Consideration of Comments on Draft Standard PRC-024-1 for the Generator Verification Standard Drafting Team — Project 2007-09

The Generator Verification Standard Drafting Team thanks all commenters who submitted comments on the proposed revision to the PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings standard. This standard was posted for a 45-day public comment period from February 17-April 2, 2009. Stakeholders were asked to provide feedback on the standard through a special electronic comment form. There were 43 sets of comments, including comments from more than 100 different people from over 60 companies representing 9 of the 10 Industry Segments as shown in the table on the following pages.

For this report, the comments have been organized by question number so it is easier to see where there is consensus. The comments submitted can be reviewed in their original format on the following Web page:

http://www.nerc.com/filez/standards/Generator-Verification-Project-2007-09.html

The drafting team considered stakeholder comments and made the following changes based on those comments:

Purpose:
The drafting team revised the purpose to clarify that new generators must be capable of riding through voltage and frequency excursions and expected unit performance during frequency and voltage excursions must be communicated to entities that monitor or model the associated generator.

Applicability:
The drafting team has determined that only the Generator Owner has responsibilities required by this NERC Standard. The "facility applicability" language that duplicated the language from the Compliance Registry Criteria is not necessary to include in the applicability section of the standard, and was removed.

The team added a footnote to both Requirements R1 and R2 to clarify that the requirements in the standard do not require any entity to have frequency or voltage protective relaying installed or activated on its units.

Requirement R1:
- Modified the sequence of the wording in the requirement
- Replaced the range of VRFs based on MVA to a single VRF for consistency with other standards
- Added the following as an additional criterion under which the generating unit may not trip:
    - When the transmission system frequency rate of change is less than 2.5 Hz/second with a total change of up to 1.0 Hz.

Requirement R2:
- Modified the language to clarify that the intent is to address trippings associated with events external to the generator
- Added more specificity to each of the criterion under which the generator unit may not trip
- Replaced the range of VRFs based on MVA to a single VRF for consistency with other standards

Requirement R3 and Requirement R4 (now R7 in the revised standard)

- Merged these requirements and moved the requirement so that it is the last requirement in the standard so that the sequence of requirements has more of a chronological order

Requirement R5 (now R3 in the revised standard)

- Modified the sequence of wording in the requirement and simplified the language for greater clarity on the required documentation of equipment limitations..

Requirement R6 (now R4 in the revised standard)

- Modified the sequence of wording in the requirement and simplified the language for greater clarity.

New Requirement R5

- Requires Generator Owners to provide requesting entities with specific documentation to support an estimate of a unit's performance during Frequency/Voltage Excursions for modeling and study accuracy.

- This requirement addresses the inability of some existing units to ride-through the voltage and frequency excursions identified in Attachment 1 and 2. The purpose of this Requirement is to provide the Transmission Planner the ability to more accurately model generating plant performance during system voltage and frequency excursions.

New Requirement R6:

- Requires Generator Owners to have new generating units designed, built, and maintained so that they don't trip and do remain within specified parameters during frequency and voltage excursions associated with events external to the unit.

Attachments 1 and 2:

- The SDT developed the off nominal frequency curve (Attachment 1) in coordination with the NERC UFLS Standard Drafting Team. The 57.8 Hz setting for generator underfrequency and 58 Hz for UFLS is to ensure that the UFLS will have a chance to arrest the system frequency decline before reaching the minimum permissible frequency for generators. The intent of the curves is to ensure that the generators do not trip when the frequency is within the area bounded by the high and low frequency curves. When the frequency excursion reaches outside the high or low curve, the generator is allowed to trip.

- The SDT developed the off nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves.

- Updated Attachment 2 to add more clarity on the calculations for the 'voltage ride through curve.

The team made conforming changes to the measures and added compliance elements to the standard. If you feel that your comment has been overlooked, please let us know immediately. Our goal is to give every comment serious consideration in this process! If you feel there has been an error or omission, you can contact the Vice President and Director of Standards, Herbert Schrayshuen, at 315 439 1390 or at herb.schrayshuen@nerc.net. In addition, there is a NERC Reliability Standards Appeals Process.[1]

[1] The appeals process is in the Reliability Standards Development Procedures: http://www.nerc.com/standards/newstandardsprocess.html.

Index to Questions, Comments, and Responses

The Industry Segments are:

1 — Transmission Owners
2 — RTOs, ISOs
3 — Load-serving Entities
4 — Transmission-dependent Utilities
5 — Electric Generators
6 — Electricity Brokers, Aggregators, and Marketers
7 — Large Electricity End Users
8 — Small Electricity End Users
9 — Federal, State, Provincial Regulatory or other Government Entities
10 — Regional Reliability Organizations, Regional Entities

		Commenter	Organization	Industry Segment									
				1	2	3	4	5	6	7	8	9	10
1.	Group	Stan Jaskot	Entergy Fossil Operations					X					

	Additional Member	Additional Organization	Region	Segment Selection
1.	Jules Guillot	Entergy Fossil Operations	SERC	5
2.	Jamil Khan	Entergy Fossil Operations	SERC	5

2.	Group	John Ciufo — SPCS	NERC System Protection and Control Subcommittee (SPCS)	X	X			X				X	X

	Additional Member	Additional Organization	Region	Segment Selection
1.	Jonathan Sykes Vice Chairman	Salt River Project	WECC	1, 5
2.	Michael McDonald	Ameren Services Company	SERC	1, 5
3.	William J. Miller	Exelon Corporation	RFC	1, 5
4.	George Pitts	Tennessee Valley Authority	SERC	1, 5, 9
5.	Sungsoo Kim	Ontario Power Generation Inc.	NPCC	5, 9
6.	See NERC SPCS Roster for more			

		Commenter	Organization	Industry Segment									
				1	2	3	4	5	6	7	8	9	10
3.	Individual	Patrick Brown	PJM Interconnection		X								
4.	Group	Jalal Babik	Dominion	X		X		X	X				

	Additional Member	Additional Organization	Region	Segment Selection
1.	Larry Whanger	F&H	SERC	5
2.	Chip Humphrey	F&H	RFC	5
3.	John Loftis	Electric Transmission	SERC	1
4.	Jack Kerr	Electric Transmission	SERC	1
5.	Lou Roeder	Electric Transmission	SERC	1
6.	Kirit Doshi	Electric Transmission	SERC	1
7.	Craig Crider	Electric Transmission	SERC	1
8.	Solomon Yirga	Electric Transmission	SERC	1
9.	Mike Garton	Regulatory	NPCC	5
10.	Louis Slade	Regulatory	MRO	6
11.	Jalal Babik	Regulatory	SERC	3
12.	Chris Funderburk	Nuclear	SERC	5

5.	Group	Guy Zito	Northeast Power Coordinating Council											X

	Additional Member	Additional Organization	Region	Segment Selection
1.	Ralph Rufrano	New York Power Authority	NPCC	5
2.	Roger Champagne	Hydro-Quebec TransEnergie	NPCC	2
3.	David Kiguel	Hydro One Networks Inc.	NPCC	1
4.	Chris de Graffenried	Consolidated Edison Company of New York	NPCC	1
5.	Brian L. Gooder	Ontario Power Generation Inc.	NPCC	5
6.	Mike Schiavone	National Grid	NPCC	1
7.	Robert Pellegrini	The United Illuminating Company	NPCC	1
8.	Sylvain Clermont	Hydro-Quebec TransEnergie	NPCC	1

	Commenter	Organization	Industry Segment									
			1	2	3	4	5	6	7	8	9	10
6.	Group	Rick Foster	SERC Dynamics Review Subcommittee (DRS)									X

	Additional Member	Additional Organization	Region	Segment Selection
9.	Randy MacDonald	New Brunswick System Operator	NPCC	2
10.	Greg Campoli	New York Independent System Operator	NPCC	2
11.	Kathleen Goodman	ISO New England, Inc.	NPCC	2
12.	Kurtis Chong	Independent Electricity System Operator	NPCC	2
13.	Peter Yost	Consolidated Edison Company of New York, Inc.	NPCC	3
14.	Bruce Metruck	New York Power Authority	NPCC	6
15.	Alan Adamson	New York State Reliability Council, LLC	NPCC	10

	Additional Member	Additional Organization	Region	Segment Selection
1.	John Sullivan	Ameren	SERC	1
2.	Anthony Williams	Duke Energy Carolinas	SERC	1
3.	Sujit Mandal	Entergy	SERC	1
4.	Venkat Kolluri	Entergy	SERC	1
5.	John O'Connor	Progress Energy Carolinas	SERC	1
6.	Bob Jones	Southern Company Services, Inc. - Trans	SERC	1
7.	Lee Taylor	Southern Company Services, Inc. - Trans	SERC	1
8.	Robbie Bottoms	TVA	SERC	9
9.	Tom Cain	TVA	SERC	9
10.	Herb Schrayshuen	SERC	SERC	10

7.	Group	Tim Hinken	Kansas City Power & Light	X		X		X	X				

	Additional Member	Additional Organization	Region	Segment Selection
1.	Michael Gammon	Kansas City Power & Light	SPP	1, 3, 5, 6
2.	Jerry Hatfield	Kansas City Power & Light	SPP	1, 3, 5, 6
3.	Nick McCarty	Kansas City Power & Light	SPP	1, 3, 5, 6

	Commenter	Organization	Industry Segment									
			1	2	3	4	5	6	7	8	9	10
4. Dan Jones	Kansas City Power & Light	SPP	1, 3, 5, 6									
8. Group	Michael Brytowski	MRO NERC Standards Review Subcommittee										X

	Additional Member	Additional Organization	Region	Segment Selection
1.	Carol Gerou	MP	MRO	1, 3, 5, 6
2.	Neal Balu	WPS	MRO	3, 4, 5, 6
3.	Terry Bilke	MISO	MRO	2
4.	Joe DePoorter	MGE	MRO	3, 4, 5, 6
5.	Ken Goldsmith	ALTW	MRO	4
6.	Jim Haigh	WAPA	MRO	1, 6
7.	Terry Harbour	MEC	MRO	1, 3, 5, 6
8.	Joseph Knight	GRE	MRO	1, 3, 5, 6
9.	Scott Nickels	RPU	MRO	3, 4, 5, 6
10.	Dave Rudolph	BPEC	MRO	1, 3, 5, 6
11.	Eric Ruskamp	LES	MRO	1, 3, 5, 6
12.	Pam Sordet	XCEL	MRO	1, 3, 5, 6

9. Group	Sam Ciccone	FirstEnergy	X		X	X	X	X				

	Additional Member	Additional Organization	Region	Segment Selection
1.	Doug Hohlbaugh	FE	RFC	1, 3, 4, 5, 6
2.	Dave Folk	FE	RFC	1, 3, 4, 5, 6
3.	Mike Williams	FE	RFC	5
4.	Art Buanno	FE	RFC	1
5.	Ed Baznik	FE	RFC	1
6.	Ken Dresner	FE	RFC	5
7.	Bill Duge	FE	RFC	5

		Commenter	Organization	Industry Segment									
				1	2	3	4	5	6	7	8	9	10
10.	Group	Ben Li	IRC Standards Review Committee		X								

	Additional Member	Additional Organization	Region	Segment Selection
1.	Anita Lee	AESO	WECC	2
2.	James Castle	NYISO	NPCC	2
3.	Matt Goldberg	ISO-NE	NPCC	2
4.	Steve Myers	ERCOT	ERCOT	2
5.	Bill Phillips	MISO	MRO	2
6.	Charles Yeung	SPP	SPP	2

11.	Individual	Scott Etnoyer	Constellation Power Generation & Constellation Nuclear					X					
12.	Individual	Rick Terrill	Luminant Power										
13.	Individual	Hugh Francis	Southern Company	X		X		X	X				
14.	Individual	Jinhui Zhang	Converteam Naval Systems Inc.										
15.	Individual	Jianmei Chai	Consumers Energy Company			X	X	X					
16.	Individual	Brent Ingebrigtson	E.ON U.S.	X		X		X	X				
17.	Individual	Brendan Kirby	AWEA								X		
18.	Individual	Mark L Bennett	Gainesville Regional Utilities	X		X		X					
19.	Individual	Michael Goggin	American Wind Energy Association								X		
20.	Individual	Cleyton Tewksbury	Veolia Environmental Services					X					
21.	Individual	Mark Ringhasuen	Old Dominion Electric Cooperative				X						

		Commenter	Organization	Industry Segment									
				1	2	3	4	5	6	7	8	9	10
22.	Individual	Patrick Farrell	Southern California Edison Company	X		X			X				
23.	Individual	Barry Francis	Basin Electric Power Cooperative	X		X		X					
24.	Individual	Tony Kroskey	Brazos Electric Power Cooperative	X									
25.	Individual	Harianto Suryo	Lakeland Electric									X	
26.	Individual	Kasia Mihalchuk	Manitoba Hydro	X		X		X	X				
27.	Individual	D. Bryan Guy	Progress Energy, Inc.	X		X		X					
28.	Individual	Bob Shanks	NIPSCo	X		X		X	X				
29.	Individual	Scott Berry	Indiana Municipal Power Agency				X						
30.	Individual	Rick White	Northeast Utilities	X									
31.	Individual	Roger Champagne	Hydro-Québec TransEnergie (HQT)	X									
32.	Individual	Mark Thompson	AESO		X								
33.	Individual	James H. Sorrels, Jr.	American Electric Power	X		X		X	X				
34.	Individual	Greg Rowland	Duke Energy	X		X		X	X				
35.	Individual	Gregory Campoli	New York Independent System Operator		X								
36.	Individual	Alice Murdock	Xcel Energy	X		X		X	X				
37.	Individual	Armin Klusman	CenterPoint Energy	X									

		Commenter	Organization	Industry Segment									
				1	2	3	4	5	6	7	8	9	10
38.	Individual	Dan Rochester	Independent Electricity System Operator		X								
39.	Individual	Kirit Shah	Ameren	X		X		X	X				
40.	Individual	John Cummings	PPL Energy Plus					X					
41.	Individual	Robert Jenkins	First Solar										
42.	Individual	Jay Seitz	US Bureau of Reclamation					X					
43.	Individual	Jason Shaver	American Transmission Company	X									

1. The PRC-024-1 Standard is applicable to the Generator Owner as opposed to Generator Operator, do you agree? If not, please explain in the comment area.

Summary Consideration:

A majority of responders commented that the relay settings are the responsibility of the GO with several respondents indicating that this Standard ought to apply to both the GO and the GOP.

The minority included comments as follows:

- The relay settings are the responsibility of the GOP
- Since the GOP does not own the generator, he cannot change the settings w/o GO approval
- The GO has the maintenance responsibility
- The GOP has the maintenance responsibility
- There will be complications for generators with multiple owners
- TP should be added to specify clearing times

The latest version of the Functional Model provides some clarity on the division of duties between the Generator Owner and Generator Operator. The Generator Owner has the responsibility for making decisions about the design and maintenance of generating facilities, including the generator protection systems: "Generator Owner Task 2: Design and authorize maintenance of generation plant protective relaying systems, protective relaying systems on the transmission lines connecting the generation plant to the transmission system, and Special Protection Systems."

The drafting team has determined that the Generator Owner has the responsibilities required by this NERC Standard. The Generator Owner requirements include following specified limits on protective relay settings, providing notification of changes to protective relay settings, documenting equipment limitations, and responding to comments from the RC, PC, TO, or TP on this subject.

Organization	Yes or No	Question 1 Comment
Northeast Power Coordinating Council	No	Both bullets should be checked above (form will not accept).The responses received were divided, and below are the comments received for your consideration. The Generator Operators, and not the Generator Owners, are typically responsible for establishing relay setpoints, calibrations, and maintenance. The Generator Owner is the Functional Model entity that has direct control over the generating unit protection settings.

Organization	Yes or No	Question 1 Comment
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Constellation Power Generation & Constellation Nuclear	No	The Generator Operators, and not the Generator Owners, are typically responsible for establishing relay setpoints, calibrations, and maintenance. The Generator Owner is the Functional Model entity that has direct control over the generating unit protection settings.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Converteam Naval Systems Inc.	No	I believe it should be applicable to both.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Gainesville Regional Utilities	No	In a number of smaller utilities, they are the same and do not need to be addressed separately
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems.		
Veolia Environmental Services	No	The generator operator is the entity charged with maintaining the facility. Therefore, the GOP has all the necessary records and procedures.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Old Dominion Electric Cooperative	No	I agree that the GO is the primary function for this requirement, but given the multitude of Go/GOP configurations out there, I think the GOP function should also be included in the applicability section of this standard.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the		

Organization	Yes or No	Question 1 Comment
responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Southern California Edison Company	No	The Generator Operator should be the functional entity to whom the standard applies because Generator Operators tend to change the settings without warning or permission.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Xcel Energy	No	We feel the GO would only be applicable for R6 and for when a new unit is being built. Once a unit is online, it is the GOP that would be performing all the actions to ensure compliance with R1-R5 of this standard. We also foresee compliance issues with jointly-owned units, if applicability were to remain only with the GO.
Response: Thank you for your response. The drafting team has determined that the Generator Owner is the appropriate party to fulfill the responsibilities required by this NERC Standard since the required actions are related to the design and maintenance of the protection systems. Please see the summary considerations above.		
Entergy Fossil Operations	Yes	Generator Owner is responsible for the maintenance of the facility. Relay settings are a Generator Owner function.
Response: Thank you for your response. The SDT agrees with your comments.		
SERC Dynamics Review Subcommittee (DRS)	Yes	Since the generator operator does not own the equipment addressed by the standard, he cannot change the settings without the generator owner's approval. The standard potentially requires changing the frequency and voltage relay trip settings. Since the generator owner owns the equipment, they also own the settings and should be the one held accountable for meeting the requirements of this standard.
Response: Thank you for your response. The SDT agrees with your comments.		
IRC Standards Review Committee	Yes	We agree. This is consistent with our view expressed for MOD-026 for which we suggest the Generator Owner, not the Generator Operator, be held responsible for generating unit equipment/device settings and data verification.
Response: Thank you for your response. The SDT agrees with your comments.		

