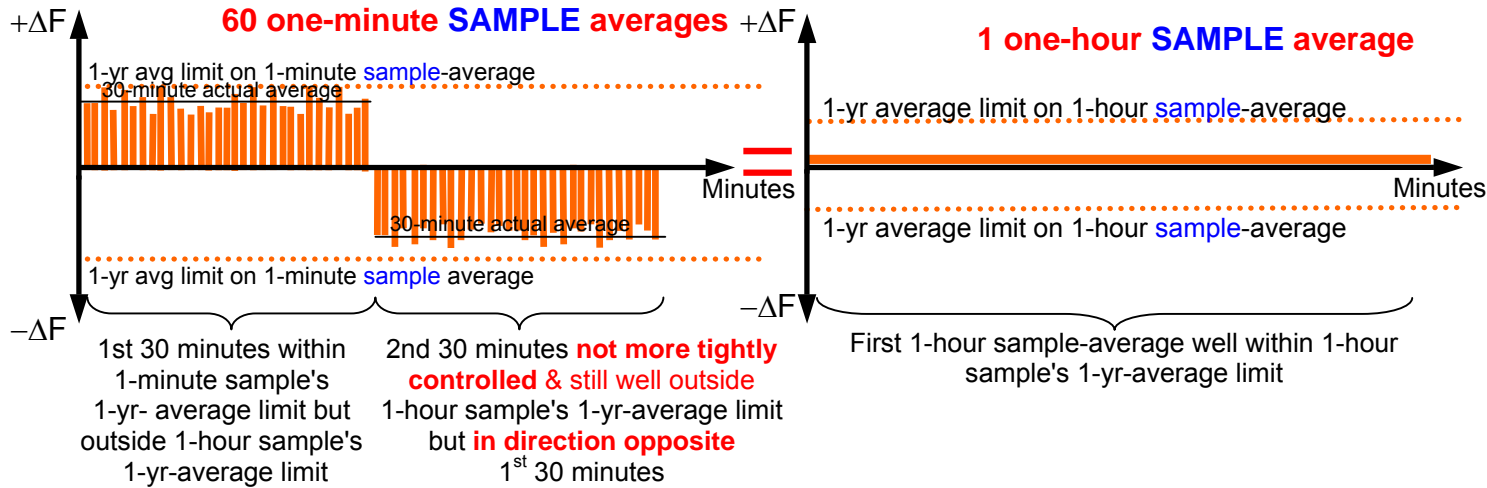
Averages" not of "Performance Averages". [Different Control Areas sample data at different per-seconds intervals; to make performances comparable between Control Areas, a uniform "sample-average" period of at least 1-minute is set.] On the other hand, all "Performance Averages" are 1-year averages.

1. **Wrong** interpretation of CPM-60 as a 60-minute "performance average" subject to a "tighter-performance" limit than CPM-1 misinterpreted as a 1-minute "performance average" [Note: deviations being "averaged" within one hour are grossly exaggerated in the graph as the "square" (which is the "performances", which are only positive and can be ten-times or more) of what is actually being averaged (the data samples which may be negative)]:



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2. **Correct** interpretation of CPM-60 as the annual performance-average of a 60-minute "sample average" subject to a "variability" limit tighter than the limit on CPM-1 which is the annual performance-average of a 1-minute "sample average" [Note: deviations being averaged within one hour are the "data samples", which are much smaller (one-tenth or less) than (or even negative) what the "performances" would be were they calculated every minute!]:



<sup>4</sup> It is crucial not to mix up an "Average of Squares" with the "Square of an Average" of data samples  $x_i$ . We know mathematically:  
 Average(Squares)  $\geq$  Square(anAverage)

because, for each hour where  $n=60$  minutes,

$$\frac{1}{n} \sum_{i=1}^n x_i^2 \geq \left( \frac{1}{n} \sum_{i=1}^n x_i \right)^2$$

$$\frac{1}{n} \sum_{i=1}^n x_i^2 \geq \frac{1}{n^2} \left( \sum_{i=1}^n x_i \right)^2$$

$$\sum_{i=1}^n x_i^2 \geq \frac{1}{n} \left( \sum_{i=1}^n x_i \right)^2$$

$$n \sum_{i=1}^n x_i^2 \geq \sum_i x_i \sum_{j \neq i} x_j + \sum_{i=1}^n x_i^2 \quad (1)$$

Since we can partition the left-hand side of (1) into sums  $x_i^2 + x_j^2$  for each pair  $i,j$ , and we can partition the right-hand side into sums  $x_i x_j + x_j x_i = 2x_i x_j$  for each pair  $i,j$ , we can assign the one  $x_i^2 + x_j^2$  on the left-hand-side of (1) to the one  $2x_i x_j$  on the right-hand-side of (1), for each and every distinct pair  $i,j$  of indices, and exhaust the partitions. Finally, since

$$x_i^2 + x_j^2 \geq 2x_i x_j \text{ for all } i,j,$$

the result is proved.

Note: In a given hour CPM-1 is an "Average of Squares" while CPM-60 is the "Square of an Average". Accordingly, equation (1) contains the well-known result for the slope of a frequency profile in the case of randomness, namely that when  $x_i x_j = 0$  for all  $i \neq j$ ,

$$\left[ \text{RMS}_{1\text{-minute}} =_{\text{df}} \sqrt{\sum_{i=1}^n x_i^2} \right] \Leftrightarrow \left[ \frac{1}{n^{1/2}} \sqrt{\sum_{i=1}^n x_i^2} =_{\text{df}} \text{RMS}_{60\text{-minute}} \right].$$

5 Proof that CPM-1 mean frequency error is equivalent to that for cpm-60. [provided on request by Energy Mark/Howard F. Illian with some improvement by Robert Blohm.]

(i) *Formulas for Statistical Variance*

The definition for Statistical Variance is given by Equation (1).

$$\sigma^2 = \frac{1}{n} \sum (x_i - \bar{x})^2 \tag{1}$$

In this form, the Statistical Variance of a data set is difficult to calculate because the mean value of the data must be calculated and subtracted from each individual value. Therefore, one of the first proofs that is introduced in a beginning statistics class is the alternative formula given by Equation (2).

$$\sigma^2 = \frac{1}{n} \sum (x_i^2 - \bar{x}^2) \tag{2}$$

(ii) *Proof of Equivalence of Statistical Variance Formulas*

The proof that the two formulas are equivalent proceeds as follows. Suppose

$$\frac{1}{n} \sum (x_i - \bar{x})^2 = \frac{1}{n} \sum (x_i^2 - \bar{x}^2) \tag{3}$$

Expand the left-hand side of Equation (3).

$$\frac{1}{n} \sum (x_i^2 - 2x_i \bar{x} + \bar{x}^2) = \frac{1}{n} \sum (x_i^2 - \bar{x}^2) \tag{4}$$

Separate the summations on both sides of Equation (4).

$$\frac{1}{n} \sum (x_i^2) - \frac{1}{n} \sum (2x_i \bar{x}) + \frac{1}{n} \sum (\bar{x}^2) = \frac{1}{n} \sum (x_i^2) - \frac{1}{n} \sum (\bar{x}^2) \tag{5}$$

Move the constant terms outside the summations on both sides of Equation (5).