Organization	Yes or No	Question 1 Comment
Southern Company	Yes	If the standard is in place, it belongs to the Generator Owner. The SAR seemed to be written for transmission, but this standard seems to be evolving to a generator setting standard. Does the SAR need to be revised? Although GO has the access to the equipment settings/records, GOP may not, GOP is the entity to operate the units. GO must communicate settings to the GOP. Since the generator operator does not own the equipment addressed by the standard, he cannot change the settings without the generator owner's approval. The standard potentially requires changing the frequency and voltage relay trip settings. Since the generator owner owns the equipment, they also own the settings and should be the one held accountable for meeting the requirements of this standard.
Response: Thank you for your response. The SDT agrees with your comments. The proposed requirements are within the scope of the SAR.		
Basin Electric Power Cooperative	Yes	I have some problems with the intent of this standard in general, but a standard of this nature would have to apply to the generator owner.
Response: Thank you for your response. The SDT agrees with your comment.		
Progress Energy, Inc.	Yes	Since the generator operator does not own the equipment addressed by the standard, he cannot change the settings without the owner's approval. The standard potentially requires changing the frequency and voltage relay trip settings. Since the generator owner owns the equipment, they also own the settings and should be the one held accountable for meeting the requirements of this standard.
Response: Thank you for your response. The SDT agrees with your comment.		
Hydro-Québec TransEnergie (HQT)	Yes	The Generator Owner is the Functional Model entity that has direct control over the generating unit protection settings.
Response: Thank you for your response. The SDT agrees with your comment.		
Independent Electricity System Operator	Yes	We agree. This is consistent with our view expressed for MOD-026 for which we suggest the Generator Owner, not the Generator Operator, be held responsible for generating unit equipment/device settings and data verification.
Response: Thank you for your response. The SDT agrees with your comment.		
US Bureau of Reclamation	Yes	We agree since PRC-004-1, Protection System Misoperation Analysis and Correction and PRC-005-1, Protection System Maintenance, are applicable to the Generator Owner (and Transmission Owner); however, PRC-001-1 Protection System

Organization	Yes or No	Question 1 Comment
		Coordination is applicable to the Generator Operator (and Transmission Operator). We believe all of the above should be coordinated and applicable to the Owner. The Standard also has a role for a Transmission entity (in this case the Transmission Planner) to specify clearing times; however no applicability or requirement is provided in the standard. We believe the role for a Transmission entity should be clarified in the Standard and applicability and requirement(s) added.
Response: Thank you for your response. The SDT agrees that the GO is the responsible party for PRC-024-1. Substantial rewriting of this Standard has occurred since the first posting, yet the TP has not yet been included in the applicability.		
NERC System Protection and Control Subcommittee (SPCS)	Yes	
PJM Interconnection	Yes	
Dominion	Yes	
Kansas City Power & Light	Yes	
MRO NERC Standards Review Subcommittee	Yes	
FirstEnergy	Yes	
Luminant Power	Yes	
Consumers Energy Company	Yes	
E.ON U.S.	Yes	
AWEA	Yes	
American Wind Energy Association	Yes	

Organization	Yes or No	Question 1 Comment
Brazos Electric Power Cooperative	Yes	
Lakeland Electric	Yes	
Manitoba Hydro	Yes	
NIPSCo	Yes	
Indiana Municipal Power Agency	Yes	
Northeast Utilities	Yes	
American Electric Power	Yes	
Duke Energy	Yes	
New York Independent System Operator	Yes	
Ameren	Yes	None
First Solar	Yes	
American Transmission Company	Yes	

2. The SDT has established the Requirements in this Standard only for the setting of voltage and frequency generator protective relays. Do you agree? If not, please explain in the comment area.

Summary Consideration:

Minority comments were wide-ranging and covered the following issues:

- Some respondents expressed that the Standard needs more technical justification.
- Generator protection relays are designed to protect generation equipment. NERC has no business dictating how Generator Owners or Operators protect their equipment. Reducing generator protection ultimately reduces power system reliability.
- Generator loss of life should be considered.
- This Standard should only apply to non-synchronous generators. PRC-001 or a new SAR will take care of synchronous generators. This Standard will encourage setting of relays that are not already set and reduce reliability.
- Setting all generator voltage trip points at the same point will result in catastrophic loss of generation.
- Other relays and devices should be included including Volts/Hertz, generator backup impedance, voltage restrained over-current, and exciter voltage regulator protective functions.
- Footnote 1 is too broad and the Standard should not address voltage regulators.
- Some locations do not need to include generators that are smaller than 100 MVA.
- Include formulas as well as the curves.
- Worst case conditions should be considered with extra margins allowed for oscillations. Generator frequency trip settings should be longer with UFLS normally reducing the frequency recovery time.

On the larger issue of performance, a significant number of respondents pointed that the SAR was clear in its scope and that the SDT should address generator plant performance and not merely propose a relay setting standard. In other words, the Standard should apply to all components of the generation plant. As originally written the Standard defeats the purpose of PRC-023 on transmission loadability.

A small dissenting minority expressed that the SAR's goal of having generators ride through voltage and frequency disturbances is not practical and that "generators" are not designed to ride through these events.

The GV SDT has determined that this NERC Standard should require new generators to ride through voltage and frequency excursions. The revised Standard does not dictate how generators should be protected. The revised Standard specifies the limits for events that new generators are required to ride through. These limits were developed based on manufacturers' information on machine capabilities as well as on power system reliability requirements. The Standard is a protective relay

setting Standard for existing generators. Further, the GV SDT has included a provision for existing generators that cannot meet the limits specified in R1 and R2.

Organization	Yes or No	Question 2 Comment
Entergy Fossil Operations	No	I disagree in principle that NERC is dictating how generator protective relays are set. These relays are set to protect the generation equipment and ensure long term reliability of the unit. Dictating settings which enhances ride through capability ensure short term reliability and can hurt long term reliability. If this if force upon us, I agree with only addressing the voltage and frequency generator protective relays.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions. The Standard does not dictate how generators should be protected. The Standard specifies the limits for events that new generators are required to ride through. These limits were developed based on manufacturers' information on machine capabilities as well as on power system reliability requirements. The Standard is a protective relay setting Standard for existing generators. Further, the SDT has included a provision for existing generators that cannot meet the limits specified in R1 and R2.		
NERC System Protection and Control Subcommittee (SPCS)	No	PRC-024 should only apply to non-synchronous machines. The SPCS believes that coordination of synchronous generator voltage and frequency protective relays with transmission relays should not be addressed in PRC-024. An effort is underway to address coordination of generator voltage and frequency protective relay settings with transmission protection systems either by modifications to PRC-001 or the development of a new SAR to address coordination requirements. SPCS is preparing a Technical Reference paper on such coordination that is expected to be completed in June, 2009. Generator voltage and frequency protective relays are included in that that paper. The purpose as stated in the SAR is "To ensure that generators will not trip off-line during specified voltage and frequency excursions." The Standard will not accomplish its stated purpose by limiting requirements to generator protective relays alone. In fact it may actually have the exact opposite consequence. Undervoltage relays are not usually set on most synchronous generators. When undervoltage relays are applied, IEEE C37.102 recommends alarm rather than trip. The more likely cause for the loss of a generator due to a dip in voltage is from the loss of equipment on the auxiliary bus. This was the cause sited for a well documented event on March 27, 1994 losing all generating units at Cinergy's Gibson Station. Other events since 1994 were also due to tripping of generators due to loss of auxiliary busses caused by voltage dips from system faults. In fact, the Standard may result in the unintended consequence of reducing reliability. Many generator owners may take the recommendation as an implied directive to set previously unused generator undervoltage relay elements to the minimums stated in the Standard. That would cause more generator trips for system faults rather than fewer trips. Similarly, many generators that currently do not have undervoltage relay settings would trip at various other inherent voltage levels during a voltage excursion. With all of them set at or about 0.90 per unit, they would all trip at the same point, causing a catastrophic loss of generation. There are significant machine protection issues which are not addressed, such as the Volts/Hertz relay which protects the machine from an over-fluxing thermal hazard. Loss of generation consequential to problems on auxiliaries is a significant problem, which is not addressed in this Standard.

Organization	Yes or No	Question 2 Comment
Response: The SDT agrees with you that the previous version of the draft Standard "will not accomplish its stated purpose by limiting requirements to generator protective relays alone." The Standard has been modified to require new generators to ride through voltage and frequency excursions. The standard is technology neutral and applies to all generators. The SDT followed the SAR in applying the Standard to all new generators and by coordinating with the underfrequency load shedding Standard development.		
Northeast Power Coordinating Council	No	Both bullets should be checked above (form will not accept).The proposed standard addresses all issues identified in the Standard Authorization Request. Coordination of generator and transmission system protection is addressed in PRC-001.As presently constituted this Standard will likely result in the inappropriate enabling and setting of frequency and voltage relays with the settings which are permitted, thus reducing system reliability, which is contrary to its stated purpose. This is supported in the comments provided below. There are significant machine protection issues which are not addressed, such as Volts per Hertz. Loss of generation consequential to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both, is a significant problem, and is not addressed in this Standard.
Response: The SDT has modified the standard to address those relays that have frequency or voltage inputs that would directly trip the unit. The SDT has clarified that generators are not required to install or set the relays to trip. The Standard has been modified to address loss of generation consequent to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both.		
SERC Dynamics Review Subcommittee (DRS)	No	Settings for generator backup impedance and voltage restrained overcurrent relays need to be covered too. Their inclusion will provide complete coverage of the generator. There have been instances where these relays have operated in the past. We understand that this will drive the need for dynamic simulations because steady state simulations will not suffice.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit.		
Kansas City Power & Light	No	In many cases the exciter voltage regulator includes generator protective functions (for example, Basler DECS 300, DECS 400) such as Volts/Hertz, undervoltage, overvoltage, underfrequency that will also trip the Unit. These functions are usually set slightly above the trip settings of the equivalent generator protective relaying, but to not include them in this requirement would effectively nullify the stability effort sought by this requirement.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit.		
Constellation Power Generation & Constellation Nuclear	No	The proposed standard addresses all issues identified in the Standard Authorization Request. Coordination of generator and transmission system protection is addressed in PRC-00. As presently constituted this Standard will likely result in the inappropriate enabling and setting of frequency and voltage relays with the settings which are permitted, thus reducing system reliability, which is contrary to its stated purpose. This is supported in the comments provided below. There are significant machine protection issues which are not addressed, such as Volts per Hertz. Loss of generation consequential to problems

Organization	Yes or No	Question 2 Comment
		on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both, is a significant problem, and is not addressed in this Standard.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit. The SDT has clarified that generators are not required to install or set the protective relays. The Standard has been modified to address loss of generation consequent to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both.		
Southern Company	No	What the standard addresses is probably what is practical, but the ultimate goal of the SAR is not practical to implement. We question whether the goal of this standard can be truly addressed from a practical standpoint. The scope of the protective equipment covered in the current draft excludes excitation system protection including over excitation, station service under voltage protection, certain nuclear facility protection schemes, boiler controls, turbine controls, each of which may not ride through the frequency and voltage swings. We feel as though the limited approach of specifying F and V relay settings on the generator may be futile in improving the ability to ride through yet on the other hand the inclusion of all of the impacted plant subsystem components would be practically and financially unmanageable. In other words, will any appreciable improvement in system reliability result from the implementation of this standard looking at F and V gen settings only. Settings for generator backup impedance and voltage restrained overcurrent relays may need to be covered too. Their inclusion will provide complete coverage of the generator. There have been instances where these relays have operated in the past. We understand that this will drive the need for dynamic simulations because steady state simulations will not suffice.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions and believes this is practical. An exemption is provided for existing generators that are unable to meet the ride through requirement. The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit.		
Gainesville Regional Utilities	No	In some areas there is no reason to include generators less than 100 MVA
Response: The SDT believes the Standard should apply to all units that meet the criteria of the compliance registry.		
Basin Electric Power Cooperative	No	Generation under frequency protection is an area I have spend much time on over the last 20 years, and I admit that I hold some strong opinions, but these opinions were arrived at after much study, disturbance analysis, and from being directly involved in actual design of three regional underfrequency load shedding (UFLS) programs. It appears that the generator off-nominal frequency protection limits shown in attachment 1 represent someone's judgment call of what is a reasonable loss of life per event, what the expected minimum frequency might be when load shedding occurs, and so forth. Such judgment calls are subjective, and there is room for interpretation. I feel that generation underfrequency/overfrequency settings of this nature have to be developed on a regional basis as part of a regional underfrequency load shedding program. I am uncomfortable with this showing up in a draft NERC standard without any

Organization	Yes or No	Question 2 Comment
		supporting technical documentation or justification. I agree that unit capabilities have to be considered, but perhaps more important, we have to consider the realities of what we can achieve with UFLS and give ourselves enough generator tripping delay time and relay margin to make the program work. Tradeoff's are involved, and this type of underfrequency analysis is inherently an estimation, so some time delay margin is needed to ensure coordination with load shedding. If generation trips too soon, the island imbalance will increase and it may not be possible to prevent total collapse of the island. Keep in mind that the real off-nominal frequency loss of life exposure is when black start programs try to pick up the pieces after load shedding fails, and premature tripping of generation is what causes load shedding to fail. In addition, hydro systems can operate at much lower frequencies than steam units, and this criteria is not appropriate for hydro systems. In my opinion, UFLS is supposed to be a safety net to cover the unforeseen, and it needs to be designed with that in mind. Ideally, we want it to be as robust as possible. Relay coordination is going to be more robust when based on worst-case performance and not on best case. This helps deal with real world complications imposed by things we have not anticipated or foreseen, or due to "as implemented" programs always being a little different than the ideal stated in the design phase. My most recent involvement with UFLS and generator off-nominal frequency protection coordination came about through the MRO Underfrequency Load Shedding Task Force effort that developed a new coordinated UFLS program for the MRO footprint. I served as chair of this taskforce and did much of the analysis. I do not want PRC-024-1 to establish standards that conflict with the MRO program. Doing so would sacrifice the effectiveness of the load shedding program we came up with. There are a couple of other areas where conflicts occur. This is in regards to how to deal with programs that need to shed more than the minimum amount of load, and in regards to the overfrequency implications. I will discuss the issues in sequence. Although the MRO UFLS Taskforce expects that under "typical conditions" that minimum frequency will be above 58 Hz, (for loss of generation/import of up to 30% of system load in the island), our worst case simulations indicate we could briefly dip below that, and we used our worst case results to set generation protection times and delays. In addition, our "equivalent inertia" modeling approach ignores machine to machine oscillations which might cause frequency at different locations to differ by .2 Hz or so as the system rings down. For this reason, we chose 57.6 Hz as the point where instant tripping is allowed. This is below our worst-case minimum frequency of 57.77 Hz (for a very low inertia, low damping, no governor scenario that is perhaps overly pessimistic). This can also be justified by considering that our design criteria set a target of average system frequency >= 58 Hz, which has to be adjusted by about - .2 Hz for machine to machine oscillations seen in the real system and not in our model, plus about .2 Hz margin to ensure good relay coordination). In order to come up with the MRO generation protection settings we monitored time spent in frequency bands spaced .1 Hz apart and we consider the performance over the full range of coverage (0 to 30 % loss of generation) and considered a wide range of assumptions concerning system based inertia (H system base = MW-sec stored in rotating mass divided by P gen) and damping in addition to a possible range of governor actions. We optimized the program to minimize time spent below 60 Hz while addressing all the other constraints we had to deal with. Once we knew the expected worst case times in each .1 Hz band below 60 Hz for the optimized program, we came up with the stair step type of generation time delay settings that gave a reasonable fit to the expected worst-case time versus frequency information (plus some margin) with the fewest frequency bands. The MRO UFLS effort tried to anticipate as much complication as possible, but we could not cover all of the inherent uncertainty involved. No one could. The main source of uncertainty we could not deal with is how potential overvoltage's may increase load and decrease the effectiveness of the load shedding program. This gave us additional justification for using a "no net governor

Organization	Yes or No	Question 2 Comment
		response" scenario for evaluating coordination between load shedding and generator protection (this voltage uncertainty is not the only reason for using a no governor assumption: basically units that are base loaded cannot respond to underfrequency, power/load controllers may override governor action, combustion turbine thermal limits will quickly override their governor action with power dropping off faster than the frequency decline, wind generation may drop off and would not have a governor anyway, and so forth; the bottom line is that we do not know what level of net governor type of action we can count on, and what little we get may be offset by increases in voltage). To fully understand what we did you will have to refer to the MRO UFLS report on the MRO website. The short version is that we ran 1000's of cases to arrive at our conclusions. What we came up with for generator underfrequency protection minimum time delays is what we need to ensure the load shedding has time to play out to restore frequency and to give some margin to ensure relay coordination. If we tighten up the generation protection time delays and raise the frequency setting for the instant trip point, then there is a narrower range of conditions for which the UFLS program would be expected to work as intended. Our safety net becomes less robust, we make things less secure. On the other hand, the MRO load shedding program is designed to be the first line of protection for the generators as it is designed to force frequency recovery even in the absence of governor action by having small blocks of load shed on delay to kick us back towards 60 Hz when recovery is too slow. Although there is a chance that frequency may be slow to recover as a worst case, most of the time it will recover much faster than the times we used for generation tripping coordination. The expected time spent below 60 Hz sort of takes on the form of a probability density function. This type of information gives a better idea of what units may be exposed to. Therefore, our approach was to coordinate generation off-nominal frequency protection to match the worst case, and then do everything possible to minimize underfrequency exposure to generators when designing the load shedding program. The recommendations of the MRO UFLS report should take precedence over what is being proposed in this document. In MRO, we recognize that the Canadian portion of MRO needs to shed more than 30% of connected load. The MRO UFLS report indicates that any program that needs to shed more than 30% of load will need to relax the MRO generator off nominal frequency time delay settings for generation and accept longer delays and lower minimum frequencies. This is an engineering reality. The Off-Nominal Frequency Capability Curve on Attachment 1 does not give this kind of flexibility. Alternately, some improvement on minimum frequency can be realized by designing a program that oversheds but then the program will be prone to overspeed problems. Programs can also start shedding at higher frequencies to improve the minimum frequency but then that creates other coordination problems with neighboring programs. This standard writing process should not replace engineering judgment. Utilities need flexibility so they can make the necessary compromises after all things are considered. Making adjustments to generation protection is most likely the best approach to ensure coordination with these larger load shedding programs.The diagram from PRC-024-1 may suggest to some folks that over frequency tripping is going to be needed or perhaps even encouraged. I do not know what the intent is, so I will just express my concerns up front. I have serious reservations about applying dedicated relays, of the type used for underfrequency protection, to trip units on overspeed. Extreme caution is needed. That is a good way to ensure total collapse of a power grid. Seriously, this could be catastrophic. Consider that plants already have internal overspeed controls. These are needed to deal with full load rejection. These controls are in addition to the normal governor, and are much more drastic. These emergency overspeed controls are not modeled in stability cases, but they exist, and will take drastic action to slow down units if frequency gets high so I feel confident that the units self protect and take care of themselves. I believe that overspeed protection should be left to these inherent controls, and that we should not put in additional relays to trip generation

Organization	Yes or No	Question 2 Comment
		on overspeed unless this is done carefully and solely for the purpose of restoring load and generation within an island.Plant internal overspeed controls have to limit speed following full load rejection, but they will also react to partial load rejections that we get by islanding. If a plant loses all lines to it (i.e. full load rejection), then go ahead and allow these inherent controls to trip the unit on overspeed or do what ever is needed. NERC does not need a standard for that. The emergency overspeed controls that protect for full load rejection can also activate on an islanding condition where we have too much generation in an island. On steam units these controls kick in between 61 to 62 Hz (it varies with each unit so I have to generalize), so system frequency is unlikely to get much higher than 61.4 Hz to 62 Hz (most that I have seen activate around 61.2 to 61.4 Hz) no matter how large the initial imbalance. Once these controls activate frequency is no longer a measure of the imbalance between load and generation. The action taken to prevent overspeed involves things like closing all the steam valves on thermal units, so it is safe to say we cannot stay in this high frequency condition for too long before random unit trips start to occur due to any number of internal plant problems. Often times one plant dies first and rebalances things for other units. The random nature of what happens next complicates any planned unit tripping actions to correct the imbalance. If dedicated unit tripping on overspeed is to be done, it can only be done on a few selected units and only as a way to hammer the imbalance back to a smaller size that we can deal with. The worst of all worlds would be to apply overspeed tripping to all units like we do for underfrequency. That would ensure any island with an initial excess of generation is going to go black after we dump all the generation. If generation is tripped to correct overspeed in an island, it has to be done in small increments (about 1 to 1.5 % of remaining load) and trip times have to be staggered. This is something that has to be studied on a case-by-case basis.In summary, we do not believe that it is appropriate to be creating a standard like this to specify settings for underfrequency/overfrequency protection for all generation. The technical basis of these limits are not given, and these setting may not coordinate with existing or proposed underfrequency load shedding programs. Aggressive load shedding programs are quite likely to need to accept more time below 60 Hz to coordinate with underfrequency relaying and expected system frequency recovery times. Protection settings of this nature should be developed in conjunction with underfrequency load shedding programs so that appropriate trade offs can be considered. Such coordination is most effective at the regional or subregional basis where a specific load shedding program can be evaluated in detail. We must give sufficient time for load shedding to act even if it means we need to accept some additional potential loss of life to generation for some hypothetical underfrequency event.
Response: The SDT developed the off-nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves. In addition, the SDT developed the off-nominal frequency curve in coordination with the NERC UFLS Standard Drafting team. The Standard is technology neutral and applies to all generators.		
First Solar	No	The application of the standard to arrays of solar inverters is unclear. While the primary breaker can be set to comply with the standards, when the system voltage is driven to zero during the fault, the inverters will lose their phase lock and begin to shut down.
Response: The Standard includes a provision to document an equipment limitation that would prohibit compliance with Requirements R1 and R2 for		

Organization	Yes or No	Question 2 Comment
existing generators.		
US Bureau of Reclamation	No	Now that the draft standard has been posted, it appears to be a more structured and limited version of existing Standard PRC-001-1 – System Protection Coordination. PRC-001-1 requires the Generator entity to coordinate protection settings with the Transmission entity. The stated Purpose of PRC-024-1 "Ensure that generator frequency and voltage protective relays are set to support transmission system stability during voltage and frequency excursions" should be attainable through PRC-001-1. If PRC-001-1 is not adequate it should be modified rather than adding an additional standard only addressing generator frequency and voltage settings. As such we do not believe there is a clear, reliability based justification for this standard as currently drafted.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Progress Energy, Inc.	No	The purpose of the standard, to ensure that generators ride through the proposed system transients, will not be accomplished by only looking at generator protective relays. PE is concerned that these same profiles for frequency and voltage (Attachment 1 and 2) could later become applicable to all plant equipment. The generating plants are not designed to ride thru/stay connected for these proposed profiles.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Hydro-Québec TransEnergie (HQT)	No	The proposed standard addresses all issues identified in the Standard Authorization Request. Coordination of generator and transmission system protection is addressed in PRC-00. As presently constituted this Standard will likely result in the inappropriate enabling and setting of frequency and voltage relays with the settings which are permitted, thus reducing system reliability, which is contrary to its stated purpose. This is supported in the comments provided below. There are significant machine protection issues which are not addressed, such as Volts per Hertz. Loss of generation consequential to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both, is a significant problem, and is not addressed in this Standard.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit. The SDT has clarified that generators are not required to install or set the protective relays. The Standard has been modified to address loss of generation consequent to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both.		
Duke Energy	No	Footnote 1 is unclear and too broad. As stated, it includes voltage regulators – which is beyond the scope of this standard. Take voltage regulator out, or specify the volts per hertz protection function only.
Response: The SDT has modified the footnote.		

Organization	Yes or No	Question 2 Comment
New York Independent System Operator	No	As presently constituted this Standard could result in the inappropriate enabling and setting of frequency and Voltage relays with the settings which are permitted, thus reducing system reliability, which is contrary to its stated purpose. This is supported in the comments provided below. It would have been much more important to require that Voltage and frequency relays be applied only when they are required for machine protection, which this Standard does not do. There are significant machine protection issues which are not addressed, such as Volts per Hertz. Loss of generation consequential to problems on auxiliary systems, problems which arise due to low Voltage or low frequency, or a combination of both, is a significant problem, and is not addressed in this Standard.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit. The SDT has clarified that generators are not required to install or set the protective relays. The Standard has been modified to address loss of generation consequent to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both.		
CenterPoint Energy	No	a) CenterPoint Energy does not agree with limiting the application of this standard to the few relays that the SDT has chosen to address (only generator under or over voltage protective relays and volts per hertz relays). In effect, the SDT is allowing possible tripping of generation during off nominal frequency and voltage excursions from several other types of relays and control systems. This may not provide adequate reliability, as loss of significant generation can occur for voltage sags. B) The SDT has not included generator backup over current, impedance, and loss of field relays within the scope of this draft standard. CenterPoint Energy believes these additional relays should also be addressed. CenterPoint Energy believes it is illogical to have a transmission relay loadability standard (PRC-023 Transmission Relay Loadability) based on current and impedance ride-through while exempting generators from comparable requirements. Such an exemption defeats the purpose of the transmission relay loadability requirements by allowing a system event to escalate due to failure of generator relays to ride-through the same types of events envisioned by PRC-023 requirements. One key purpose for PRC-023 is to not interfere with system operators' ability to take remedial action to protect system reliability. C) In addition to including other types of generator relays, the relaying and control for plant auxiliary systems should also be addressed for operation during off nominal frequency and voltage excursions. Again, it is illogical to have a transmission relay loadability requirements based on current and impedance ride-through while exempting a generation plant from comparable requirements. CenterPoint Energy realizes that generating plants have many internal control systems on auxiliary equipment that could be impacted during low voltage events, but exempting such systems from this standard defeats its purpose. CenterPoint Energy also recognizes that failures or incorrect operation of equipment installed for voltage ride-through capability on auxiliary equipment controls, such as UPS devices, will occur. Therefore, CenterPoint Energy recommends the SDT specifically address plant auxiliary equipment ride through. CenterPoint Energy suggests that the requirements be similar to those in NERC standard PRC-004 Analysis and Mitigation of Transmission and Generation Protection System Misoperations. That is, if the plant incorrectly trips during a voltage sag due to auxiliary systems problems, the problem will be investigated and, where necessary, a system-wide

Organization	Yes or No	Question 2 Comment
		corrective action plan will be developed and completed.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
American Wind Energy Association	Yes	A relay setting standard is fine, although the wind industry would also be able to comply with the standard if it were a performance standard.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
AWEA	Yes	PRC-024 should be a performance standard but since that is unlikely to pass I can live with a relay setting standard
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
FirstEnergy	Yes	However, it should clearer in the requirements how mechanical and electrical overspeed protection is coordinated with the UF relay settings. Also, we would appreciate the SDT's view on why the frequency requirement are not being written into the existing PRC-006 (UFLS) standard.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions thus covering all aspects of the generating plant. The SDT has coordinated the development of the UF relay curve with UFLS SDT.		
IRC Standards Review Committee	Yes	We agree that it is a good start.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Indiana Municipal Power Agency	Yes	A performance standard would be virtually impossible to perform and verify for all the equipment at a plant. The relay approach may not meet the SAR objective for generators to remain on line through voltage and frequency excursions, but this approach is the only practical way that allows standard requirements to be written and enforced.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
American Electric Power	Yes	It is appropriate to limit the scope of this standard to setting of voltage and frequency generator protective relays, but it should be noted that other factors may cause generators to trip as a consequence of voltage or frequency excursions besides voltage or frequency sensing relays. An example is tripping due to complications involving over-excitation protection. Are other factors addressed elsewhere?

Organization	Yes or No	Question 2 Comment
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Independent Electricity System Operator	Yes	We agree that it is a good start. However, other settings such as those mentioned in the Background Information Section (generator backup over current or impedance, loss of field, etc.) also give rise to tripping of the generator. Consideration should be given to expanding the scope of the SAR to include these settings. The lack of a standard for generator out-of-step protection resulted in adverse effects on the Michigan-Ontario ties during the 2003 blackout.
Response: The SDT has modified the Standard to address those relays that have frequency or voltage inputs that would directly trip the unit, while staying within the scope of the approved SAR.		
Ameren	Yes	Please clearly state that such relays do not have to be added or elements enabled, GO makes the decision what protection to include. R1 and M1, and R2 and M2 should allow for proof that the frequency and/or voltage relays are omitted or set to alarm only, not trip.Please clearly define 'point of interconnection' used in 4.2.2; typically this is where the generating source connects to the switchyard or networked transmission system but these relays are typically at the generator terminals on the low side of the generator step-up transformer.
Response: The SDT has clarified that generators are not required to install or set the protective relays.		
MRO NERC Standards Review Subcommittee	Yes	
Luminant Power	Yes	
Converteam Naval Systems Inc.	Yes	
Consumers Energy Company	Yes	
E.ON U.S.	Yes	
Veolia Environmental Services	Yes	

Organization	Yes or No	Question 2 Comment
Old Dominion Electric Cooperative	Yes	
Southern California Edison Company	Yes	
Brazos Electric Power Cooperative	Yes	
Lakeland Electric	Yes	
Manitoba Hydro	Yes	
NIPSCo	Yes	
Northeast Utilities	Yes	
Xcel Energy	Yes	
American Transmission Company	Yes	
PJM Interconnection	Yes	
Dominion	Yes	
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		

3. PRC-024-1 specifies the limits for generator protective system settings as defined in PRC-024-1 - Attachment 1 and PRC-024-1 - Attachment 2. Are there generating units in your fleet that are not capable of meeting the thresholds in these attachments due to turbine/generator equipment design limitations?

If yes, please estimate the percentage and total MW capacity of your units that cannot meet the requirement.

Estimated total MW capacity of units that cannot meet the requirement:

Summary Consideration:

There was no consensus on this issue.

The issues associated with the majority of the comments received:

1. A wide range (from 0% to 100%) of existing generators may not be able to meet the Standard's requirements based on existing turbine/generator equipment design limitations, auxiliary bus low voltage ride-thru incapability, or manual turbine and automatic reactor protection settings (15 comments)
2. It is not certain, without more study, if equipment limitations will require relay settings in the "no trip" zone (8 comments)
3. It is unclear what limits apply to variable generation (3 comments)
4. The "no trip" curves need clarification (2 comments)

The GV SDT considerations for issues associated with the majority of the comments received are:

1. Requirement R4 has been written to address the inability of existing units to ride-through the voltage and frequency excursions of Attachment 1 and 2. The purpose of this Requirement is to provide the Transmission Planner the ability to more accurately model generating plant performance during system voltage and frequency excursions.
2. The Generator Owner has an opportunity to obtain an exception for those existing units that cannot meet Requirements R1 or R2 in accordance with Requirement R3. R3 has been revised to provide greater clarity on the required documentation of equipment limitation.
3. As written, the BES registry criterea delineates which generating units are in the scope of the standard. The SDT is interested in voltage and frequency rate-of-change concerns and welcomes more technical information on this issue in comments to the next posting.

4. R1, R2, and R3, as well as Attachments 1 and 2, have been revised to provide greater clarity. The table in Attachment 1 showing frequency-time relationship is intended to provide further clarification to the Off Nominal Frequency Capability Curve.

Some other comment issues are:

1. The Jul 2008 UFLS suggested setting state to arrest frequency no lower than 58Hz. Why is Attachment 1 below this value? (2 comments) (Attachment 1 has 57.8 Hz as the no trip threshold.)
2. The basis for the UF curve should be provided (1 comment). (Off nominal OF events have occurred which have exceeded the curve in Attachment 1 with no detrimental effects reported.)
3. Decades of operating experience should be acceptible proof of ride-thru capability (1 comment)
4. Rate of changes in voltage and frequency should be specified on the ride-thru capability requirements (1 comment)

The GV SDT considerations for the other comment issues are:

1. The SDT developed the off nominal frequency curve in coordination with the NERC UFLS Standard Drafting Team. The 57.8 Hz setting for generator underfrequency and 58 Hz for UFLS is to ensure that the UFLS will have a chance to arrest the system frequency decline before reaching the minimum permissible frequency for generators. The intent of the curves is to ensure that the generators do not trip when the frequency is within the area bounded by the high and low frequency curves. When the frequency excursion reaches outside the high or low curve, the generator is allowed to trip.
2. The SDT developed the off nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves.
3. The Generator Owner has an opportunity to obtain exception for those existing units that cannot meet Requirements R1 or R2 in accordance with Requirement R3. R3 has been revised to provide greater clarity on the required documentation of equipment limitation.
4. The SDT is interested in voltage and frequency rate-of-change concerns and welcomes more technical information on this issue in comments to the next posting.

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
Northeast Utilities		Information not available at this time.	Information not available at this time.

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
Response: Thank you for your comments.			
Independent Electricity System Operator		We are unable to comment on how many generating units in the fleet that are not capable of meeting the threshold in the Attachments since we are not a Generator Owner. However, we are unclear on the basis of the 57.8 Hz setting stipulated in R1.3 as it is not consistent with the proposed UFLS characteristics (posted in July of 2008) in which it indicates that frequency should be arrested at no less than 58.0 Hz. Further, the basis for the very restrictive over-frequency curve proposed in attachment #1 is not obvious. The over-frequency standard proposed in PRC-024 was exceeded during the blackout of 2003 for Ontario generation that was connected radically into New York. No adverse effects attributed to this over frequency event have been reported to the IESO.	
Response: The SDT developed the off nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves. In addition, the SDT developed the off nominal frequency curve in coordination with the NERC UFLS Standard Drafting Team. The 57.8 Hz setting for generator underfrequency and 58 Hz for UFLS is to ensure that the UFLS will have a chance to arrest the system frequency decline before reaching the minimum permissible frequency for generators. The intent of the curves is to ensure that the generators do not trip when the frequency is within the area bounded by the high and low frequency curves. When the frequency excursion reaches outside the high or low curve, the generator is allowed to trip.			
MRO NERC Standards Review Subcommittee	No	The MRO does not own any generation.	
Response: Thank you for your comments.			
FirstEnergy	No	A possible concern would be the effect on auxiliary system equipment and reliability at voltages below 90%.	
Response: Thank you for your comments.			