$$\frac{1}{n} \sum (x_i^2) - 2\bar{x} \frac{1}{n} \sum (x_i) + \bar{x}^2 \frac{1}{n} \sum (1) = \frac{1}{n} \sum (x_i^2) - \bar{x}^2 \frac{1}{n} \sum (1) \quad (6)$$

Remove the mean of the ones from Equation (6) since they are equal to one.

$$\frac{1}{n} \sum (x_i^2) - 2\bar{x} \frac{1}{n} \sum (x_i) + \bar{x}^2 = \frac{1}{n} \sum (x_i^2) - \bar{x}^2 \quad (7)$$

Replace the mean of the  $x_i$  in Equation (7) with the resulting  $\bar{x}$  that represents the mean.

$$\frac{1}{n} \sum (x_i^2) - 2\bar{x} \times \bar{x} + \bar{x}^2 = \frac{1}{n} \sum (x_i^2) - \bar{x}^2 \quad (8)$$

Replace the term  $\bar{x} \times \bar{x}$  in Equation (8) with the term  $\bar{x}^2$ .

$$\frac{1}{n} \sum (x_i^2) - 2\bar{x}^2 + \bar{x}^2 = \frac{1}{n} \sum (x_i^2) - \bar{x}^2 \quad (9)$$

Simplify Equation (9).

$$\frac{1}{n} \sum (x_i^2) - \bar{x}^2 \equiv \frac{1}{n} \sum (x_i^2) - \bar{x}^2 \quad (10)$$

Since the two sides of the equation are identical, the proof of equivalence is complete.

*(iii) Demonstration that the CPM-1 and CPM-60 Means are Identical*

If the data for the one-minute measurements is consistent with the data for the one-hour measurements, then the following Equation (11) will be true.

$$x_j = \bar{x}_j = \frac{1}{60} \sum_{k=1}^{60} (x_{j,k}) \quad (11)$$

where:  $x_{j,k}$  is the value for one-minute data for an hour  $j$

$x_j$  is the associated value for one-hour data.

This formula for the mean used in CPM-1 can be compared to the mean used in CPM-60. These equations are shown as Equations (12a) & (12b).

$$\bar{x}_{60} = \frac{1}{m} \sum_{j=1}^m (x_j) \quad (12a) \quad \bar{x}_1 = \frac{1}{n} \sum_{i=1}^n (x_i) \quad (12b)$$

where:  $n$  is the number of minutes in a year

$m$  is the number of hours in a year

Since  $n = 60m$ , the equations can be rewritten as shown in Equations (13a) & (13b).

$$\bar{X}_{60} = \frac{1}{m} \sum_{j=1}^m \left( \frac{1}{60} \sum_{k=1}^{60} (x_{j,k}) \right) \quad (13a) \quad \bar{X}_1 = \frac{1}{m} \sum_{j=1}^m \left( \frac{1}{60} \sum_{k=1}^{60} (x_{j,k}) \right) \quad (13b)$$

where:  $j = 60i$ .

*(iv) Conclusion*

Since, by equations (3)-(10)

$$\sigma_1^2 = \frac{1}{n} \sum (x_i^2 - \bar{X}_1^2) \text{ and}$$

$$\sigma_{60}^2 = \frac{1}{m} \sum (x_j^2 - \bar{X}_{60}^2), \text{ then}$$

$$\text{RMS}_i^2 = x_i^2 = \sigma_1^2 + \bar{X}_1^2 \leq \epsilon_1^2 \text{ and}$$

$$\text{RMS}_j^2 = x_j^2 = \sigma_{60}^2 + \bar{X}_{60}^2 \leq \epsilon_{60}^2 \text{ and, therefore,}$$

the Mean Frequency Error  $\bar{X}_1$  for CPM-1 is identical to the mean frequency error  $\bar{X}_{60}$  for CPM-60.

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**Attachment 2 – Comments from NPCC-CP9 and ISO-NE**

**Introduction**

This is the second posting of the Balancing Standard, and the NPCC generated extensive comments on the first posting. The first posting included metrics CPM-60 and DEM, which have now been removed. The second posting still includes CPS 1, unchanged from its present implementation, and an apparently modified version of the Abnormal Operations Metric (AOM).

Many comments from the first posting still apply. Those that still do apply were simply cut and paste, with minimal modification, contained in the second section of this document.

The final section of this document contains comments that are directly linked to specific items in the second posting.

We oppose the new standard as drafted. We would be better off with either of the two alternatives described below in the comments from the first posting, or, simply keeping CPS 2 and DCS.

**Recycled Comments From The First Posting**

The information extracted from 2 prior documents is numbered below for ease of reference.

1. There is poor coordination with the Operate Within Limits Standards, as that standard only addresses extreme scenarios such as instability. If a negative ACE causes merely a noncascading thermal overload or forces re-dispatch in another control area, neither standard will cover that.
2. The NPCC notes positively that the AOM metric *starts* with a true reliability perspective for off-frequency operation. The NPCC disagrees with its inappropriate contamination with a frequency-dependent MW limit that results in excessive complexity. Two alternative implementations are offered to get around the complexity. One NPCC alternative replaces all metrics with a single CPS2-like metric, except that if your ten minute ACE doubles the CPS2-like limit, 2 violations are incurred, triple it and you get three violations, etc. The second alternative keeps DCS (with a 50% FCL threshold and other minor changes) and CPS2 with its present singular violation strategy, but the CPS2 limit is determined from a variant of AOM methodology. The first alternative would be preferred only when sufficient penalties are in place. Note that both alternatives cover frequency and net unscheduled tie line flows.

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3. Although CPS1 is clearly preferred by most respondents as a metric of choice, its limitations have not been well understood and its failure to meet the initial charge of the Operating Committee – don't let the frequency get worse - has not been given adequate attention. As stated in a prior submittal, it is CPS 2 that has been the constraining criterion that is keeping the frequency from getting even worse, from the viewpoint of the Operating Committee charge. More details are available on request.
4. When one reviews the BAAL methodology, it becomes apparent that CPS 1 is not reliability based.
5. The Balancing Standard as proposed is based on an incorrect assumption that only frequency control matters. As has been stated previously to justify the creation of the CPS2 criterion, poor control to excess by a control area can cause large net unscheduled flows on the transmission system of other control areas, causing reliability problems while the frequency remains close to schedule (e.g., a control area has a sustained ACE = -500 while the frequency is 60.001 Hz). With the elimination of DCS and CPS2 and the addition of one more CPS1-like MW-Hz metric, both would tend to result in a positive score for poor control for these scenarios. While the Balancing Standard Team defers this reliability impact to the Operate Within Limits Standard, that standard only addresses extreme scenarios such as instability, cascading outages, etc. As a minimum, there is a lack of coordination between the standards. Although this may not be in the scope of the original SAR, it is the NPCC's position that reliability problems caused by poor control should be dealt with in the Balancing Standard.
6. While the CPS methodology is a convenient way of conceptualizing frequency performance, it contains assumptions that do not fit the present realities of interconnected operation. It assumes that ACE values are random and will have a long term mean of zero. The consistently high on and off peak monthly average frequency deviation values for 2002 and the first half of 2003 belie that assumption. For example, the on peak average frequency deviation for the first 6 months of 2003 was 6.2 mHz, while it was 7.1 mHz off peak. The time of day phenomenon studied by the Frequency Excursion Task Force also challenges that assumption. The NPCC hopes the Balancing Standard Team will perform sufficient empirical checks on actual operation, and further hopes that other methods available that can function well in the presence of coincidence are given due consideration.
7. With respect to frequency deviation and reliability directly associated with its magnitude, the BAAL criterion makes significant progress in identifying a limit for it, below which the risk of under-frequency relay operation is unacceptable. Given that NERC is now supposed to be a reliability only organization, criteria addressing frequency performance should provide a passing score when a control area does its part to stay within those reliability limits, and a failing score when it does not. But CPS1 methodology deals with a targeted distribution that needs to occur well within those reliability bounds. Note that as the frequency performance of the Eastern Interconnection has fallen off from its pre-CPS epsilon 1 value of 10.6 mHz to its present 14 mHz performance, the NERC Resources Subcommittee has reassured the NERC Operating Committee that a reliability problem does not yet exist. A new methodology to assure that the frequency stays within true reliability based limits is needed. From the perspective of avoiding under-frequency relay operation, the reliability goal is met when the frequency stays out of the prohibited range, but it does not matter what the distribution is within that acceptable range. Applying CPS1 methodology to this problem, NPCC feels, is inappropriate. Below, the NPCC offers two alternatives, combining recognition of coincidence among control area ACE values with reliability based frequency limits. The NPCC fundamentally disagrees with the assertion in the "Introduction to the Balance Resources and Demand Standard" that "There is no

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obvious reason to change this concept of the frequency profile for the new standard.”, and prior NPCC input on this matter has not been included in the summarization of industry comments. Within the acceptable frequency bounds from a reliability perspective, commercial standards and/or criteria may be developed to address issues such as inadvertent and equity, but this should not be confused with pure reliability interests.

8. Significant efforts will be required in the following areas to implement the BAAL standard:

- \* Tuning each criterion by some NERC group such as the Resources Subcommittee
- \* Training Operators and Control Area personnel in the subtle aspects of understanding the criterion and keys to assuring compliance
- \* Software to be developed to compute, collect, and archive the data
- \* Data collection and analysis for compliance purposes by each control area
- \* NERC Task Force and/or Staff Review Of Results And Enforcement Of Penalties

The NPCC alternatives presented below attempt to simplify the standard, reducing the above mentioned burdens while meeting the ultimate reliability goals.

9. The standards have been written without recognizing the need for minimal requirements within each hour, which is basically another manifestation of recognizing coincidence among ACE values. For example, an average frequency performance of 14 mHz with all hours between 13 mHz and 15 mHz is very different than having 10 mHz performance for on peak hours and 22 mHz for off peak hours – which would still yield a 14 mHz average. There may also be significant variation among hourly mean values of frequency that can be of concern.

10. The standards for the Reliability Authorities are complex, unclear in some areas, and may lead to an excessive compliance-monitoring burden. Also, the case of a Reliability Authority also serving as a sole Balancing Authority in its footprint is not addressed (e.g. does it log its directives to itself?)

11. MW-Hz metrics do not work well for single control area interconnections (ERCOT) or to members of an interconnection that are operating asynchronously (HydroQuebec). The NPCC alternatives apply equally well to single control area interconnections and control areas operating asynchronously.

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## **12. Brief Review Of Experience With CPS 1, CPS 2, and DCS**

One positive aspect of CPS theory is that it provides a theoretical framework that links an individual control area's ACE to the overall frequency observed, and it provides a framework for establishing frequency targets. It is appealing on a theoretical level in that it infers the behavior needed by the member control areas in bounding their ACE to get the frequency behavior that is desired. One effect of its implementation is that it allowed control areas to back off of the excessive demands of the A1 criterion, which caused needless over-control, and the transition to it has resulted in consumer savings.

### *CPS 1 commentary*

However, some of the subtleties of CPS theory are both not well-known and also very limiting. When the NERC Operating Committee charged the NERC Resources Subcommittee with the development of new control performance criteria, it gave a free hand to find alternative methods, with the one caveat that the method would maintain frequency performance at the level experienced at that time. A noteworthy characteristic of CPS 1 is this: if the frequency target is set at the level that is actually desired and that frequency target is achieved, about one-half of the control areas of an interconnection will be found to be non-compliant. To overcome the negative ramifications, the CPS1 target from which limits were generated was set much higher (10.6 mHz versus 18 mHz for the Eastern Interconnection). Most control areas were achieving CPS 1 scores between 160 and 180% during the first few years, well above the 100% minimum. Over time, a few control areas began to use new algorithms designed to try to keep their ACE out of phase with frequency while providing less control action. But most other control areas may have selected fewer generators for AGC duty, or detuned the MW deadbands in their traditional AGC software. Market influences in the 21<sup>st</sup> century began to affect frequency at specific times of day, in a manner greater than what occurred historically. The frequency increasingly deviated beyond that level specified by the NERC Operating Committee (e.g., 10.6 mHz pre-CPS versus 14 mHz more recently). The Resources Subcommittee has recognized the greater frequency bandwidth, and it has told the Operating Committee that the present level is not a reliability concern. The typical CPS 1 scores are now in the range of 140 to 160%. The net result is that the frequency has obviously deteriorated beyond the real target, and yet CPS 1 as formulated and implemented continues to give high scores, well away from the 100% compliance limit. The CPS 1 compliance violations summarized in the table below do not track well in explaining why the NERC Operating Committee directive has not been met. This is an inherent limitation in the method and NPCC suggests that CPS 1 focused methodology is inappropriate for pure reliability based limits.

A running annual score has been recognized by some proponents of the CPS 1 method at the NERC Resources Subcommittee as being far too long an averaging interval. There has been discussion about the need to be CPS 1 compliant on a monthly basis in each hour of the month as well.

In summary, the empirically observed deficiencies are well-known. Market-related time of day effects need to be addressed and it is the hope of NPCC that the Drafting Team will consider our recommendations.

### *CPS 2 Commentary*

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The CPS 2 limit was included as a criterion upon the insistence of a few regions as a compromise. Some CPS 1 advocates insisted that it was not necessary, as CPS 1 was sufficient by itself to maintain frequency, and that CPS 2 is not technically defensible. When one reviews the CPS 2 violations since its inception, far more control areas have violated it than CPS 1. CPS 2 compliance violations may have been the only restraint on keeping the frequency from getting worse at a faster rate. While the direct financial incentives are not yet there, the fact is that control areas do not like to be seen as non-compliant. Some control areas have made CPS 2 compliance a corporate goal that affects employee bonuses.

CPS 2 has served a useful function in keeping “path of least resistance detuning” (i.e., expanding AGC control deadbands, reducing processed ACE gains, putting fewer generators on control) from getting out of hand. While new CPS oriented algorithms are available, most control areas do not have the time to deal with installing, tuning, and monitoring them. To the extent that control area personnel have any time at all to deal with trying to reduce the cost of regulation, the “path of least resistance detuning” approach has been employed for the most part.