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
IRC Standards Review Committee	No	We are unable to comment on how many generating units in the fleet that are not capable of meeting the threshold in the Attachments since we are not a Generator Owner. However, we are unclear on the basis of the 57.8 Hz setting stipulated in R1.3 as it is not consistent with the proposed UFLS characteristics (posted in July of 2008) in which it indicates that frequency should be arrested at no less than 58.0 Hz.We also think the question is a bit misleading and may not result in providing the SDT any grounded suggestions or concurrence on the appropriate frequency levels that the SDT may already have in mind. The question as written suggests that the SDT is trying to canvass the industry through this commenting process. This is a way to obtain feedback, but it does not provide the rationale of the proposed levels. We suggest that the SDT research the limitations of the machines that are connected to the BPS (perhaps by a survey or a NERC data request) to better support the proposed frequency limit, then ask for concurrence or alternative suggestions.	
Response: Thank you for your comments. The SDT developed the off nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves. In addition, the SDT developed the off nominal frequency curve in coordination with the NERC UFLS Standard Drafting team. The 57.8 Hz setting for generator underfrequency and 58 Hz for UFLS is to ensure that the UFLS will have a chance to arrest the system frequency decline before reaching the minimum permissible frequency for generators.			
Consumers Energy Company	No	Consumers Energy doesn't have generating units that cannot meet the thresholds. However, we would like to offer the following comments:The Standards Drafting Team should be congratulated for the excellent curves in Attachment 1. A review of our fleet which contains units of several vintages, manufactured by General Electric, Westinghouse, Siemens, and Allis-Chalmers, shows that turbine-generators from all of these manufacturers comply with these curves. To assist Generator Owners and Compliance Auditors, the SDT should furnish mathematical formulae for the "slanted lines" in the curves. Should a	

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
		Generator Owner elect to set an underfrequency relay at 120 seconds and 59.1 Hz, there might be uncertainty or disagreement about compliance, depending upon how the interpolation of the graph is viewed. Interpolation from a semi-log plot is often not easy. This uncertainty can and should be eliminated by including the two formulae in Attachment 1.	
Response: Thank you for your comments. The table in Attachment 1 showing frequency-time relationship is intended to provide further clarification to the Off Nominal Frequency Capability Curve.			
Old Dominion Electric Cooperative	No	I am not 100% sure this is the case, but I am fairly confident all our units do meet these thresholds.	
Response: Thank you for your comments.			
Basin Electric Power Cooperative	No	It is unclear what limits apply to wind generation, but we believe our conventional generation can easily accommodate the settings defined by Attachment 1, even though we feel that such off-nominal protection settings should not be established in this standard and that such coordination should occur at the regional level were UFLS program details are worked out. I would like to offer some observations based on real life experience. Our experience is that some folks have a good technical understanding of generation capabilities and others do not. In many instances, folks do not know what actual capabilities are, and if the proposed settings conflict with existing settings then they will initially report that they cannot accommodate the recommendations (the status quo carries a lot of weight even when no one can find the original justification for existing settings). Generally, all the parties have to get together and work through things to create a higher level of awareness of the issues so we can eliminate misconceptions. The new non-utility generation owners do not have the same load serving obligations as traditional utilities and this gives them different incentives for	

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
		how they want to set generation protection. In many instances, they want to trip too early, to the detriment of the grid.	
Response: Thank you for your comments. Regional Entities may set requirements more stringent than the NERC Standard to address regional requirements.			
Entergy Fossil Operations	No		
Luminant Power	No		
E.ON U.S.	No		
AWEA	No		
Gainesville Regional Utilities	No		
American Wind Energy Association	No		
Veolia Environmental Services	No		
Lakeland Electric	No		
Manitoba Hydro	No		
American Electric Power	No		
US Bureau of Reclamation	No		
American Transmission	No	ATC does not own any generation	

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
Company			
Response: Thank you for your comments.			
Progress Energy, Inc.	Yes	100% of Progress Energy nuclear units will not stay connected per the proposed Attachment 1 and 2 due to auxliary equipment protection.70-80% of the combustion turbine units would trip during the frequency excursions proposed by NERC.To make sure that generation "ride through" is coordinated with conditions that could damage all types of generation facilities, Progress Energy recommends that the SDT consult with turbine manfacturers to develop the frequency profile. Frequency limitations are typically driven by turbine manfacture design. We also need to the mindful of the total cummulative off-frquency excursions limits laid down by the turbine manufacturers.For example, most large steam turbine vendors prohibit turbine operation below 58 hz in order to prevent the probable occurrence of turbine blade resonance (turbine blade failure). Our nuclear plant operators will immediately manually trip the turbines at 58 hz to prevent equipment damage. For combustion turbines under frequency limitations exist below 59 Hz while the maximum operating duration at 59.5 Hz is limited to 60 seconds. Of our five nuclear plants, all five would not be capable of riding through either the proposed frequency or voltage transitents due to manual turbine and automatic reactor protection settings. These settings are not generator protective relays but they will result in a complete loss of generation. Two Progress Energy nuclear plants will trip on reactor coolant pump undervoltage below 80% pu at 0.75 seconds and one will trip on underfrequency below 58.2 hz at 0.2 seconds.	Approximately 3,500 MW of nuclear generation for SERC and 900 MW for FRCC. Approximately 3500 MW CT generation in SERC and 5000 MW CT generation in FRCC.
Response: Thank you for your comments. The SDT developed the off nominal frequency capabilities based on turbine manufacturers' capabilities in conjunction with the ability to set relays between the frequency curve and the manufacturers' curves. In addition, the SDT developed the off nominal frequency curve in coordination with the NERC UFLS Standard Drafting Team.			

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
NIPSCo	Yes	4.7 % estimated percentage of units that can't meet thresholds due to design limitations:	155 Estimated total MW capacity of units that cannot meet the requirement.
Response: Thank you for your comments.			
Hydro-Québec TransEnergie (HQT)	Yes	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.
Response: Thank you for your comments.			
Northeast Power Coordinating Council	Yes	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.
Response: Thank you for your comments.			
Kansas City Power & Light	Yes	There are a number of generating units that currently have relay settings outside the proposed underfrequency and overfrequency relay settings. It is not known at this time if it is possible to adjust the settings within the proposed relay settings.50%	1900 MW
Response: Thank you for your comments.			
Duke Energy	Yes	15% of system capacity	Approximately 4000 MW
Response: Thank you for your comments.			
New York Independent System Operator	Yes	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.	A relatively small percentage of units do not meet this requirement but it is not known which of these cases are due to actual machine design limitations.

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
Response: Thank you for your comments.			
Constellation Power Generation & Constellation Nuclear	Yes	A number of our units do not meet this requirement but it is not known which of these cases are, due to actual machine design limitations.	
Response: Thank you for your comments.			
Ameren	Yes	We have not yet performed a detailed review wrt proposed limits, but expect there will be some that are not capable of meeting these stated thresholds. It can be hard to get capability data and warranties have expired, for older units or those purchased from other owners. The PRC-024-1 curves should not become a de facto requirement. If decades of operating experience have proven satisfactory from both a BES and generator equipment life persperctive, this should be accepted as evidence as well. Generic guidance, such as past ANSI/IEEE standards, recommended practices, and guides should be allowed for older units exception evidence as well. Clearly state that field testing is not required.	
Response: Thank you for your comments. The Generator Owner has an opportunity to obtain an exception for those existing units that cannot meet Requirements R1 or R2 in accordance with Requirement R3. R3 has been revised to provide greater clarity on the required documentation of equipment limitation.			
Southern California Edison Company	Yes	Uncertain, as curves and tables in attachments need additional clarification.	Uncertain, as curves and tables in attachments need additional clarification.
Response: Thank you for your comments. R1, R2, and R3, as well as Attachments 1 and 2, have been revised to provide greater clarity.			
Southern Company	Yes	Some are, some are not. Some we can prove, some we don't know and can't find out. With no experts to evaluate turbine under/over frequency in our company and turbine manufacturers	40,000MW voltage, Unknown frequency

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
		either out of business or unwilling to provide turbine limits, is there any possible exception allowed for settings inside the no trip zone? Also, for existing turbines, we believe that the turbine blade conditions would have to be evaluated to make a judgement on how to shift the withstand. How can we be sure that we are not stressing our turbine if we set our devices outside of the curve in the standard? Can question 3 be addressed quantitatively? Instead of "100% on voltage", it should be "0%".Auxiliary systems are not included in the standards scope as drafted.100% on voltage (can't prove - auxilliary system) Unknown on frequency	
Response: Thank you for your comments. The Generator Owner has an opportunity to obtain exception for those existing units that cannot meet Requirements R1 or R2 in accordance with Requirement R3.			
First Solar	Yes	The response, and therefore compliance with this proposed Standard, are not clear. The standard does not seem to contemplate static power generators that would be part of renewable energy systems like solar PV. As part of the requirement there should be specificity on a number of points. For example as written it does not clearly define what the generator does during the out of frequency/voltage conditions. Presumably the inverters would not be required to drive current into the fault and thereby increase fault duties. Furthermore, once the fault is cleared, it does not define the speed/rate at which power is ramped up from the generator. This rate could be hard to achieve with a static converter. Finally, the standard does not define the rate of change of frequency or voltage. Typically devices are more sensitive to high rate changes. All of these items need more detail and specificity to determine how new forms of generation can meet these requirements.	
Response: The SDT thanks you for your comments. The standard does apply to variable energy resource facilities such as solar PV. The standard does not set requirements for generator output during a fault. Conventional synchronous generators will supply fault current so that protective relaying can			

Organization	Yes or No	Question 3 Estimated percentage of units that can't meet thresholds due to design limitations:	Question 3 Estimated total MW capacity of units that cannot meet the requirement:
detect the fault expeditiously. A performance requirement (R6) has been added for new generation (designed, built, and connected to the grid) after the Standard becomes effective, but does not specify a post-fault output for a facility. The SDT has added a limit to the rate of change of frequency that the Generator Owner is expected to ride through.			

4. The curve in PRC-024-1 — Attachment 2 was based upon analysis performed of simulated system disturbances. System voltage traces representative of several hundred disturbances were co-plotted on a voltage versus time graph. The voltage duration curve in this attachment is derived from these voltage traces. A margin was then applied to the voltage duration curve to account for unanticipated system conditions. The 9 cycle fault clearing time required by the FERC 661-A Order is incorporated into this curve. Given this background on the development of PRC-024-1 — Attachment 2, do you agree with the parameters of the curve? If not, please explain in the comment area.

Summary Consideration:

- A majority of respondents indicated support that simulations should be verified.
- Some commenters questioned the general applicability:
  - Wind generator performance requirements should not be imposed on synchronous generator relay settings
  - Curves should be based on generator capabilities, not on expected system performance
  - Generators should not trip on under voltage but should only alarm
  - Concern that the curves could be extended to other plant equipment
- Still other commenters questioned specific values:
  - Delayed clearing may require 30 cycles at zero voltage, 9 cycles is inadequate
  - The curve should go to at least 10 seconds at 0.9pu, not 4. Also 2 seconds at 0.45pu, and 3 seconds at 0.75pu
  - Phase to ground faults will result in higher voltages on the un-faulted phases
  - It is not clear if the curves are for phase to neutral voltages, phase to phase voltages, or positive sequence voltages
- Another minority comment was that relays are at the machine terminals not at the POI so the curves should be applied at the generator terminals

The GV SDT has determined that the curves in Attachment 2 are reasonable. Only minor modifications were contemplated, such as the addition of new text in the notes section.

Organization	Yes or No	Question 4 Comment
NERC System Protection and	No	FERC 661-A is a wind generator facility ride-through performance criterion, not a synchronous generator relay setting requirement. They cannot be compared as being equivalent. A synchronous generator undervoltage capability will be quite

Organization	Yes or No	Question 4 Comment
Control Subcommittee (SPCS)		different from an entire wind facility undervoltage ride-through capability. The 9 cycle zero voltage interval is inadequate. The 9 cycle setting would cover for most normally cleared faults but generators must also remain on line through faults with delayed clearing due to breaker failure as required in the NERC TPL Standards. The time interval for such clearing is more typically 12 to 15 cycles. This time delay can increase to 0.5 seconds if high speed protection is out of service, for example a single relay communication channel, at the time of a fault and the fault is then cleared in zone 2 time. SPCS believes that R.R.1 is worded in a confusing way. It implies that you had to trip in 9 cycles or less - rather than not trip for a minimum of 9 cycles- albeit we want to wait longer than that. SPCS respectfully questions whether it is conceptually possible to properly state these criteria as a single curve. It is more appropriate to have separate requirements for wind generation and other generators. Additionally, they should differ related to points of interconnections (a contractual arrangement), and refer to the high-side of the GSU for all other generation. This would lend consistency and avoid unnecessary confusion. There are a number of important issues that arise with current approach, including: In general, generator protection should not trip generators on UV, but should alarm, as stated in IEEE C37.102. Please also see latest C50.12 and C50.13. UV is generally a thermal consideration and an alarm is more appropriate to call operator attention to a malfunction. The existence of a curve such as this in a NERC Standard will lead to generator owners enabling UV relays to trip and setting them per the curve, which is a serious danger to system reliability. For some specific situations such as unmanned hydro units, tripping on time-UV may be considered. The idea of a ride-through curve originated with wind farms, and is not generally conceptually appropriate for other generators. For example, this approach is not conceptually appropriate for cylindrical rotor synchronous machines. The Voltages presented are at the point of interconnection and are not directly translatable to machine relay voltage settings. Machine Volts/Hertz curves are a significant issue and are not addressed. The UV performance of plant auxiliaries is a significant issue, and is not addressed. The standard should be very clear to discourage plant owners from setting under- and over- voltage relays if they don't already have them, or need them for very specific situations. SPCS also is concerned because it appears the SDT has considered only the positive sequence voltage in developing the curves in Attachment 2. Overvoltage relays measure individual phase-to-ground or phase-to-phase quantities and SPCS expect that generator owners will apply these curves based on the quantities measured by the relays in developing relay settings. As such, the curves must be based on the quantities that are measured by protective relays and the quantities must be clearly stated. To highlight our concern, consider that for a line-to-ground fault at the point of interconnection on an effectively grounded system the unfaulted phases may have fundamental frequency voltages of 125% or more for the duration of the fault. Under such conditions generators with overvoltage relays set per the curve may trip at 120% voltage prior to clearing the fault from the transmission system. Under these conditions tripping is not required for generator protection and may have a detrimental impact on system reliability, yet it is permissible per the proposed curve. There is guidance in the industry and C37.102 to provide dielectric (insulation) protection for extremely high voltages, however 120 % voltage is overprotecting the generator. For Generator protection, the first line of defense is generator surge arrestors but some units may also use a high set overvoltage protection as well. This voltage is a much higher level then 120% shown in the curve (i.e. 150% of rated voltage). Voltage relays applied to the system side of the generator step-up transformer should be configured and set in such a way that they do trip the generator for higher voltages on unfaulted phases for phase-to- ground faults. As you may know generator windings are sometimes tested with high potential: New machines can be tested as high as twice (200%) rated line-to-line voltage plus 1000 Volts (Commissioning

Organization	Yes or No	Question 4 Comment
		High Pot) for one minute. Older Machines that are in service for significant time can be tested at 125% to 150% of rated line-to-line voltage (Maintenance High Pot) for one minute. There are some industry differences of opinion on this topic of course but 120% instantaneously is too low.Voltage settings are based on type of insulation material (Class F is in common present days) and its thickness. A curve would need to be developed that takes insulation thickness into account. USBR's practice is to use manufacture designed 105% continuous. Then, 59 is set a 110% of 105% (continuous use) for time coordination (TOV) and 130% of 105% of phase-to-ground voltage for instantaneous (IOV).
Response: Thank you for your detailed response to this question. Based on industry input a Requirement has been added to require generators designed and built after the Standard goes into effect to ride through voltage and frequency excursions. The Standard is technology neutral and applies to all generators. The SDT has clarified that generators are not required to install or set the relays to trip. The Standard has been modified to address loss of generation consequent to problems on auxiliary systems, problems which arise due to low voltage or low frequency, or a combination of both. The intent of the Standard is to provide a definition of the no trip boundary for generator relay operation (existing plants) or generating facility performance (new plants). If the generator can remain on line during this boundary, no relay changes or modifications are required. The boundary defines generator relay settings for normally cleared three-phase fault on the transmission system and does not address transmission relay failures that would result in delayed clearing. Delayed clearing with the POI voltage at zero presents serious out-of-step issues for generators. The SDT recognizes the IEEE C37.102 requirement that generator protection should not trip on undervoltage, but should alarm. The proposed PRC-24-1 Standard does not require tripping, but rather defines a boundary when generators that are equipped with high and low voltage relays should not trip generators. Attachment 2 was developed based on a positive sequence model. As such, only balanced voltages should be considered when addressing relay settings.		
Northeast Power Coordinating Council	No	Both bullets should be checked above (form will not accept).The curves should be revised based on generator capabilities and design requirements rather than the expected system response for simulated disturbances. Although the simulation results and tools used to develop the curves have not been provided it appears that the proposed curves are based on transient stability simulations. The transient stability program includes only the positive sequence component of system voltage and neglects phenomena that do not result in significant shaft torques. By contrast, protective relays measure individual phase or phase-to-phase quantities or in some cases specific sequence quantities. As proposed the curves may be interpreted differently in relay applications to the detriment of bulk electric system reliability and customer service. Since the curves will be used to set protective relays they should be based on the quantities that are measured by protective relays and the quantities should be clearly stated. We have provided examples of how the curves could be misinterpreted or misapplied if the curves are not constructed in terms of measured relay quantities and settings specific to the point of measurement: Based on the proposed curve an overvoltage relay can be set at 120% with no intentional time delay. If this relay measures phase-to-ground voltage at the Point of Interconnection (POI) then for a close-in line-to-ground fault the unfaulted phases may have fundamental frequency voltages of 125% or more for the duration of the fault (effectively grounded system), resulting in undesired generator tripping prior to clearing the fault from the transmission system. Protection against overvoltages that are shorter in duration than the operating time of circuit breaker is provided by surge arresters on the high-voltage terminals of the transformer and by surge protectors on the terminals of the generator. The curve implies that for a voltage of more than 120% that the generator can trip instantaneously (without intentional time