While CPS 2 limits are there to prevent large unscheduled net flows from control areas, the numbers are inherently related to a frequency as opposed to a transmission target. A method to calibrate it to transmission needs is not yet available, but should be the subject of future research. But from an empirical view, perhaps by blind luck, the 50 to 100% increase of L10 limits over its Ld limit predecessor has not caused any consistent obvious problems on an interconnection basis. Radial-like scenarios may not be well-served at times by the CPS 2 limits, and control areas would need to work out their differences bilaterally when this occurs.

In summary, CPS 2 has been a far more relevant criterion than CPS 1 from an empirical point of view. While some have found it to be undesirable on a theoretical basis, we now have a large empirical compliance violation data base to determine which criterion is in fact more effective. There is a need to include empirical verification, as well as the theoretical.

The table below summarizes some key comparative statistics for CPS 1 versus CPS 2.

Comparison Of CPS 1 Versus CPS 2 Compliance Failures  
Using Monthly Values From January 2002 Through June 2003

Number of values reported for CPS 2 that are compliance in excess of 96%	1092
Number of values reported for CPS 2 that are between 93% and 96%	481
Number of values reported for CPS 2 that are between 90% and 93%	304
Number of CPS 2 values reported that are below 90%	26
Number of CPS 1 rolling year values below 100%	0
Number of CPS 1 rolling year values between 100% and 110%	6
Number of monthly CPS 1 values below 100%	27

It is noteworthy that CPS 2 violations are more likely to be in phase with the frequency deviation. For example, during July 2003, the ISO New England control area had scores of 155% (for the month) and 96% for CPS1 and CPS2, respectively. 72% of its CPS 2 violations were in phase with frequency, while 17% were out of phase with frequency, and 11% occurred with frequency essentially near the scheduled frequency ( a +/- 2 mHz soft zero was used in this analysis). If it is assumed that CPS 2 violations are far more likely to be in phase with frequency, then the 26 CPS 2 failures and the 304 samples in the 90-93% range can be seen

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as providing a constraint to even worse frequency performance. A sample hour of CERTS ACE and frequency data was also analyzed to determine how often the effect of applying a CPS 2 limit would assist versus hinder frequency performance. This analysis indicated that the CPS 2 constraint would assist frequency performance more than 80% of the time. While these short studies are anecdotal and not conclusive, they are probably indicative of what CPS 2 is achieving, and it agrees with intuition. Further analysis is needed. This concept is used to good advantage in the NPCC alternative metrics.

*DCS Commentary*

As a metric, the present DCS does a fine job in determining whether contingency reserve is deployed in a timely manner when DCS samples are taken. However, the 80% of first contingency threshold often results in too few samples for some control areas in a quarter. Also, there is little incentive to recover quickly for losses below the reportable threshold. The quarterly penalty may not always be an effective economic deterrent, because some control areas nominally carry contingency reserve in an amount greater than the first contingency loss, and, the penalty is applied on the first contingency loss. Prior to the removal of penalties compounding across quarters, the DCS penalty had a better chance of being an effective deterrent for these cases. Those control areas may need a sizable non-compliance level to have a real effect on them. However, some control areas make DCS compliance a corporate goal, and that self-imposed discipline can be highly effective.

A common complaint concerning the DCS is that normal operation allows operation up to the L10 limit with impunity, while the DCS requires crossing zero. NPCC suggests that the DCS should be kept in its present form with the following modifications:

- \* Change the reporting threshold for 80% to 50% of The First Contingency Loss to obtain sufficient samples
- \* Revise the compliance evaluation to require recovery only to the L10 limit
- \* Restore the compounding of penalties across quarters

One of the two alternative NPCC proposals includes these DCS modifications as a metric. The other proposal captures DCS effects in a single metric and can potentially eliminate the need for the DCS, if sufficient penalties are associated with the new metric.

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## Comments On The Second Posting

1. Page 1, definition of Balancing Authority ACE Limit  $T_v$ . The definition is incomplete and/or vague. It says that it is limited to 30 minutes, which seems to imply that it could be less. Under what circumstances? Section 305 a 3 x is equally vague. It is difficult to evaluate the metric with this degree of vagueness. See also section 302 2 ii.

Targeted research is being used to determine initial values of  $T_v$ . These values may be different for each of the Interconnections, but should not be greater than 30 minutes. At NPCC's suggestion the  $T_v$  was limited to no greater than 30 minutes (see Al Miller's comments to the 1<sup>st</sup> Posting). However, if a given limited is defined by an entity to be valid only for times less than 30 minutes then that entity must follow its own computations and use a  $T_v$  less than 30 minutes.

Targeted research and field testing are being used to determine the time at which the probability of a second contingency exceeds acceptable limits (Section 305 a 3 x).

The SDT is not sure of what you want us to review with respect to Section 302 (2)(ii). This Requirement was revised to clarify the conditions under which the RA may direct its BAs to move ACE.

2. Page 2, section 300 purpose. As stated in the previous comments from the first posting, it is NOT all about frequency. Net unscheduled flows are an issue too, and other standards do not address this adequately. The standards need to be well coordinated.  
During the refinement of the SAR for this standard, the consensus of industry commenters was to omit consideration of unscheduled flows from this standard. The SDT has asked the Operate within IROLS SDT to address the issue of unscheduled flows from the perspective of exceeding loading limits.
3. Page 3, section 301 a 1. There seems to be a mixing of what the Reliability Authority's responsibilities are, with those of the Balancing Authority. With the new limits proposed in this standard, both the RA and the BA will be able to monitor Interconnection Frequency with respect to the Frequency Trigger Limits, Frequency Abnormal Limits and Frequency Relay Limits. The BA will be able to monitor its ACE against its real-time BAALs. The RA will be able to monitor Interconnection Frequency against the set of frequency limits, and will be able to monitor ACE for every BA in the Interconnection against each BA's BAALs.
4. Page 3, section 301 a 2 i. Without knowing how often control areas may exceed a BAAL, it is not clear what degree of data collection burden exists. I defer to the compliance folks, but, will each BAAL event that is recovered in a timely manner present a reporting burden that is unacceptable? Also, is the data requested excessive, and who will review it when a BAAL violation is recovered in a timely manner? Also see page 5 section 301 d 3 iv which calls for reporting even when the BAAL is violated for less than 30 seconds.  
The SDT used historical data to determine how a BA would be impacted by BAALs – and found that this was only a few instances a month for the data sample used. The SDT agrees with commenters who indicated that this requirement may need to be adjusted following the

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results of field testing. On an interim basis, the SDT changed the requirement and measure to simplify the data retention requirement for BAAL events where  $T_v$  is not exceeded – in the revised standard only automatically recorded data must be retained (date, time, magnitude and duration of the event). Because there shouldn't be any instances of exceeding BAAL for time greater than  $T_v$ , some data is needed to verify that the standard is working as intended and that the BAs are responding as expected. Once the industry is confident that the standard is working as intended, this requirement may be modified. The Compliance Monitor is expected, during audits or triggered investigations, to review data for instances of exceeding BAAL for time less than BAAL  $T_v$ .

5. Page 5, section 301 c. We might want to perpetuate CPS2 and DCS as a regional difference. If that is done, if we can show that we operate to a more restrictive criterion continuously, could we get a waiver from what seems to be an overly prescriptive methodology? Is the compliance check in section 301 e 1 overly prescriptive?

If CPS2 and DCS are more restrictive, then by definition the BA would be in compliance with the new standard and no regional difference is required. 'How' a BA meets a standard is not germane to the standard as long as the BA is compliant.

The SDT is not in a position to guarantee the granting of waivers. Any Region may request a regional difference – if the Regional difference results in an exclusion from adherence to a NERC requirement, then that exclusion is subject to the approval of the Ballot Pool for the standard. Industry comments have led SDTs to believe that more specificity, rather than less specificity, is desired.

6. Page 7 Section 302 2 ii b. Could we get oscillatory frequency behavior with all RAs telling all BAs that they need to be in a particular direction? This requirement has been modified to clarify that conditions under which the RA will direct BAs to take actions. Under the revised standard, additional language has been added to ensure that RAs coordinate their actions with one another – this should prevent RAs from directing BAs to all move ACE at the same time in a manner that would be detrimental to frequency.
7. Page 8 Section 302 a 3. What do we do when RA and BA are one and the same? See page 12 section 303 d 3 I as well.

The RAs actions are the BAs instructions.

If the RA and BA are one and the same entity, there will still be some directives issued to move ACE and these should be documented. An entity that chooses to assume the responsibility of more than one Function is responsible for meeting the requirements of each of those Functions. If an RA is also the BA then that entity would be responsible for monitoring its own ACE against its own BAALs as well as Interconnection frequency against the suite of frequency-related limits.

8. Page 8 Section 302 a 4. Wouldn't it be less burdensome to have 3 RA's in an interconnection do this, instead of all? The frequency is basically the same throughout the interconnection in a steady state sense, unless islanding occurs. The intent was to ensure that each RA recognized and was responsive to its responsibility in helping to maintain Interconnection Frequency within acceptable limits. Selecting a subset of RAs to report on this would not support this goal – and the actions taken by individual RAs may not be identical throughout the Interconnection.

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9. Page 8 section 302 b 2 i. Noting that BAAL MW limits are frequency sensitive, and the RA's frequency meter differs some and is scanned differently than that of the BA's, whose frequency and BAAL limits are used? Does the BA need to send its BAAL limit to the RA or will the RA compute it. And how are things sorted out for compliance evaluation? Ditto for the yet to be defined  $T_v$ .

The BA is responsible for the real-time BAAL. The RA is responsible for 'monitoring' the BAs compliance to that limit. Thus (unless otherwise agreed to between the BA and the RA) the BA would be responsible for transmitting its BAAL to the RA.

While not stated in the Standard, it would be assumed that the RA may want to compare the frequency differences between itself and its RAs; and would do so as a matter of due diligence – but not as a matter of standard compliance.

The  $T_v$  is a time measure and would be (except for some tiny relativistic effects) identical in both areas. However, the value used (again unless otherwise defined) would be dependent on the BA's data.

10. Page 8 section 302 b 3. Where is the Frequency Abnormal Limit Violation Report defined or described?

The Frequency Abnormal Limit Violation Report has been renamed the Frequency Limit Violation Report and is still a work in progress. This is expected to be a simple report of the facts surrounding any instance of exceeding an FTL for time greater than  $FTL T_v$  or for any instance of exceeding an FAL. The information included on the report would include the following:

- (i) The Area Control Error limits and one minute average Area Control Error for each Balancing Authority in its Reliability Authority Area for the duration of the event.
- (iii) Event duration, start and end time and recorded frequency for the time frame when interconnection frequency exceeded a Frequency Trigger Limit.
- (iv) Directives issued

11. Page 9 section 302 d 3 ii. Why not 5 business days?

This was changed to 5 business days.

12. Page 9 section 302 c and d. Who computes 1 minute average ACEs of the BA's, and note also that BAALs and  $T_v$  values will differ based on whose frequency source is used.

Under Section 301(b)(5) the "BA shall calculate ..." The BA is responsible for computing the one minute averages.

However, this particular section [(302)(d)] has to do with data retention. The BA has the responsibility for computing these values (ACE is a BA parameter). This section only requires that the RA have 'available' the one-minute averages. Those averages can be stored by anyone. The BA is liable for compliance and would be the most logical entity to supply and to maintain those averages. This section only requires that the RA have access to them.

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13. Page 11 section 302 e 2. The compliance measure holds the RA responsible even if he does his job 100% correctly, but the BA either cannot or does not do its part. Is this fair?  
The RA's job is not to merely issue directives, its job is to ensure that Interconnection frequency does not exceed an FTL's associated T<sub>v</sub> or an FAL.
14. Page 11 section 302 e 2. There are major problems with the time aspect of the first column. Note that there could be 30 minutes or more of either scan rate (e.g., 4 second) or one minute data. At what point do you determine the BA summation? How are they combined? Again note T<sub>v</sub>'s definitional absence.  
The levels of non-compliance were revised and the matrix is no longer used.
15. Page 12 section 303 a 1 i. The need to shed firm load must be addressed explicitly.  
Agreed. The revised standard states this more specifically:  
"The Balancing Authority shall take all available actions to meet the RAs directive, up to and including shedding of firm load."
16. Page 15 section 304 a 2 i and iii. Minimum technical standards for some degree of consistency and fairness are needed.  
Agreed. The criteria for requirement 304 was copied, almost word for word, from existing Operating Policy 1.C. Most industry commenters supported this requirement as proposed, and the SDT will not pursue any changes to this requirement until after field testing has been completed.
17. Page 15 section 304 a 2 iii. 5<sup>th</sup> word should be "determine".  
Agreed –this typographical error has been corrected.
18. Page 15 section 304 a and b and e. What is a seasonally operating balancing authority, and, what about generation only BAs?  
A seasonally operating Balancing Authority is a generator-only BA that operates, typically, only during 'peak' periods. The 'seasonally operating' phrase was changed in the revised standard to 'generation only' BA.
19. Page 17 section 305 a. It is hard to evaluate a methodology when it is still a work in progress.  
Agreed. At this point we are trying to verify that the process we've identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.
20. Page 17 section 305 a 3 iv. Use of an average may not be correct. Note the FRS white paper discusses significant differences in Interconnection frequency response as a function of time of day. Pick a conservative or worst case value!  
This issue can be addressed as part of the targeted research.  
Conservative is a word that must be defined. Does NPCC have a suggestion that they would like to pose to the public? Worst case values would occur when there is no response, which creates a mathematically awkward solution.

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21. Page 17 section 305 a 3 x. These details are important and should be coordinated with any emerging FRS standard.

The SDT does not have any control over the development of any other standard and at present, no SAR for an FRS standard has been posted for public comment.

22. Page 19 section 306 BAAL could be developed for fixed limits that are not a function of prevailing frequency. Why not keep it simple for the operators? During the recovery from a loss of generation, their target will be moving around on them.

If a BA requires a fixed limit for its operations, the SDT recommends using the BAAL value at the point where it crosses the FTL. The BA should never have BAALs that are more constraining than these values during normal operating conditions.

Using BAAL @ FTL will ensure that frequency-based reliability is maintained – use of any other limit would be based on something other than frequency, and would be outside the scope of this standard. Most commenters supported the concept of BAALs that vary with frequency. Part of the field testing will be to ensure that the variable limits will be acceptable to system operators.