Organization	Yes or No	Question 4 Comment
		delay). We suggest that instantaneous trips at any voltage level are neither required nor effective for generator protection. The overvoltage curve should approach zero time asymptotically or alternatively 250% for 20ms, 135% for 300ms, 120% for 20 seconds, 110% continuously. Alternatively the curve should be based on generator capability rather than FERC 661A which is applicable to wind generators with very limited capability. In the undervoltage region the 9 cycle zero voltage has been carried over from FERC 661-A which is to facilitate wind integration. The 9 cycle zero voltage ride-thru, although less than prior utility designs, may be sufficient. We again recommend that SDT translate the intended positive sequence values to phase quantities measured by the relay to avoid misapplication. A single-line-to-ground fault will result in a positive sequence voltage of approximately 0.5-0.7pu but the voltages on individual phases or between phases may be quite different. The curve appears adequate from a positive sequence perspective but may not be interpreted as intended. In the undervoltage region we recommend that 85% be applied from 3 seconds to 15 seconds to ensure that generators stay connected longer than load and to permit time for automatic reactive element switching. There is no reason to trip this fast in this regionBased on the proposed curves we are concerned that the SDT has considered only the system response to typical design contingencies and only the positive sequence voltage from transient stability simulations. Although we have suggested alternate values the final values will depend on how the curve is defined, the form of measurement and relay application. As proposed we believe the curves leave too much for misinterpretation and misapplication.We respectfully question whether it is conceptually possible to properly state this criteria as a single curve. There are a number of important issues that arise with this approach, including the following:> In general generators should not trip on UV, but should alarm. Please see latest C50.12 and C50.13. UV is generally a thermal consideration and an alarm is appropriate to call operator attention to a malfunction.> The existence of a curve such as this in a NERC Standard will lead to generators enabling UV and setting per some part of the curve, which could be a serious hazard to system reliability.> For some specific situations such as unmanned hydro units, tripping on time-UV is appropriate.> The idea of a ride-through curve originated with wind farms, and is not generally conceptually appropriate. For example, this approach is not conceptually appropriate for cylindrical rotor synchronous machines.> The minimum voltage for 9 cycles does not allow enough time to allow for breaker failure protection operation. 13 -15 cycles would be appropriate.> The voltages presented are at the point of interconnection and are not directly translatable to machine relay Voltage settings.> Machine Volts per Hertz curves are a significant issue and are not addressed.> The UV performance of plant auxiliaries is a significant issue, and is not addressed.> We suggest that ANSI/IEEE Standards C37.102, C50.12, and C50.13 should be used and listed as references to this Standard.
Response: Thank you for your detailed response to the question. Development of the voltage ride-through curve started by reviewing the needs of the transmission system and then comparing them to known technical papers and standards. The positive sequence models of the power system that were utilized in the performance analysis did include detailed machine representation accepted by IEEE which calculated shaft torques and other machine parameters. The SDT recognizes the IEEE C37.102 requirement that generator protection should not trip on undervoltage, but should alarm. The proposed PRC-24-1 Standard does not require tripping, but rather defines a boundary when generators that are equipped with high and low voltage relays should not trip generators. The SDT has clarified that generators are not required to install or set the relays to trip. Attachment 2 was developed based on a positive sequence model. As such, only balanced voltages should be considered when addressing relay settings. The boundary defines generator relay settings for normally cleared three-phase fault on the transmission system and does not address transmission relay failure that would		

Organization	Yes or No	Question 4 Comment
result in delayed clearing.		
Kansas City Power & Light	No	R2 specifies that the generator may not operate on V/Hz evaluated at nominal frequency. Some generators have specific requirements to trip on V/Hz at 110%. This is in conflict with the upper boundry point of Attachment 2 for times greater than 1 second. We recommend to change this requirement so that it does not apply to V/Hz settings. It is not practical to set generator protective relays fed from generator potential transformers to meet the voltage requirement at the point of interconnect to the BES. We recommend that the voltage chart requirement be applicable to the voltage measured by the generator protective relays, not the voltage at the point of interconnect to the BES.
Response: Thank you for providing a response to this question. Attachment 2 defines voltage durations at the generating facility substation (POI). For a POI voltage of 1.1pu the voltage at the generator terminals will be lower due to voltage regulation and the impedance of the step-up transformer. The Standard is concerned with generator response to excursions on the transmission system, so the voltage profile in Attachment 2 must be defined at the transmission voltage (POI) level. The equivalent profile at the generator terminals depends on the characteristics of the equipment at each facility, so the Generator Owner would have to determine how it affects his specific equipment.		
Constellation Power Generation & Constellation Nuclear	No	The curves should be revised based on generator capabilities and design requirements rather than the expected system response for simulated disturbances. Although the simulation results and tools used to develop the curves have not been provided it appears that the proposed curves are based on transient stability simulations. The transient stability program includes only the positive sequence component of system voltage and neglects phenomena that do not result in significant shaft torques. By contrast, protective relays measure individual phase or phase-to-phase quantities or in some cases specific sequence quantities. As proposed the curves may be interpreted differently in relay applications to the detriment of bulk electric system reliability and customer service. Since the curves will be used to set protective relays they should be based on the quantities that are measured by protective relays and the quantities should be clearly stated. We have provided examples of how the curves could be misinterpreted or misapplied if the curves are not constructed in terms of measured relay quantities and settings specific to the point of measurement: Based on the proposed curve an overvoltage relay can be set at 120% with no intentional time delay. If this relay measures phase-to-ground voltage at the Point of Interconnection (POI) then for a close-in line-to-ground fault the unfaulted phases may have fundamental frequency voltages of 125% or more for the duration of the fault (effectively grounded system), resulting in undesired generator tripping prior to clearing the fault from the transmission system. Protection against overvoltages that are shorter in duration than the operating time of circuit breaker is provided by surge arresters on the high-voltage terminals of the transformer and by surge protectors on the terminals of the generator. The curve implies that for a voltage of more than 120% that the generator can trip instantaneously (without intentional time delay). We suggest that instantaneous trips at any voltage level are neither required nor effective for generator protection. The overvoltage curve should approach zero time asymptotically or alternatively 250% for 20ms, 135% for 300ms, 120% for 20 seconds, 110% continuously. Alternatively the curve should be based on generator capability rather than FERC 661A which is applicable to wind generators with very limited capability. In the undervoltage region the 9 cycle zero voltage has been carried over from FERC 661-A which is to facilitate wind integration. The 9 cycle zero voltage ride-thru, although less than prior utility designs, may be sufficient. We again

Organization	Yes or No	Question 4 Comment
		recommend that SDT translate the intended positive sequence values to phase quantities measured by the relay to avoid misapplication. A single-line-to-ground fault will result in a positive sequence voltage of approximately 0.5-0.7pu but the voltages on individual phases or between phases may be quite different. The curve appears adequate from a positive sequence perspective but may not be interpreted as intended. In the undervoltage region we recommend that 85% be applied from 3 seconds to 15 seconds to ensure that generators stay connected longer than load and to permit time for automatic reactive element switching. There is no reason to trip this fast in this regionBased on the proposed curves we are concerned that the SDT has considered only the system response to typical design contingencies and only the positive sequence voltage from transient stability simulations. Although we have suggested alternate values the final values will depend on how the curve is defined, the form of measurement and relay application. As proposed we believe the curves leave too much for misinterpretation and misapplication.We respectfully question whether it is conceptually possible to properly state this criteria as a single curve. There are a number of important issues that arise with this approach, including the following:* In general generators should not trip on UV, but should alarm. Please see latest C50.12 and C50.13. UV is generally a thermal consideration and an alarm is appropriate to call operator attention to a malfunction.* The existence of a curve such as this in a NERC Standard will lead to generators enabling UV and setting per some part of the curve, which could be a serious hazard to system reliability.* For some specific situations such as unmanned hydro units, tripping on time-UV is appropriate.* The idea of a ride-through curve originated with wind farms, and is not generally conceptually appropriate. For example, this approach is not conceptually appropriate for cylindrical rotor synchronous machines.* The minimum voltage for 9 cycles does not allow enough time to allow for breaker failure protection operation. 13 -15 cycles would be appropriate.* The voltages presented are at the point of interconnection and are not directly translatable to machine relay Voltage settings.* Machine Volts per Hertz curves are a significant issue and are not addressed.* The UV performance of plant auxiliaries is a significant issue, and is not addressed.* We suggest that ANSI/IEEE Standards C37.102, C50.12, and C50.13 should be used and listed as references to this Standard.
Response: Thank you for your detailed response to the question. Development of the voltage ride-through curve started by reviewing the needs of the transmission system and then comparing them to known technical papers and standards. The positive sequence models of the power system that were utilized in the performance analysis did include detailed machine representation accepted by IEEE which calculated shaft torques and other machine parameters. The SDT recognizes the IEEE C37.102 requirement that generator protection should not trip on undervoltage, but should alarm. The proposed PRC-24-1 Standard does not require tripping, but rather defines a boundary when generators that are equipped with high and low voltage relays should not trip generators. The SDT has clarified that generators are not required to install or set the relays to trip. Attachment 2 was developed based on a positive sequence model. As such, only balanced voltages should be considered when addressing relay settings. The boundary defines generator relay settings for normally cleared three-phase fault on the transmission system and does not address transmission relay failure that would result in delayed clearing. The Standard is concerned with generator response to excursions on the transmission system, so the voltage profile in Attachment 2 is defined at the transmission voltage (or POI) level. The equivalent profile at the generator terminals depends on the characteristics of the equipment at each facility, so the Generator Owner would have to determine how it affects his equipment and evaluate accordingly. Machine Volts per Hertz capabilities were reviewed by the SDT. The upper boundary of the voltage duration curve in Attachment 2 is designed to accommodate those limits.		

Organization	Yes or No	Question 4 Comment
Southern Company	No	Controversy of Voltage cumulative nature, not showing the 95%-100% generator terminal voltage, difference between the curve being on the tranmission side of the GSU and the generator relay being on the generator side of the GSU. The generator terminal voltage shown at 95%-105% listed in R2.1. We are concerned that future auditors will interpret this limit as being the coordination limit. The voltage curve of Attachment 2 is stated for system voltage; however as mentioned in the conference call, the volts per hertz protection was specifically referenced and used to support setting criteria. We have a problem with this approach since the V/HZ relay is looking at the generator voltage and the curve is shown for the system voltage. How do we demonstrate coordination since the two are on different basis which cannot accurately be resolved via steady state techniques?The wording used in section R2.2.1 is confusing. The words should be changed to "For three-phase transmission system zone 1 faults with Normal Clearing, generator relaying shall be set longer than the expected fault clearing time, but does not have to be set for greater than nine cycles."
Response: Thank you for your detailed response to the question. The Attachment 2 voltage ride-through diagram is referenced to the point of interconnection to the BES; therefore, addressing the generator terminal voltage on this diagram would add confusion. Attachment 2 was developed based on a positive sequence model. As such, only balanced voltages should be considered when addressing relay settings. The reference document addressed interactions between the synchronous generator Volts/Hertz curves and the Attachment 2 curve. The Attachment 2 curve is intended to fit within the Volts/Hertz curve requirements. The voltage profile at the generator terminals depends on the characteristics of the equipment at each facility and can be determined either by load flow for steady state conditions or dynamically. The Generator Owner would have to determine how it affects his equipment and evaluate accordingly. The SDT has clarified the R2.1 (now R2.1.1. in the revised standard) Standard language.		
Converteam Naval Systems Inc.	No	please see my further comments on this.
Response: Thank you for your comment.		
Gainesville Regional Utilities	No	I am concerned that Generator Operators even understand what is written above
Response: Thank you for providing a response to this question. The Standard is intended to be written such that generator operators will understand the requirements. We welcome any recommendations would help to clarify the document.		
Southern California Edison Company	No	Additional information is need for clarity on the curve and table in the attachment.
Response: Thank you or providing a response to the question. We welcome any recommendations that would help to clarify the document.		

Organization	Yes or No	Question 4 Comment
Basin Electric Power Cooperative	No	This may be appropriate but I have not seen the supporting technical report so I cannot say that I agree.
Response: Thank you or providing a response to the question. Supporting documents are available on the NERC website.		
Progress Energy, Inc.	No	PE is concerend that the proposed profile for voltage (Attachment 2) could later become applicable to all plant equipment. The generating plants are not designed to ride thru/stay connected for this proposed profile. 100% of our nuclear units will trip if subjected to the proposed voltage transient test. The trips would be due to reactor coolant pump undervoltage, reactor coolant pump power monitoring protection, and reactor protection system power supply undervoltage exceeding their respective time delays during the voltage excursion. Each nuclear plant has slightly different trips based on the reactor design and vintage.
Response: Thank you or providing a response to the question. For existing generators, the proposed PRC-24-1 Standard defines requirements for the setting of generator protective relays. The Standard does not require a redesign of the auxiliary systems for existing generators. For generating facilities that are designed and built after this Standard goes into effect, a new performance requirement has been added.		
Hydro-Québec TransEnergie (HQT)	No	The curves should be revised based on generator capabilities and design requirements rather than the expected system response for simulated disturbances. Although the simulation results and tools used to develop the curves have not been provided it appears that the proposed curves are based on transient stability simulations. The transient stability program includes only the positive sequence component of system voltage and neglects phenomena that do not result in significant shaft torques. By contrast, protective relays measure individual phase or phase-to-phase quantities or in some cases specific sequence quantities. As proposed the curves may be interpreted differently in relay applications to the detriment of bulk electric system reliability and customer service. Since the curves will be used to set protective relays they should be based on the quantities that are measured by protective relays and the quantities should be clearly stated. We have provided examples of how the curves could be misinterpreted or misapplied if the curves are not constructed in terms of measured relay quantities and settings specific to the point of measurement: Based on the proposed curve an overvoltage relay can be set at 120% with no intentional time delay. If this relay measures phase-to-ground voltage at the Point of Interconnection (POI) then for a close-in line-to-ground fault the unfaulted phases may have fundamental frequency voltages of 125% or more for the duration of the fault (effectively grounded system), resulting in undesired generator tripping prior to clearing the fault from the transmission system. Protection against overvoltages that are shorter in duration than the operating time of circuit breaker is provided by surge arresters on the high-voltage terminals of the transformer and by surge protectors on the terminals of the generator. The curve implies that for a voltage of more than 120% that the generator can trip instantaneously (without intentional time delay). We suggest that instantaneous trips at any voltage level are neither required nor effective for generator protection. The overvoltage curve should approach zero time asymptotically or alternatively 250% for 20ms, 135% for 300ms, 120% for 20 seconds, 110% continuously. Alternatively the curve should be based on generator capability rather than FERC 661A which is applicable to wind generators with very limited capability.

Organization	Yes or No	Question 4 Comment
		In the undervoltage region the 9 cycle zero voltage has been carried over from FERC 661-A which is to facilitate wind integration. The 9 cycle zero voltage ride-thru, although less than prior utility designs, may be sufficient. We again recommend that SDT translate the intended positive sequence values to phase quantities measured by the relay to avoid misapplication. A single-line-to-ground fault will result in a positive sequence voltage of approximately 0.5-0.7pu but the voltages on individual phases or between phases may be quite different. The curve appears adequate from a positive sequence perspective but may not be interpreted as intended. In the undervoltage region we recommend that 85% be applied from 3 seconds to 15 seconds to ensure that generators stay connected longer than load and to permit time for automatic reactive element switching. There is no reason to trip this fast in this regionBased on the proposed curves we are concerned that the SDT has considered only the system response to typical design contingencies and only the positive sequence voltage from transient stability simulations. Although we have suggested alternate values the final values will depend on how the curve is defined, the form of measurement and relay application. As proposed we believe the curves leave too much for misinterpretation and misapplication.We respectfully question whether it is conceptually possible to properly state this criteria as a single curve. There are a number of important issues that arise with this approach, including the following:> In general generators should not trip on UV, but should alarm. Please see latest C50.12 and C50.13. UV is generally a thermal consideration and an alarm is appropriate to call operator attention to a malfunction.> The existence of a curve such as this in a NERC Standard will lead to generators enabling UV and setting per some part of the curve, which could be a serious hazard to system reliability.> For some specific situations such as unmanned hydro units, tripping on time-UV is appropriate.> The idea of a ride-through curve originated with wind farms, and is not generally conceptually appropriate. For example, this approach is not conceptually appropriate for cylindrical rotor synchronous machines.> The minimum voltage for 9 cycles does not allow enough time to allow for breaker failure protection operation. 13 -15 cycles would be appropriate.> The voltages presented are at the point of interconnection and are not directly translatable to machine relay Voltage settings.> Machine Volts per Hertz curves are a significant issue and are not addressed.> The UV performance of plant auxiliaries is a significant issue, and is not addressed.> We suggest that ANSI/IEEE Standards C37.102, C50.12, and C50.13 should be used and listed as references to this Standard.
Response: Thank you for your detailed response to the question. Development of the voltage ride-through curve started by reviewing the needs of the transmission system and then comparing them to known technical papers and standards. The positive sequence models of the power system that were utilized in the performance analysis did include detailed machine representation accepted by IEEE which calculated shaft torques and other machine parameters. The SDT recognizes the IEEE C37.102 requirement that generator protection should not trip on undervoltage, but should alarm. The proposed PRC-24-1 Standard does not require tripping, but rather defines a boundary when generators that are equipped with high and low voltage relays should not trip generators. The SDT has clarified that generators are not required to install or set the relays to trip. Attachment 2 was developed based on a positive sequence model. As such, only balanced voltages should be considered when addressing relay settings. The boundary defines generator relay settings for normally cleared three-phase fault on the transmission system and does not address transmission relay failure that would result in delayed clearing. The Attachment 2 curve is intended to fit within the Volts/Hertz curve requirements. The voltage profile at the generator terminals depends on the characteristics of the equipment at each facility and can be determined either by load flow for steady state conditions or dynamically. The Generator Owner would have to determine how it affects his equipment and evaluate accordingly.		