23. Page 19 section 306 It seems that this is quite different from the AOM in the first posting in that the diversity of ACE is not discussed. What assumptions apply? What would be typical FTL limits, so a comfort level for resulting BAALs in representative scenarios can be evaluated?

The assumptions used to develop the calculations for BAAL are presented with the Consideration of Comments to the First Posting of the Balance Resources and Demand Standard, in the paper submitted by Howard Illian.

Sets of sample limits are posted on the Balance Resources and Demand “related files” web site and can be downloaded for your review. There are two sets of files posted – a set for the Eastern Interconnection and a set for the Western Interconnection. The samples allow you to see how BAAL varies with frequency, and allow you to see how different sized BAs with different frequency biases may be effected by BAALs.

At this point we are trying to verify that the process we’ve identified is acceptable. The results of targeted research and field testing may show that additional changes are needed to the requirement. The results of the targeted research and field testing will be publicly posted so everyone can see the results and use the results to help make an informed decision when determining whether to approve this standard.

### ***NPCC Alternatives***

In response to the first posting, the NPCC proposed 2 alternative methods to the four metrics proposed in the first posting. Basically, the NPCC proposed the development of fixed MW limits from a variant of the AOM methodology offered at that time. Similarly, fixed MW limits could be developed from the BAAL methodology that now replaces the AOM methodology. Many details from the comments on the first posting are omitted for brevity.

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The first NPCC alternative would use the existing CPS 2 metric with its limit computed by the BAAL methodology instead of L10, along with the present DCS. Also, the following modifications to the current DCS would be evaluated: change the DCS reporting threshold from 80% to 50% of the first contingency loss to generate more samples per quarter; only require recovery to the CPS 2 limit for compliance purposes; and, compound DCS penalties across quarters.

The second NPCC alternative would have only one metric, using a fixed MW BAAL limit as a replacement for L10 in CPS 2. However, multiple violations would be assessed per ten-minute interval. A sample violation assignment for the percent above the CPS 2 limit is shown in the following table.

More than this % of the CPS 2 limit and	Less than this % of the CPS 2 limit	# of violations
0	100	0
100	200	1
200	300	2
300	400	3

For example, a control area with a CPS 2 limit of 100 MW has a 500 MW contingency and the ACE stays at -500 for an hour. Five (5) violations per ten-minute interval times six (6) ten-minute intervals per hour yields 30 violations. However, a linear recover in ten-minutes, yielding a -250 MW ten-minute ACE value for the first ten-minute interval would result in only 2 violations. This method would be preferred over the first alternative if very strong and effective penalties are associated with the “all in one” metric.

In response to NPCC's first proposal, the SDT does not see support for continuing the Disturbance Control Standard. Loading generation during high frequency conditions as a reaction to the loss of generation is not seen as a frequency concern. To the extent that NPCC would like to retain this more restrictive constraint, NPCC may, without seeking NERC consent, impose such a requirement on the members of NPCC.

In response to the second proposal, NPCC has made a proposal but has not provided any justification or rationale for the proposal. The SDT would ask why, other than defining another methodology, should a single hard MW limit be imposed. The SDT sees consensus in the creation of measure that a directly related to the problem being addresses. The concern that all entities may not be able to full advantage of the dynamic nature of the proposed standard is not a reason to take that potential benefit from those that can. Again, to the extent that NPCC would like to retain this more restrictive constraint, NPCC may, without seeking NERC consent, impose such a requirement on the members of NPCC. To the extent that NPCC can provide more justification around which other commenters would join NPCC, the SDT would help in building a consensus for that position; however, to the extent that NPCC is presenting just another methodology to effect at best the same outcome, the SDT is not empowered to impose that methodology.

## Attachment 3 – Comparison of fixed BAAL to Frequency Dependent BAAL

Prepared for the NERC Balancing Resources and Demand Standard Drafting Team

by Howard F. Illian, President, Energy Mark, Inc.

October 6, 2004

### Introduction

As the new Balancing Resources and Demand Standard has been developed, there has been a vocal minority that has insisted that a CPS-2 Type measure should continue to be included within the measures in the standard. It is proper to answer the questions raised by these respected individuals in detail. This paper addresses the issues that have been raised as part of this discussion.

### Arguments Supporting a Fixed MW ACE Limit

A number of reasons have been presented as support for promulgating a fixed MW ACE limit as part of the Balancing Resources and Demand Standard. Representative reasons are listed below. These reasons have been grouped into general categories.

#### ***Fairness:***

1. BAAL is much different than CPS-2. A small control area may be outside of BAAL for very small MW values. A large BA can be thousands of MW out, causing a FTL excursion, and still be within BAAL. There needs to be fixed upper and lower limits to BAAL. – *Howard Rulf*

#### ***Variable Limits:***

2. There is concern about the ease of use of variable MW limits during disturbance recovery. - P.D. Henderson
3. There needs to be a fixed floor (and ceiling) for the BAAL. Make the floor equal to the interconnects largest single generating unit (~1300 MW). The ceiling could be symmetrical or some other comparable criteria. – *Howard Rulf*

#### ***Effectiveness:***

4. The CPS-2 limit was included as a criterion upon the insistence of a few regions as a compromise. Some CPS-1 advocates insisted that it was not necessary, as CPS-1 was sufficient by itself to maintain frequency, and that CPS-2 is not technically defensible. When one reviews the CPS-2 violations since its inception, far more control areas have violated it than CPS-1. CPS-2 compliance violations may have been the only restraint on keeping the frequency from getting worse at a faster rate. While the direct financial incentives are not yet there, the fact is that control areas do not like to be seen as noncompliant. Some control areas have made CPS-2 compliance a corporate goal that affects employee bonuses. – *Michael Potishnak*
5. In summary, CPS-2 has been a far more relevant criterion than CPS-1 from an empirical point of view. While some have found it to be undesirable on a theoretical basis, we now have a large empirical compliance violation data base to determine which criterion is in fact more effective. There is a need to include empirical verification, as well as the theoretical. – *Michael Potishnak*
6. It is noteworthy that CPS-2 violations are more likely to be in phase with the frequency deviation. For example, during July 2003, the ISO New England control area had scores of 155% (for the month) and 96% for CPS-1 and 2 respectively. 72% of its CPS-2 violations were in phase with frequency, while 17% were out of phase with frequency, and 11% occurred with frequency essentially near the scheduled frequency ( a +/- 2 mHz soft zero was used in this analysis). If it is assumed that CPS-2 violations are far more likely to be in phase with frequency, then the 26 CPS-2 failures and the 304 samples in the 90-93% range can be seen as providing a constraint to even worse frequency performance. A sample hour of CERTS ACE and frequency data was also analyzed to determine how often the effect of applying a CPS-2 limit would assist versus hinder frequency performance. This analysis indicated that the CPS-2 constraint would assist frequency performance more than 80% of the time. While these short studies are anecdotal and not conclusive, they are probably indicative of what CPS-2 is achieving, and it agrees with intuition. Further analysis is needed. This concept is used to good advantage in the NPCC alternative metrics. – *Michael Potishnak*