Organization	Yes or No	Question 4 Comment
New York Independent System Operator	No	We respectfully question whether it is conceptually possible to properly state this criteria as a single curve. There are a number of important issues that arise with this approach, including the following:> In general generators should not trip on UV, but should alarm. Please see latest C50.12 and C50.13. UV is generally a thermal consideration and an alarm is appropriate to call operator attention to a situation or malfunction which results in low voltage.> The existence of a curve such as this in a NERC Standard will lead to some generator owners enabling UV and setting per some part of the curve, which could be a serious hazard to system reliability.> For some specific situations such as unmanned hydro units, tripping on time-UV is appropriate.> The idea of a ride-through curve originated with wind farms, and is not generally conceptually appropriate. For example, this approach is not conceptually appropriate for cylindrical rotor synchronous machines.> The minimum Voltage for 9 cycles does not allow enough time for breaker failure protection operation. 13 -15 cycles would be appropriate.> The Voltages presented are at the point of interconnection and are not directly translatable to machine relay Voltage settings.> Machine Volts per Hertz curves are a significant issue and are not addressed.> The UV performance of plant auxiliaries is a significant issue, and is not addressed.> We suggest that ANSI/IEEE Standards C37.102, C50 12, and C50.13 should be used and listed as references to this Standard.
Response: Thank you for your detailed response to this question. The SDT has clarified that generators are not required to install or set the relays to trip. The intent of the Standard is to provide a definition of the no trip boundary for generator relays. If the generator can remain on line during this boundary, no relay changes or modifications are required. The boundary defines generator relay settings for normally cleared three-phase fault on the transmission system and does not address transmission relay failures that would result in delayed clearing. The SDT recognizes the IEEE C37.102 requirement that generator protection should not trip on undervoltage, but should alarm. The proposed PRC-24-1 Standard does not require tripping, but rather defines a boundary when generators that are equipped with high and low voltage relays should not trip generators. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions, addressing plant auxiliaries concerns. Machine Volts per Hertz capabilities were reviewed by the SDT. The upper boundary of the voltage duration curve in Attachment 2 is designed to accommodate those limits.		
CenterPoint Energy	No	a) Attachment 2 of PRC-024-2 is truncated at 4 seconds and does not define the duration of the 0.9 pu voltage level. CenterPoint Energy recommends the total duration of the 0.9 pu voltage level be established at a MINIMUM of 10 seconds. The basis for 10 seconds is for coordination with undervoltage load shedding (UVLS) systems. b) Attachment 2 has a step function profile. CenterPoint Energy has reviewed these proposed steps for voltage recovery to 0.9 pu and concurs with most proposed steps. However, CenterPoint Energy studies indicate an insufficient coordination margin at the proposed 0.30 seconds at 0.65 pu voltage point. Noting the CenterPoint Energy transmission grid is a compact and stout system, CenterPoint Energy believes it is highly unlikely many transmission systems can recover to a 0.65 voltage level in 18 cycles (0.30 seconds). To address this, CenterPoint Energy recommends reducing the number of steps. For this, as well as including a 0.9 pu voltage level ride-through for a minimum of 10 seconds, CenterPoint Energy recommends the data points (Time / Voltage) in the LVRT DURATION table be as follows: 0.15 / 0.000, 2.00 / 0.450, 3.00 / 0.750, and 10.00 / 0.900.
Response: Thank you for your detailed response to this question. Attachment 2 has been extended to 600 seconds. The profile of the voltage duration		

Organization	Yes or No	Question 4 Comment
curve is based on studies done in the Eastern and Western Interconnections. If you have studies that document longer recovery times, please share them with the SDT.		
Independent Electricity System Operator	No	Simulation results only add value when sufficient validation has been performed to provide confidence that good decision can be made on the basis of these simulations. Simulations by themselves are not enough. Were the simulations used in this exercise validated against actual performance? To cater for protection differences within jurisdictions, it would be better to label the jogs in the voltage characteristic with the corresponding physical meaning (e.g. maximum normal fault clearing, maximum delayed fault clearing) rather than assign specific times. Within Ontario, it is unclear whether the voltage curves are sufficient to accommodate present practice for delayed fault clearing. It is unclear in the curves whether the POI voltage is the positive sequence voltage or phase voltage. The meaning of per unit should also be clarified. For example, Ontario uses a 220kV voltage basis for a system operated as high as 250kV. Does 1.2PU mean 264 kV or 300kV? The over-voltage settings should be re-expressed to ensure the short duration over-voltages that follow lightning strikes and capacitor switching do not result in generator tripping.
Response: Thank you for your detailed response to this question. Validation against actual system performance is important. The simulations that were initially performed as part of this analysis had their genesis within WECC. On an ongoing basis, the Modeling & Validation Work Group validates system model performance against actual system events. The voltage ride-through curve provided in Attachment 2 of PRC-24-1 addresses specific performance that would be required over a wide range of system events and locations. The positive sequence models of the power system that were utilized in the performance analysis did include detailed machine representation accepted by IEEE which calculated shaft torques and other machine parameters. Clarification 1 currently indicates: "The per unit voltage base for this curve is the scheduled operating voltage as measured at the point of interconnection to the Bulk Electric System."		
Ameren	No	FERC 661-A applies to wind generator Voltage Ride Though (VRT) for a three phase fault. We disagree with PRC-024-1 now expanding it to all generators.R2.2.1 wording is confusing: it implies that the UV trip setting must be less than 9 cycles which conflicts with the LVRT curve and its interpretation for lessor voltage dips.
Response: Thank you for your detailed response to this question. The SDT has developed a technology neutral Standard that applies to all generators. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions. The SDT has clarified that generators are not required to install or set the relays to trip. The SDT revised R2.1.1 as follows: " For three-phase transmission system zone 1 faults with Normal Clearing, set voltage relays based on actual fault clearing times, not to exceed 9 cycles."		
First Solar	No	See response to the previous question. While this may envelope the probable range of voltages that may occur on the system, it does not sufficiently describe the response of the generating plant to these disturbances. To simply say that the protective relays should not trip lacks sufficient detail to apply to inverter based PV projects.
Response: Thank you for your response to this question. The SDT has developed a technology neutral Standard that applies to all generators. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions. The SDT has clarified		

Organization	Yes or No	Question 4 Comment
that generators are not required to install or set the relays to trip.		
US Bureau of Reclamation	No	The SDT background material above states that the 9 cycle time is required by FERC Order 661-A. FERC Order 661-A applies to wind generators. We believe there is no convincing reliability based rationale to expand the scope of the FERC Order via this standard to include synchronous machines, noting that Genrators are already required (PRC-001-1) to coordinate settings with the host Transmission Operator.
Response: Thank you for your response to this question. The SDT has developed a technology neutral Standard that applies to all generators. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions. The SDT has clarified that generators are not required to install or set the relays to trip.		
American Transmission Company	No	It would be beneficial to have the option of measuring the voltage at the generator bus or point of interconnection (POI), with the understanding that the proper voltage must be maintained at the POI.
Response: Thank you for your comment. The SDT specifically chose the point of interconnection because that is where the faults occur that this Standard is intended to address. The SDT has provided additional assumptions for the calculation of relay settings on the basis of the voltage as measured at the POI.		
Luminant Power	No	
E.ON U.S.	No	
AWEA	No	
American Wind Energy Association	No	
Veolia Environmental Services	No	
Lakeland Electric	No	
Manitoba Hydro	No	

Organization	Yes or No	Question 4 Comment
American Electric Power	No	
MRO NERC Standards Review Subcommittee	Yes	Where would be the appropriate voltage measurement point? (Generator bus or POI)
Response: Thank you for providing a response to this question. The Standard is concerned with generator response to excursions on the transmission system, so the voltage profile in Attachment 2 is defined at the transmission voltage (or POI) level. The equivalent profile at the generator terminals depends on the characteristics of the equipment at each facility, so the Generator Owner would have to determine how it affects his equipment and evaluate accordingly.		
SERC Dynamics Review Subcommittee (DRS)	Yes	However, the wording used in section R2.2.1 is confusing. The words should be changed to "For three-phase transmission system zone 1 faults with Normal Clearing, generator relaying shall be set longer than the expected fault clearing time, but not greater than nine cycles."
Response: Thank you for providing a response to this question. The SDT has clarified the language of R2.2.1 (now R2.1.1. in the revised standard) Standard language.		
Entergy Fossil Operations	Yes	I do not know enough about this to comment either way
Response: The SDT will add clarifications to the Standard based on industry inputs.		
IRC Standards Review Committee	Yes	From a system operator's perspective, we think these parameters are appropriate to prevent unnecessary tripping of the generators, which may otherwise give rise to unreliability, while minimizing their expose to prolonged period of under and overvoltages.
Response: Thank you for providing a response to this question.		
Old Dominion Electric Cooperative	Yes	In general, I agree with your curve. I need to review more completely before I am ready to vote Yes on it.
Response: Thank you or providing a response to the question. We welcome any recommendations that would help to clarify the document.		

Organization	Yes or No	Question 4 Comment
Duke Energy	Yes	The applicability of the curve is limited to the protective relays addressed by the standard. This curve is not meaningful if the plants were going to trip due to other causes. See our response to Question #9.
Response: Thanks you for your response to the questions. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
PJM Interconnection	Yes	In R2.2.1, replace -greater- with -faster- or -slower-, whichever is correct. In R2.2.3 replace -intended- with -required-. In R4, replace -written- with -documented-. In R5, add an -s- to -System- in the parentheses. In R3, R4 and R5 - Concerned with the GO responsibility to send to their RC, PC, TO and TP. Would rather see the GO responsibility be to just to respond to any RC, PC, TO and TP requests.
Response: Thank you for your comments. The SDT has modified the Standard to address the language concerns relative to R2.2.1 (now 2.1.1 in the revised standard) and R2.2.3 (now 2.1.3). The SDT prefers the choice of written as opposed to documented in R4. In R3 and R5 all the named entities must receive the information. In R4 we agree that only the requesting entity must receive the information.		
Dominion	Yes	We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that " For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected "We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system under voltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator (2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations? If the standard is intended to apply to volts per hertz relays, suggest:1. Revising footnote 1 to specifically include volts per hertz relays.2. Revise Steps 4.2.1 and 4.2.2 to specifically include volts per hertz relays.3. That the standard should incorporate specific guidance for facilities using volts per hertz logics and include a graph showing the voltage and frequency excursions in terms of volts per hertz.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions, addressing the auxiliary systems concern. With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either. The SDT agrees and has added volts per hertz relays among the listed items in footnote 1.		
Northeast Power Coordinating Council	Yes	Referencing R5 and R6 of the Standard: The Reliability Coordinator should be give veto power over exceptions to the requirements herein. Should the Generator Owner/Operator not be able to, or be unwilling to, make changes to setpoints to come into compliance with this Standard, the Reliability Coordinator should be given the authority to invoke required mitigation, such as requiring the Generator Owner/Operator to contract for compensatory load shedding up to the total

Organization	Yes or No	Question 4 Comment
		amount of MW of each generating unit that fails to comply with the required setpoints. In addition, The "Off-Nominal Frequency Capability Curve" in Attachment 1 does not coordinate with the underfrequency load shedding (UFLS) program design parameters proposed by the NERC Underfrequency Load Shedding Standard Drafting Team for Project 2007-01. The misccoordination occurs in the time range approximately between 5 and 10 seconds. This miscoordination can be eliminated by extending the horizontal line at 57.8 Hz to 5 seconds and revising the diagonal line to have endpoints at 57.8 Hz/5s and 59.5 Hz/1800s. This modification will provide coordination with the UFLS program design parameters while still maintaining coordination with turbine-generator capability.Due to the time scale on the graph in Attachment 2, the curves do not indicate the time at which the transient overvoltage and undervoltage requirements end, at which point the continuous voltage requirements would be applicable. Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to infer that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled. > A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective devised, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this question will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of voltage relays based on voltage at the point of interconnection, which is not directly translatable to voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard.We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that " For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected "We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system undervoltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator?(2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations?

Organization	Yes or No	Question 4 Comment
Response: Thank you for your comments. The SDT has captured what we believe are the main points of your comment sand has provided responses below: • **RC should have veto power over exemptions** – The SDT believes it is the responsibility of the GO to determine the capability of the existing unit. The judgment as to validity of an exemption is a compliance matter. • **RC should have authority to decide mitigation, e.g., compensatory load shedding –** The SDT believes mitigation of inability to comply with a Standard is a compliance matter. • **UFLS mis-coordination –** The UFLS SDT and this Standard Drafting Team conferred and resolved the mis-coordiantion. The resolution that was mutually agreed to was for the UFLS SDT to modify its Standard to accommodate the frequency curve in this Standard. • **PRC-024 should not interfere with UFLS –** The two teams have coordinated the frequency curves and strategies. • **State that settings shall be determined to prevent machine damage in consultation with manufacturers' recommendation –** The SDT developed the curves in accordance with manufacturer's recommendations and the Standard includes an exemption process for existing generators. • **Are settings permitted on the curve?** No, settings are not permitted on the curve/line and the Standard has been modified to reflect this more clearly. -- • **POI versus generator terminal –** The SDT specifically chose the point of interconnection because that is where the faults that this Standard is intended to address occur. • **Auxiliary systems relays and Steady state versus dynamic simulation –** Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions, addressing the auxiliary systems concern. With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either. The SDT agrees and has added volts per hertz relays among the listed items in footnote 1.		
SERC Dynamics Review Subcommittee (DRS)	Yes	1. We recommend deleting the proposed section R2.2.2. If not deleted, change: "meet a shorter voltage ride through" to "meet a less stringent voltage ride through". 2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be provided before they are made in the field. 3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request"
Response: Thank you for your comments. **1. The SDT agrees and has modified the Standard to reflect this. In the revised standard, the phrase, "less stringent" is used. (See 2.1.2)** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable duration for the time horizon of the PA.**		

Organization	Yes or No	Question 4 Comment
3. **The SDT agrees and has modified the standard to reflect this.**		
Kansas City Power & Light	Yes	Please consider including the Balancing Authority as an entity for the Generator Owner to provide settings information in requirements R3 & R4 since the BA is an entity that has a direct relationship with the operational status of generating stations. R5: Do not agree with the bulleted item where increasing the capability of a generator by 10% is a reason for exemption expiration. As an example, turbine or boiler enhancements can result in greater efficiencies and resulting in an increase of generator capability with no change to the generator or its protection capabilities whatsoever. Recommend removal of this bulleted item. R5: The generator exciter voltage regulator contains protective relay settings such as Volts/Hertz, undervoltage, overvoltage, underfrequency that will also trip the Unit. Is the exciter voltage regulator considered to be part of the generator protective relay system? If so, would a limitation of the exciter voltage regulator be allowed as an exception to the standard or, since the protective system is excluded, would R5 mandate that the exciter voltage regulator be replaced to remove the exception? This issue should be clarified in R5.
Response: The SDT does not observe a reliability need to provide these setting data to the Balancing Authority. **The SDT intends for a GO who decides to increase capability of its unit by a significant amount (now 10%) to also address the technical limitation cited in its exemption.** **The NERC Glossary definition of Protective System does not include voltage regulator. However, the SDT intends this Standard to include all protective functions and relays that directly trip the generator based on frequency and voltage excursions, regardless of where they are located.**		
MRO NERC Standards Review Subcommittee	Yes	It would be good to have the option of measuring the voltage at the Generator bus or POI. With the understanding that the voltage must be maintained of the POI.
Response: Thank you for your comment. The SDT agrees that it is the voltage at the POI that must be maintained. The Standard is concerned with generator response to excursions on the transmission system, so the voltage profile in Attachment 2 is defined at the transmission voltage (or POI) level. The equivalent profile at the generator terminals depends on the characteristics of the equipment at each facility.		
FirstEnergy	Yes	1. FE's consensus is that the PRC-024 allowable under-frequency vs. time tripping curve is too tight. By too tight, we mean that the LP turbine buckets and blades are much more tolerant of off freq operation than the proposed tables. Comparing them to the old ECAR curves and allowable tripping times shows they are more stringent. Given how seldom these events occur, (never happened yet in the Eastern Interconnect) expending more of this capacity appears justified. 2. Section A5 Implementation schedule - it may not give sufficient time to implement these requirements. We suggest an

Organization	Yes or No	Question 4 Comment
		additional year as follows: no less than 33% within 2 years of effective date no less than 66% within 3 years of effective date no less than 100% within 4 years of effective date 3. R1.2 Should say off-nominal not off-normal. 4. R2.1 Suggest changing the word "measured" to "experienced". 5. In R5, we suggest changing the first bullet to read: "The equipment causing the limitation is modified, upgraded or replaced with equipment that removes the technical limitation.", and then delete the second bullet. 6. Requirements 3, 4 and 6 specify that the Generator Owner shall provide information to RCs, PCs, TOPs, and TPs that monitor or model the associated unit; however, there is no requirement for these entities to identify themselves to the Generator Owner. How will the Generator Owner know they have identified all of the entities that need the information? 7. In R5, the Generator Owner is granted an exception from requirements R1 or R2 simply by providing documentation of a equipment limitations. There is no independent view of the appropriateness of this exception. The drafting team should consider requiring independent verification of the equipment limitation prior to the granting of an exception to the requirements of the standard. 8. Sec. D References - Is this intended to be part of the standard? If so, it would be helpful if it was linked to the white paper so that we can review it. 9. In Requirements R3 through R6, the SDT may want to consider adding the Transmission Owner as another entity who may need this information. 10. R2.2.1 may need to be re-worded as it requires that protection trip in no greater than 9 cycles. We are not aware of a disadvantage to the system if the tripping takes longer than 9 cycles.