7. CPS-2 has been a far more relevant criterion than CPS-1 from an empirical point of view. While some have found it to be undesirable on a theoretical basis, we now have a large empirical compliance violation data base to determine which criterion is in fact more effective. There is a need to include empirical verification, as well as the theoretical. – *Alan Adamson*
8. Requirement (a) (2) only requires a BA to take actions to balance resources and demand following its BAAL violation. Depending on the BA size, it could encourage large sustained  $\pm$  ACE (e.g. reference to “Introduction to the Balance Resource and Demand Standard – East BAAL Example” assuming a BAAL with frequency bias of -300 MW for a frequency deviation of 0.03 Hz the BA could have - 1000 MW ACE and be within the BAAL limits) – *P.D. Henderson*
9. Some analyses have indicated that the CPS-2 constraint would assist frequency performance more than 80% of the time. While these short studies are anecdotal and not conclusive, they are probably indicative of what CPS-2 is achieving, and it agrees with intuition. Further analysis is needed. This concept is used to good advantage in the NPCC alternative metrics. – *Alan Adamson*

***ACE Control or Frequency Control:***

10. Area Control Error Abnormal Operating Zone is unbounded when out of phase with frequency. The NPCC fundamentally disagrees with the concept of being unbounded, and emphasizes the need for a CPS-2-like limit. – *Michael Potishnak*
11. NPCC supports developing limits linked to reliability concerns and the Relay Limits are a suitable starting point. The Abnormal Limits and Trigger Limits seem to be too complex in their present form and NPCC prefers to have limits that are simpler. NPCC feels that identification of ACE limits based so heavily on frequency do not reflect whether an area has an adequate balance of generation and load. NPCC seeks a simpler MW limit for the BA’s ACE. This simpler MW limit would be conducive to proper control for asynchronous control areas. – *Michael Potishnak*
12. As stated in numerous other places, concern is raised only when one particular symptom of choice, frequency deviation, is observed. A relatively large negative ACE for the control area’s size is a far better indicator of a potential reliability problem (e.g., CPS-2) . – *Michael Potishnak*

***Large Unscheduled Flows:***

13. Avoidance of large amounts of sustained generation/load mismatch so that large net unscheduled flows are not imposed on other control areas. – *Michael Potishnak*
14. In the Purpose bullet, the NPCC believes that the purpose should address large net unscheduled flows even if they are coincidentally aiding frequency. – *Michael Potishnak*
15. In the second paragraph of the section entitled “Control Performance Standard – CPS-2”, there is an inaccurate description of CPS-2 being an attempt to control inadvertent flow. Its purpose is to reasonably bound 10 minute averages of large net unscheduled flows out of control areas, and a review of the CPS-2 compliance data presented above demonstrates that the goal is mostly achieved. CPS-2 was not designed as a tool for inadvertent management. – *Michael Potishnak*

***Transmission Loading:***

16. The CPS-2 limits should be broaden slightly and then made to apply 100% of the time not just the existing 90%. The argument has been made that other standards address transmission issues. This is not totally true. The Operating within Limits standard may protect the transmission system but waits until the system is in a problem before it applies. Secondly it cuts those BA that may be pulling to the point that they are causing the problem. Because they have no schedule and are not in the IDC they will not be cut. This is definitely a balance resources and demand issue. With the proposed elimination of CPS-2 if a large unit trips and the frequency is high there is no metric to make a BA return to schedule. The BA could pull forever despite transmission problems that he may be creating. – *Don McInnis*
17. NPCC also feels there is a lack of coordination between the standard drafting teams and has noted instances where one team felt an issue was addressed in another standard to later learn it was not. As an example, with respect to the Operate Within Limits standard, transmission overloads that are caused by poor control are not covered by this standard unless they reach a high level IROL. We would suggest that there be technical oversight as we go forward with these processes to ensure there are no “gaps” or critical reliability issues that are not addressed in the resultant standards. – *Michael Potishnak*
18. It is based on an incorrect assumption that only frequency control matters. As has been stated previously to justify the creation of the CPS-2 criterion, poor control to excess by a control area can cause large net

unscheduled flows on the transmission system of other control areas, causing reliability problems while the frequency remains close to schedule (e.g., a control area has a sustained ACE = -500 while the frequency is 60.001 Hz). With the elimination of DCS and CPS-2 and the addition of 3 more CPS-1-like MW-Hz metrics, all four would tend to result in a positive score for poor control for these scenarios. While the Balancing Standard Team defers this reliability impact to the Operate Within Limits Standard, that standard only addresses extreme scenarios such as instability, cascading outages, etc. As a minimum, there is a lack of coordination between the standards. Although this may not be in the scope of the original SAR, it is the NPCC's position that reliability problems caused by poor control should be dealt with in the Balancing Standard. – *Michael Potishnak*

19. While CPS-2 limits are there to prevent large unscheduled net flows from control areas, the numbers are inherently related to a frequency as opposed to a transmission target. A method to calibrate it to transmission needs is not yet available, but should be the subject of future research. But from an empirical view, perhaps by blind luck, the 50 to 100% increase of L10 limits over its Ld limit predecessor has not caused any consistent obvious problems on an interconnection basis. Radial-like scenarios may not be well-served at times by the CPS-2 limits, and control areas would need to work out their differences bilaterally when this occurs. – *Michael Potishnak*
20. In the detailed discussion, the section entitled "Other topics were excluded because they are addressed by other SARs or standards", in effect transmission overloads are deferred to a different standard. However, that standard sets a very high bar that will not address significant problems related to poor control that do not concurrently cause a large deviation of frequency from schedule. As a minimum, the standards lack coordination, and reliability could be affected adversely. – *Michael Potishnak*
21. For example, if control area A's under-generation causes an overload on a transmission line in control area B that control area B resolves it by shifting its generation because control area A continues to drag, but only a thermal overload would persist without control area B's corrective action and the frequency stayed above 60 Hz, control area A does not receive any non-compliance assessment from either standard. – *Michael Potishnak*
22. The standard should address large imbalance situations and the affect that it could have on the transmission system. Large imbalance regardless of frequency status is not a good thing and should be limited as much as possible. – *Alan Boesch*
23. Large net unscheduled flows into and out of control areas due to large ACE values can have an adverse reliability effect on the transmission systems of other control areas. – *Alan Adamson*
24. We also recommend that you revisit a measure concerning large ACE versus inter-tie overloads. – *Bart McManus*

Each of these problem areas are discussed in the following sections.

## **Fairness**

It is stated that only fixed limits similar to CPS-2 are fair. This is stated because small Balancing Authorities (BAs) are only allowed small MW deviations before they pass the BAAL and large BAs are allowed large MW deviations without being outside their BAALs. It is further stated that large BAs are allowed to have deviations of thousands of MW causing a FTL excursion and still be within their BAALs. These comments are not interpreted as there should be no difference in the limits between small and large BAs but rather the limits provided as examples are not fair because they appear on their surface to be more restrictive for smaller BAs.

The interaction that the commenters fail to understand is that a relatively large ACE deviation by a small BA has little affect on interconnection frequency while a large ACE deviation by a large BA can have a large affect on interconnection frequency. Since both the frequency and the ACE change for the large BA the actual limit for the large BA is significantly tighter than the raw number indicate.

For example, if a small BA with a Frequency Bias of 20 MW / 0.1 Hz has an ACE deviation of 100 MW on the Eastern Interconnection, the change in frequency will be about 0.003 Hz. On the other hand, if a large BA with a Frequency Bias of 200 MW / 0.1 Hz has an ACE deviation of 1000 MW on the Eastern Interconnection, the change in frequency will be about 0.033 Hz. If the Frequency Trigger Limit is about 0.100 Hz, then the BAAL for the small BA will be about 600 MW. Using the same Frequency Trigger Limit, the BAAL for the large BA will also be about 600 MW. It can hardly be argued that the measure favors large BAs.

## **Variable Limits**

Some have raised the concern that using a variable instead of fixed limit will make it more difficult for the system operator. The problem is not with using a variable limit. If there is a problem, it is with how the information is presented to the operator. In fact, the operators have been using a variable limit for years. It is called ACE. ACE is made up of two terms. The first indicates the tie line error and varies with how well the BA is matching supply with demand. The second term is the frequency bias term and varies with frequency error in a manner similar to BAAL. It is illogical to state that there is a problem in using a BAAL that varies with frequency when the ACE that is used in every control room varies with frequency in a similar manner.

## **Effectiveness**

In the distant past it was acceptable to consider only the ability of a performance measure to identify a reliability problem. There was little concern that it might also identify a non-problem as a problem. This resulted in consideration of many unrelated criteria being used to insure that nothing slipped through the measurement cracks. The failure of reliability criteria to indicate a reliability problem can be considered Type I Error. If additional actions were indicated even though they sometimes were not required to insure reliability, it was of little concern. The additional costs of meeting these overly restrictive criteria were just passed on to the customers through regulated cost plus based rates. Thus the goal was to minimize Type I Error.

Since the industry has begun restructuring, it has been recognized that limits that are more restrictive than required for reliability can be used unfairly to manipulate the markets. For example, the development of the concepts of TTC and ATC were developed specifically to mitigate this problem. The failure of reliability criteria by falsely indicating a reliability problem when none exists is the converse of Type I Error and is called Type II Error. As we move forward with restructuring it is both appropriate and necessary to minimize both Type I Error and Type II Error.

Comments suggest that it is important to insure that there are no loop holes in the reliability criteria. What is left out is that in an industry restructured it is also important that reliability criteria not be overly restrictive. The fact that a particular criterion is more restrictive does not provide useful information with respect to whether it is an effective criterion. The additional violations may just be Type II Errors. Reliability criteria that are correct only 80% of the time are not good enough in an industry that has been restructured into markets, when more selective criteria are available.

## **ACE Control or Frequency Control**

The recommendations that support the use of ACE, independent of frequency as the basis of reliability criteria, ignore history. ACE itself was developed as a means of apportioning coordinated interconnection frequency control responsibility as its goal. The covariance measure of the relationship between ACE and frequency contained in the CPS-1 measure provides a technically defensible way of measuring how well a specific ACE experience contributes to that frequency control goal. Measurements of ACE alone without consideration of frequency turn the problem upside down and place ACE ahead of frequency rather than keeping it subordinate to frequency.

## **Large Unscheduled Flows**

The use of a fixed ACE limit does not have a sound basis for implementation on the general interconnection. This is because transmission is only constrained in one direction at a time. Therefore, in a grid system, a fixed limit is equally likely to restrict flows that reduce the constraints and flows that increase the constraints. This makes an ACE limit unsuitable for limiting transmission constraint management, because the Type II Error associated with doing so can approach 50%.

There is, however, a special case where the application of a fixed ACE limit might be beneficial to interconnection reliability. This special case occurs when a region of the interconnection is peninsular and has a constraint that limits its transfers between itself and the remainder of the interconnection. Under these circumstances, it may be useful to limit the ACE error allowed for BAs in the peninsular region, but putting a limit on ACE error for BAs not in the peninsular region faces the same problem of large Type II Error. Therefore, in this special case, only a regional standard is justified. Under these circumstances, an interconnection wide limit will unreasonably limit non-peninsular BAs without reliability justification. As stated previously, limits more restrictive than required for

reliability can provide opportunities for market manipulation and make unsuitable reliability criteria in a restructured industry.

### **Transmission Loading**

Many comments indicate that the Operate Within Limits Standard does not manage the large ACE errors that fixed or non-frequency dependent limits would manage. This statement is true, but the weakness lies not with the Balancing Resources and Demand Standard, but with the Operate Within Limits (OWL) Standard and the supporting mitigation measures. What is missing is the inclusion of ACE in the mitigation measures used to manage transmission limits, specifically, the Transmission Loading Relief (TLR) Procedures used to provide relief of transmission overloads.

The inclusion of ACE within the OWL and its associated TLR Procedures requires not only changes in the procedures, but new technical methods to represent ACE Errors correctly and modifications in the software to implement those new technical methods.

The basic problem is that the TLR Procedures and the Interchange Distribution Calculator (IDC) upon which they are based has been built upon classical load flow programs used in planning. It uses the "slack bus" method to balance load and generation. Therefore, any imbalance between load and generation is represented as a flow between the bus responsible for the imbalance and the slack bus. Although, this method provides a good representation of balanced flows such as interchange transactions, it is not a useable representation of actual imbalanced flows on the system resulting from ACE deviations.

The OWL Standard and associated procedures requires the following modifications.

1. Modify the IDC to accurately represent imbalanced flows on the system resulting from ACE.
2. Provide calculations of Transmission Distribution Factors (TDF) for ACE deviations from the IDC.
3. Set appropriate limits as to when ACE deviations should be included in TLR similar to the selection process used to select transactions using the ACE deviation and the associated TDF.
4. Restructure the TLR Priorities from 0 to 7 by increasing the current priorities by 1 and adding ACE deviations as priority 0.

All of the above steps except 1. are relatively straight forward to implement. Modification of the IDC is a little more complicated but can be achieved with current technology. The reason that the current IDC is inappropriate for managing ACE deviations is that it uses a slack bus to manage imbalances. It would be relatively easy to modify the power flow to use Frequency Responses of BAs as represented by their Frequency Biases used in their ACE Equations to distribute the slack bus across all of the BAs in proportion to their relative frequency responses. When this modification is made in the power flow, the resulting ACE deviations are correctly represented on the transmission system. This method can also be demonstrated to properly represent opposite and equal ACE deviations between two BAs, because the superposition theorem states, that the sum of the individual flows resulting from the individual imbalances will correctly represent the balanced flow when the two flows occur concurrently.

Instead of attempting to implement inappropriate criteria in the Balancing Resources and Demand Standard, the Operate Within Limits and associated implementation procedures should be modified to provide the best solution to the issues raised.

### **Conclusions**

Frequency dependent limits are appropriate for BAAL and fixed limits are inappropriate for the following reasons.

1. Frequency dependent limits are fair when properly adjusted to BA size.
2. Frequency dependent limits are no more complex than ACE or CPS-1.
3. Frequency dependent limits are more effective because they minimize both Type I and Type II Errors.
4. Frequency dependent limits properly set frequency control as the primary goal of control.
5. Frequency dependent limits do not limit transmission flows without a reliability problem.
6. A more effective alternative method is provided to properly include ACE control in procedures when transmission operating limits are exceeded.

## **Recommendations**

Retain the frequency dependent limit on BAAL and begin steps to include ACE within the OWL Standard and associated procedures.