Response:

1. **The SDT intends for GOs to set its relays as tight as possible and not merely on the curve/line.**
2. **The SDT set the timeframe by consensus among team members and the companies they represent. Stakeholder comments have not thus far objected to the implementation schedule. On this basis the SDT is leaving the schedule as proposed.**
3. **The SDT agrees and has made the change.**
4. **The SDT has modified the wording in R2.**
5. **The intent of R5 is to require eliminating the exception if the generator is upgraded by 10% or more.**
6. **The GO is expected to know what entity is its RC, PC, TO, and TP.**
7. **The drafting team considered requiring an independent evaluation of existing generator exceptions and determined that it is not practical.**

Organization	Yes or No	Question 4 Comment
8. No referenced documents are part of the Standard. **9. The SDT considered including the Transmission Owner and determined that the Transmission Operator is the appropriate organization to receive the information.** **10. The 9 cycle maximum clearing time is intentional. It is not a system consideration; it is because generators cannot withstand zero voltage at the POI for long periods of time.**		
IRC Standards Review Committee	Yes	a. R5: The wording "the Generator Owner is granted an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation once it provides documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit, within 30 days of identifying the equipment limitation." is not written in a way to hold an entity responsible for any action. We suggest to reword it such that it places a responsibility to the Generator to seek approval for an exception, as follows: "the Generator Owner shall obtain approval for an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation through the submission of documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit within 30 days of identifying the equipment limitation. Along with this proposed change, there is also a need for the entities receiving the approval request to respond to the request. Another requirement is needed to complete this process. b. The latter part of R5 should be reworded to hold an entity responsible for the needed actions associated with expiring the exception such that the requirement is measurable and enforceable. c. R6: It is unclear to us what purpose this requirement serves. If R5 is to be revised as we suggest (see above), then the "limitation" in question will be presented with technical justification in the request for approval. The receiving entities (RC, PC, TOP and TP) will have a chance to accept or reject the request with due consideration of the technical argument. This is part of the approval request process; hence we do not see the need for R6 if R5 is to be reworded. If a remand process needs to be stipulated, then inclusion in R5 a requirement for the receiving entity(ies) to respond to the request - either approving or disproving the with a rationale, would suffice.
Response: Thank you for your comment. **a. The required action is for the GO to provide documentation of the equipment limitation. The SDT believes it is the GO's responsibility to determine any limitations on existing generators' ability to meet the Standard.** **b. The GO is responsible for meeting the requirements when an exception expires.** **c. R6 (R4 in the revised standard) provides the RC, PC, TO, and TP with an opportunity to seek clarification concerning existing generator limitations in meeting the Standard.**		
Constellation Power	Yes	The 4 kV protection that includes under frequency and under voltage relays trip the generator in some of our plants. The

Organization	Yes or No	Question 4 Comment
Generation & Constellation Nuclear		SDT needs to clarify whether this standard applies to such protection.
Response: Thank you for your comment. The Standard applies to setting of voltage and frequency relays that directly protect the generator.		
Southern Company	Yes	1. We recommend deleting the proposed section R2.2.2. If not deleted, change "meet a shorter voltage ride through" to "meet a less stringent voltage ride through". 2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be provided before they are made in the field. 3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request" 4. How did the SDT translate the transient voltage excursion plot to the cumulative voltage curve? 5. The voltage ride through curve was said to be cumulative, this should be specified on the curve. 6. How can we prove that our static voltage curve coordinates with this cumulative curve 7. Implementation schedule we believe that the unit size should be considered, and that the most critical units should be worked on first. Completing 33% each year is too ambitious for those members that have > 300 units. 8. What regions are working on voltage ride through and Underfrequency (ufls and undefrequency tripping of generators) 9. Should the PRC-024 SDT wait until the regions have completed their work? 10. Generator engineers do not see a relevance for a voltage ride-through for any generator other than wind.
Response: Thank you for your comment. **1. The SDT agrees and has modified the standard to reflect this.** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable duration for the Time Horizon of the PA.** **3. The SDT agrees and has modified the Standard to reflect this.** **4. The SDT analyzed the amount of time the voltage remained outside of the required range in each of the events modeled.** **5. The SDT has clarified the language.** **6. A cumulative curve was selected to coordinate with relays that measure elapsed time.** **7. The SDT set the timeframe by consensus among team members and the companies they represent. Stakeholder comments have not thus far**		

Organization	Yes or No	Question 4 Comment
objected to the implementation schedule. On this basis the SDT is leaving the schedule as proposed. **8. At the recommendation of FERC and NERC, the SDT has coordinated the UF relay curve with the NERC UFLS SDT members input.** **9. At the recommendation of FERC and NERC, the SDT has coordinated the UF relay curve with the NERC UFLS SDT members input.** **10. The SDT has taken the direction to develop a Standard that is technology neutral.**		
Converteam Naval Systems Inc.	Yes	0. (Overall) This is a good document that has good background study and contains a lot of expertise; 1. (Voltage definition inconsistency)In the LVRT curves, it talks about the voltage at the point of interconnection. However, in R2.1 it uses voltage at the generator terminals. I think there is a little inconsistency between these two. It would be good to just use one of them, preferably the former one. The reason is that different generator plants might have different impedance between the generator terminals and the points of interconnection, so defining the voltage at the terminals poses a little unfairness. Another part of the reason is that for transmission protection purpose, it should ends at the point of interconnection. 2. (Voltage range inconsistency)The voltage range is 0.9-1.1pu in the VRT curve, but it says 0.95-1.05 in R2.1. It would be good to make it consistent. 3. (Date point missing) In the table supporting the VRT curves, the 0.95 and 1.05pu data are missing. 4. (Priority) WECC and MRO have different VRT curves. Which one will override which one at the end? Will the NERC PRC-024 take priority than the Regional Entities? 5. Was reactive power support during faults considered in the draft group? Will it be required in the future Thanks
Response: Thank you for your comment. **0. Thank you!** **1. The Standard applies to transient voltage excursions at the POI. R2.1 addresses steady state voltages at the generator terminals.** **2. The VRT curve addresses the transient voltage event. R2.1 addresses steady state conditions, outside the range of the VRT curve.** **3. The table addresses the transient voltage event and does not address steady state conditions.** **4. This proposed standard is a NERC standard. The SDT is not addressing current or future regional Standards.** **5. The Standard addresses voltage ride through. Reactive power and voltage support are important considerations in determining if a generator will meet the Standard. Methods to meet the Standard requirement are not specified in the Standard.**		
Consumers Energy	Yes	Please see comments on Question 3.

Organization	Yes or No	Question 4 Comment
Company		
Response: Thank you for your comment. Please see responses to Question 3.		
Old Dominion Electric Cooperative	Yes	Provide some insight on Technical Exceptions for generators that cannot met these requirements (the CIP TFE process might be useful in this)
Response: Thank you for your comment. The SDT believes it is the responsibility of the GO to determine the capability of the existing units to meet the Standard.		
Southern California Edison Company	Yes	The curves and tables in the attachments require additional clarification.
Response: Thank you for your comments. Additional clarification has been added.		
Progress Energy, Inc.	Yes	1. Recommend deleting proposed R2.2.2. If not deleted the language needs to be clarified as follows: "meet a shorter voltage ride through" should be changed to "meet a less stringent voltage ride through". 2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be provided before they are made in the field. 3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request" 4. The purpose and the applicability of the standard needs to be revised to clearly specify that the scope of PRC-024-1 only applies to main generator protective relaying and excludes protective functions associated with plant auxiliary equipment.
Response: Thank you for your comments. **1. The SDT agrees and has modified the Standard to reflect this.** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable duration for the Time Horizon of the PA.** **3. The SDT agrees and has modified the Standard to reflect this.** **4. The Standard has been modified and now applies to overall new generator performance.**		
NIPSCo	Yes	R4 These groups should already have this information. The coordinators or planners should have proof and be able to provide this information now.R5 Normally would not accumulate enough time in the under-frequency zone to be a danger to the turbine blades but under unusual circumstances might accumulate too much time and not be able to continue to operate

Organization	Yes or No	Question 4 Comment
		in the under-frequency region that is being specified. We might not have enough time to wait for the 30 day period.
Response: Thank you for your comment. • **The purpose of the Standard is to assure that the relay setting information is available to the groups that require it.** • **Existing generators that are not able to meet the Standard are able to obtain an exception.**		
Northeast Utilities	Yes	R2.2.1 seems to imply that a generator must set an undervoltage trip with a time delay of no more than 9 cycles. This seems to conflict with the intent of PRC-024. Is the intent perhaps to require the TO to clear Zone 1 faults in no more than 9 cycles? Or is the intent to allow the GO to set the time delay as low as 9 cycles and no less? I suggest the latter.R3, R4, and R5 - This information should be provided to the owner of any UFLS or UVLS as well.
Response: Thank you for your comment. The intent is to allow TOs to reduce the required 9 cycle ride through requirement in cases where transmission system design allows faster clearing.		
Hydro-Québec TransEnergie (HQT)	Yes	Referencing R5 and R6 of the Standard: The Reliability Coordinator should be give veto power over exceptions to the requirements herein. Should the Generator Owner/Operator not be able to, or be unwilling to, make changes to setpoints to come into compliance with this Standard, the Reliability Coordinator should be given the authority to invoke required mitigation, such as requiring the Generator Owner/Operator to contract for compensatory load shedding up to the total amount of MW of each generating unit that fails to comply with the required setpoints. In addition, The "Off-Nominal Frequency Capability Curve" in Attachment 1 does not coordinate with the underfrequency load shedding (UFLS) program design parameters proposed by the NERC Underfrequency Load Shedding Standard Drafting Team for Project 2007-01. The misccoordination occurs in the time range approximatley between 5 and 10 seconds. This miscoordination can be eliminated by extending the horizontal line at 57.8 Hz to 5 seconds and revising the diagonal line to have endpoints at 57.8 Hz/5s and 59.5 Hz/1800s. This modification will provide coordination with the UFLS program design parameters while still maintaining coordination with turbine-generator capability. Due to the time scale on the graph in Attachment 2, the curves do not indicate the time at which the transient overvoltage and undervoltage requirements end, at which point the continuous voltage requirements would be applicable. Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to infer that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled. > A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective

Organization	Yes or No	Question 4 Comment
		devised, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this question will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of voltage relays based on voltage at the point of interconnection, which is not directly translatable to voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard. We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that " For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected "We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system undervoltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator?(2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations?

Response: Thank you for your comment.

- **The GO has the responsibility for determining the capability of existing generators and their ability to meet this Standard. How the power system deals with the inability of an existing generator to meet the Standard requirements is not addressed in this Standard.**
- **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.**
- **The voltage curve ends at 1000 seconds. Steady state limits apply after 600 seconds.**
- **Clarification has been added that the Standard does not require voltage or frequency protective relays to be installed or enabled.**
- **Clarification has been added concerning setting relays exactly on the curve.**
- **Clarification has been added concerning assumptions to be made when calculating generator terminal voltage settings that correspond to required POI limits.**
- **The Standard has been modified to be a new generator performance Standard.**
- **With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either.**

Organization	Yes or No	Question 4 Comment
AESO	Yes	In addition to the SRC ISO/RTO comments the AESO would like to add: As we understand it, the intent of this standard is to ensure that the generators ride through certain levels of frequency and voltage excursions, yet it only addresses the generator protection. We feel it must also address the protection and capabilities of the auxiliaries, unit transformers, lines, etc. If any of these trip off due to the same excursions that the generator is required to ride through, then the generator will be down and the standard will not have achieved its goal.
Response: Thank you for your comment. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Duke Energy	Yes	The issue typically addressed by international grid codes is an over-all plant performance standard and plant dynamic studies are performed to evaluate the impact on in-plant systems. Standards applicable to only generator protection might give a false sense that a plant could survive the transients and the reliability of the BES would be just as adversely impacted if large plants were to trip for causes other than a main generator relay. The basis and reliability benefit for voltage ride through transients should be clarified. Generator UF relays must coordinate with grid UFLS relaying. Some areas may apply UVLS and logic dictates that the coordination of that protection with a generator ride through criteria should be specified. Recommend that the scope of "equipment" that can be granted an exception be limited in some way or explicitly qualified. Otherwise, plant performance can be dictated by less-consequential auxiliary equipment (e.g. variable speed drives with UV settings per manufacturer standard instructions). Because R5 grants exception automatically in response to the GO providing documentation of any limitation. R5 bullet 2 - recommend changing "generator nameplate capacity rating" to "generator gross Real Power capability". The existing words are too general and including 'nameplate' is confusing.
Response: Thank you for your comment. • **The Standard has been modified to require new generators to ride through voltage and frequency excursions.** • **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.** • **The GO has the responsibility for determining the capability of existing generators and their ability to meet this Standard.** • **The SDT used the term, "continuous capacity rating" instead of "nameplate capacity" in the revised standard.**		
New York Independent System Operator	Yes	Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to insure that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine

Organization	Yes or No	Question 4 Comment
		manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled.> A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective device, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and Voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this questions will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of Voltage relays based on Voltage at the point of interconnection, which is not directly translatable to Voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard.
Response: Thank you for your comment. • **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.** • **Determining existing generator capability is the responsibility of the GO.** • **Clarification has been added to make it clearer that the Standard does not require installing voltage or frequency protection relays nor does it require setting any relays at the curve values.**		
Xcel Energy	Yes	Please clarify if there is an expectation/requirement for new units to install voltage and frequency protective relays.
Response: Thank you for your comment. There is no requirement for any generator to install or have voltage or frequency protective relays. Clarification has been added.		
CenterPoint Energy	Yes	a) CenterPoint Energy is concerned with what appears to be a lack of consistency and coordination between standards efforts. Considering PRC-023, CenterPoint Energy believes it is illogical to have transmission relay loadability requirements based on 0.85 pu system voltage for an extended period (such as, 15 minutes) to allow system operators to take remedial actions, while exempting generators from comparable requirements. For another example, it appears this proposed standard is not consistent with that being proposed for under-frequency load shedding systems that can help prevent cascading outages. b) Requirements, such as R2.2.1 and R2.2.2, are essentially fill-in-the-blank, location-specific criteria that are unnecessary

Organization	Yes or No	Question 4 Comment
		and could have unintended consequences. Location-specific criteria can change over time with additions and modifications of the transmission system. Entities will have no incentives to voluntarily exceed the minimum required criteria, even though their plant has a greater ride-though capability. R2.2.1 further allows relaying to be set on actual fault clearing times, instead of the 9 cycles indicated in Attachment 2. In addition, R2.2.2 allows the use of location-specific criteria, but only if such criteria are less stringent. CenterPoint Energy believes NERC reliability standards should not include fill-in-the-blank, location-specific criteria. CenterPoint Energy recommends modifying R2.2.1 to reference Attachment 2 and to clarify the ride-through criteria is zero voltage for 0.15 seconds (9 cycles). CenterPoint Energy recommends deleting R2.2.2. c) R5 allows generating plants to meet less stringent criteria if generator manufacturer literature indicates limitations, which would further erode system support from generation resources. It does not appear there is any process to substantiate the legitimacy of such limitations. CenterPoint Energy recommends deleting R5 and associated references.
Response: Thank you for your comment. **a) The Standard has been modified to require new generators to ride through voltage and frequency excursions. The SDT has coordinated the development of the UF relay curve with UFLS SDT.** **b) Requirements R2.2.1 and R 2.2.2 (new R2.1.2) allow the TO to relax the voltage ride through requirements in specific cases where the transmission system is designed to accommodate reduced generator performance.** **c) New R3 exempts existing generators that are not capable of meeting the Standard's requirements from having to do so. The GO is responsible for determining the generator's capabilities.**		
Independent Electricity System Operator	Yes	a. R5: The wording "the Generator Owner is granted an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation once it provides documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit, within 30 days of identifying the equipment limitation." is not written in a way to hold an entity responsible for any action. We suggest to reword it such that it places a responsibilility to the Generator to seek approval for an exception, as follows:"the Generator Owner shall obtain approval for an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation through the submission of documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit within 30 days of identifying the equipment limitation." The requirement for getting non-conforming protection approved should be so stipulated to put the onus for mitigating actions on the Generator Owners. For example, in the case of non-conforming underfrequency settings, the requesting Generator Owner should be required to demonstrate that mitigating (i.e. arrangements for additional compensating load shedding) measures have been arranged with the Balancing Authority in their submission. Equipment settings that infringe upon the curves may be implemented only after approval is granted by the appropriate entities. Along with this proposed change, there is also a need for the entities receiving the approval request to respond to the request. Another requirement is needed to complete this process.

Organization	Yes or No	Question 4 Comment
		b. The latter part of R5 should be reworded to hold an entity responsible for the needed actions associated with expiring the exception such that the requirement is measurable and enforceable. c. R6: It is unclear to us what purpose this requirement serves. If R5 is to be revised as we suggest (see above), then the "limitation" in question will be presented with technical justification in the request for approval. The receiving entities (RC, PC, TOP and TP) will have a chance to accept or reject the request with due consideration of the technical argument. This is part of the approval request process, hence we do not see the need for R6 if R5 is to be reworded. If a remand process needs to be stipulated, then inclusion in R5 a requirement for the receiving entity(ies) to respond to the request - either approving or disproving the with a rationale, would suffice.
Response: Thank you for your comment. **a) The required action in the new R3 is for the GO to provide documentation of the equipment limitation(s) to the RC, PC, TO, and TP. The GO is not required to seek approval.** **b) The SDT believes that new R3 is measurable and enforceable.** **c) The purpose of new R3 is to exempt existing generators that are not capable of meeting the Standard from having to do so.**		
Ameren	Yes	This standard could be ineffective if someone's auxiliary power protection trips out on low voltage or frequency and brings the unit down before the generator protection. Those settings on the aux buses are there to protect the equipment from failure since most of the downstream loads such as motors and electronics won't ride through an excursion as well as large T/G sets. We suggest that ANSI/IEEE Standards C37.102, C50.12, and C50.13 should be used and listed as references to this Standard. Reporting mechanism in R3 and R4 raises some commercial concerns. We prefer a secure repository of reporting to the RRO. Then only those who do have valid reasons for studies or monitoring could be granted access to the information. Footnote 1 expands 'protective relays' definition to include voltage regulator, etc. Instead state that only direct trip elements (functions) in the voltage regulator and exciter are included, if that's the intent. It should be made very clear.
Response: Thank you for your comment. • **The Standard has been modified to require new generators to ride through voltage and frequency excursions.** • **The SDT recognizes that the information required to be reported must be protected appropriately and expects the receiving organizations will fulfill all of their information protection obligations.** • **Clarification has been added to footnote 1.**		
PPL Energy Plus	Yes	PPL is concerned with the following concepts in the standard: 1) The standard applies equally to asynchronous and synchronous machines, salient pole and round rotor machines,

Organization	Yes or No	Question 4 Comment
		photovoltaic, and other resources and as such the standard does not appear to recognize that these technologies respond differently to voltage and frequency excursions. 2) Better clarity of generator owner and transmission owner roles regarding changing existing fault clearing times is needed in the proposed standard. 3) R2.2 requires further clarity regarding relay settings. 4) R3 and R4 look the same. 5) The reference paper under Section D needs a thorough review by the industry.
Response: Thank you for your comment. **1. The SDT has taken the direction to develop a Standard that is technology neutral.** **2. The TO is allowed to relax the relay setting Standard (shorter durations or higher minimum voltages and or lower maximum voltages) if the full capability of the Standards is not required in specific instances.** **3. Further clarification has been added.** **4. Old R3 and old R4 are combined into the new R6.** **5. The SDT welcomes thorough industry review of the reference paper.**		
US Bureau of Reclamation	Yes	Requirements R3 and R4 place a coordinating role on the Generator Owner to provide trip settings to four entities, the Reliability Coordinator, Planning Coordinator, Transmission Operator, and Transmission Planner. We believe it is more appropriate for the Generator Owner to coordinate settings with a single Transmission entity since the purpose of the Standard is "... to support transmission system stability during voltage and frequency excursions." and for the Transmission entity to further coordinate if necessary. The Transmission entity is in a better position to know what additional entities, if any should be involved. For the data points provided in the Attachment 2, HVRT DURATION and LVRT DURATION, we recommend both time and voltage units of measure be provided.
Response: Thank you for your comment. Old R3 and old R4 are combined into the new R6. The SDT agrees with the comment and has added clarification to the voltage and time units in Attachment 2		
PJM Interconnection	Yes	
Dominion	Yes	

Organization	Yes or No	Question 4 Comment
FirstEnergy	Yes	
Luminant Power	Yes	
Consumers Energy Company	Yes	
E.ON U.S.	Yes	
AWEA	Yes	
American Wind Energy Association	Yes	
Veolia Environmental Services	Yes	
Lakeland Electric	Yes	
Manitoba Hydro	Yes	
NIPSCo	Yes	
Northeast Utilities	Yes	
American Electric Power	Yes	
American Transmission Company	Yes	

5. Coordination between UFLS programs and generator frequency tripping is especially a concern in islanded situations. Is the connection voltage of ≥100kV, the size threshold for generator units 20 MVA and greater and 75 MVA for multiple units at a single site, sufficient to address this concern? If not, please explain in the comment area.

Summary Consideration:

Most respondents agreed with the proposal.

The major comment issues raised are:

1) All operating units affect frequency excursion recovery regardless of size or voltage
2) Applicability should be on a case-by-case basis
3) Only large units are significant to stability

The GV SDT considerations for the major comment issues are:

- After consideration of comments and discussion with NERC staff, the SDT agrees with the majority position that the applicability of facilities that meet the Compliance Registry Criteria is sufficient to address coordination between UFLS programs and generator tripping. The language that duplicated the language from the Compliance Registry Criteria is not necessary to include in the applicability section of the standard, and was removed from the revised standard. The SDT does not believe that applicability of generating facilities should be assigned to other parties to determine on a case-by-case basis. Nor does the SDT believe that applicability should be limited to generating facilities larger than what is defined in the Compliance Registry Criteria.

Organization	Yes or No	Question 5 Comment
NERC System Protection and Control Subcommittee (SPCS)	No	The interconnection Voltage is not relevant, only the amount of generation potentially lost to the system.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the		

Organization	Yes or No	Question 5 Comment
applicability to Generator Owners as described in the Compliance Registry Criteria.		
Northeast Power Coordinating Council	No	Both bullets should be checked above (form will not accept).Reliability of underfrequency load shedding (UFLS) programs is dependent on assurance that the UFLS program will shed load prior to generation tripping in islanded conditions. The frequency response to generator tripping is primarily a function of the amount of generation tripped and is substantially independent of the location of the generator interconnection. Therefore, the standard should not specify a threshold on interconnection voltage. We are concerned that the generator unit capacity thresholds are set too high. Given the tolerances in UFLS program design, the unit capacity thresholds should be established to ensure that 99 percent of the generation in a system complies with the requirements of this standard. The SDT should identify unit capacity thresholds on this basis, similar to how thresholds were developed in MOD-026.The interconnection voltage is not relevant, only the amount of generation potentially lost to the system. Some sub-regions, employing a UFLS Program, are dependent on Generator Owners/Operators meeting the specifications for generator Underfrequency setpoints in order to maintain a viable UFLS Program. For sub-regions where a large percentage of the total generation fleet is comprised of individual units < 20 MVA and connected to buses < 100 kV, the contribution of these units to the overall success of the sub-regions UFLS Program are more pronounced. It is suggested that the threshold should be established by referring to the requirements of the Region or as established by the Reliability Coordinator (sub-region). As an alternative, it is suggested that all generating units operating in a Reliability Coordinators' or RTO/ISO's market system, regardless of size, shall follow this Standard based on their materiality to the reliability of the bulk power system.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
IRC Standards Review Committee	No	There should not be any exemption of the coordination on frequency trip setting. In an islanded situation, each generator's status is critical to ensuring that frequency decline is successfully arrested based on the assumption that all on-line generators would not trip within specific frequency bounds unless prior approval has been sought and granted to allow tripping. Not holding the smaller generators subject to the requirements associated with generator frequency tripping exposes the island to a great uncertainty on the amount of generation that can be relied upon to arrest frequency excursion.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
Constellation Power Generation & Constellation Nuclear	No	Reliability of underfrequency load shedding (UFLS) programs is dependent on assurance that the UFLS program will shed load prior to generation tripping in islanded conditions. The frequency response to generator tripping is primarily a function of the amount of generation tripped and is substantially independent of the location of the generator interconnection. Therefore, the standard should not specify a threshold on interconnection voltage. We are concerned that the generator unit capacity thresholds are set too high. Given the tolerances in UFLS program design, the unit capacity thresholds should be established to

Organization	Yes or No	Question 5 Comment
		ensure that 99 percent of the generation in a system complies with the requirements of this standard. The SDT should identify unit capacity thresholds on this basis, similar to how thresholds were developed in MOD-026.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		
Southern Company	No	The unit size and plant size seem to be conservatively small. From a practical standpoint, our focus in this standard should be on the largest units, those that are most cricital in the reliability. A more reasonable limit would be 100MVA generator units and 200 MVA for multiple units at a single site.
Response: Thank you for your comment. The SDT believes that exempting units smaller than 100 MVA or sites smaller than 200 MVA would put the reliability of the Bulk Electric System at risk during a frequency excursion. This is especially true in islanding situations where smaller units may predominate within a particular island.		
E.ON U.S.	No	E.ON U.S. believes that the standard should apply to facilities at 200 kV and above in order to be consistent with equipment thresholds of other NERC standards.
Response: Thank you for your comment. The SDT believes that exempting units connected at voltages less than 200 kV would put the reliability of the Bulk Electric System at risk during a frequency excursion. This is especially true in islanding situations where units connected at less than 200 kV may predominate within a particular island.		
Veolia Environmental Services	No	Additional criteria would be useful to identify units that are critical to the BES. If a BA and/or TOP has identified a unit a non-critical, then such a unit should be exempt from this standard regardless of size and connection voltage.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. The SDT feels that all units that meet the Registry Criteria are of importance to the grid, especially during frequency excursions.		
Basin Electric Power Cooperative	No	This is likely to be something that has to be applied on a case by case basis, with consideration given to how many units we have that would not be covered by some sort of coordinated UFLS/generation protection settings. There is some latitude to make exceptions, but in the future, we may have many more units that fit this category, and then this becomes a big issue. Units which trip too soon will just impact the load shedding program unless a corresponding amount of load is shed at essentially the same time and more or less at that same location.

Organization	Yes or No	Question 5 Comment
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. The SDT does not agree that requirements should be applied on a case by case basis.		
Northeast Utilities	No	Significant generator capacity may be connected at distribution voltages and set with sensitive anti-islanding frequency/voltage setpoints. These generators need to report their setpoint data to the owner of any UFLS/UVLS systems that may be affected by the generator performance. This can be a significant amount of generation relative to the size of the UFLS/UVLS program.Consideration should also be given as to whether the requirements should apply to generators where the site aggregate is >20MVA.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		
Hydro-Québec TransEnergie (HQT)	No	Reliability of underfrequency load shedding (UFLS) programs is dependent on assurance that the UFLS program will shed load prior to generation tripping in islanded conditions. The frequency response to generator tripping is primarily a function of the amount of generation tripped and is substantially independent of the location of the generator interconnection. Therefore, the standard should not specify a threshold on interconnection voltage. We are concerned that the generator unit capacity thresholds are set too high. Given the tolerances in UFLS program design, the unit capacity thresholds should be established to ensure that 99 percent of the generation in a system complies with the requirements of this standard. The SDT should identify unit capacity thresholds on this basis, similar to how thresholds were developed in MOD-026.The interconnection voltage is not relevant, only the amount of generation potentially lost to the system.Some sub-regions, employing a UFLS Program, are dependent on Generator Owners/Operators meeting the specifications for generator Underfrequency setpoints in order to maintain a viable UFLS Program. For sub-regions where a large percentage of the total generation fleet is comprised of individual units < 20 MVA and connected to buses < 100 kV, the contribution of these units to the overall success of the sub-regions UFLS Program are more pronounced. It is suggested that the threshold should be established by refering to the requirements of the Region or as established by the Reliability Coordinator (sub-region). As an alternative, it is suggested that all generating units operating in a Reliability Coordinators' or RTO/ISO's market system, regardless of size, shall follow this Standard based on their materiality to the reliability of the bulk power system.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		
New York Independent System	No	The interconnection Voltage is not relevant, only the amount of generation potentially lost to the system.

Organization	Yes or No	Question 5 Comment
Operator		
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		
Independent Electricity System Operator	No	In an islanded situation, each generator's status is critical to ensuring frequency decline is successfully arrested based on the assumption that all on-line generators would not trip within specific frequency bounds unless prior approval has been sought and granted to allow tripping. Not holding the smaller generators subject to the requirements associated with generator frequency tripping exposes the island to a great uncertainty on the amount of generation that can be relied upon to arrest frequency excursion.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		
Converteam Naval Systems Inc.	No	
Indiana Municipal Power Agency	Yes	A single unit not meeting these thresholds (an unregistered unit) can always be registered if a technical justification is given and proven. However, this does not mean a "blanket" registration can apply to all units (unregistered units) that do not meet these thresholds.
Response: Thank you for your comments. The SDT agrees with your position. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
American Electric Power	Yes	The applicability appears to be from the NERC Compliance registry. This is probably okay for the requirement on voltage related tripping, but the impact of frequency related tripping is not restricted to the BES as it likely would be with voltage tripping. A separate single-size applicability, independent of BES/non-BES connection, may be more appropriate for the frequency tripping requirement.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. Extending the applicability to units beyond those covered under the Registry Criteria would make those units subject to all Generator Owner requirements in all other Standards.		

Organization	Yes or No	Question 5 Comment
SERC Dynamics Review Subcommittee (DRS)	Yes	All generating units with the given thresholds are registered in the NERC compliance registry. We believe that these units should adhere to the requirements in the Standard. Each system reacts differently to the loss of different sizes of generators. This Standard, which is applicable to every registered entity, should cover these situations. Hence, the given thresholds, though restrictive, are adequate.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
Ameren	Yes	Again from our perspective, the main objective is allow UFLS/UVLS to do their job to arrest frequency/voltage decline and retain generation on-line so as not to exacerabate the extreme disturbance. Of course, generation equipment limits must be respected. This standard should not encourage GO to augment protection or become more conservative than warranted, possibly refuting the main objective. We formerly belonged to the now defunct MAIN region. Previous MAIN requirements for generators were: Generator UF Setting (Hz) Minimum Time Delay (Sec)> 59.5 Hz Automatic tripping not permitted< 59.5 to > 59.2 Hz 2700 seconds< 59.2 to > 58.5 Hz 120 seconds< 58.5 to > 58.0 Hz 15 seconds< 58.0 Hz Owner's Discretion We have applied these to generation that has connected in the last decade unless the GO had manufacturer recommendations to the contrary.
Response: Thank you for your comment. The SDT agrees that generation equipment limits must be respected and allows exemption for documented technical limitations in Requirement R3. A phrase has been added to R1 and R2 indicating that frequency and voltage protective relaying is not required. The Frequency vs. Time curves in Attachment 1 are designed to coordinate with the curves being used by the NERC Underfrequency Load Shedding (UFLS) Standard Drafting Team.		
US Bureau of Reclamation	Yes	The threshold should be consistent with the NERC Reliability Compliance Registry Criteria.
Response: Thank you for your comments. The SDT agrees with your position. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
Progress Energy, Inc.	Yes	All generator units with the given thresholds are registered in the NERC compliance registry. We consider that such units should adhere to the requirements in the standard. Each system reacts differently to the loss of different sizes of generators. This standard, which is applicable to every entity, should cover all such situations. Hence, the given thresholds, though restrictive, are adequate.
Response: Thank you for your comments. The SDT agrees with your position. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		

Organization	Yes or No	Question 5 Comment
Old Dominion Electric Cooperative	Yes	This is the NERC/FREC set levels, all units with this scope should have to comply with the standard. Units that are not within the above criteria should be exempt from it as they are not aware, possible to provide their input.
Response: Thank you for your comments. The SDT agrees with your position. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria.		
Consumers Energy Company	Yes	We believe this is sufficient to address the concern if this picks up the wind farms that are a growing part of generating capacity.
Response: Thank you for your comments. After consideration of comments and discussion with NERC staff, the SDT has assigned the applicability to Generator Owners as described in the Compliance Registry Criteria. The SDT feels most wind farms are registered due to their aggregate size and Point of Interconnection voltage.		
FirstEnergy	Yes	
Luminant Power	Yes	
AWEA	Yes	
Gainesville Regional Utilities	Yes	
American Wind Energy Association	Yes	
Southern California Edison Company	Yes	
Brazos Electric Power Cooperative	Yes	
Lakeland Electric	Yes	

Organization	Yes or No	Question 5 Comment
Manitoba Hydro	Yes	
Kansas City Power & Light	Yes	
Entergy Fossil Operations	Yes	
PJM Interconnection	Yes	
Dominion	Yes	
MRO NERC Standards Review Subcommittee	Yes	
Duke Energy	Yes	
American Transmission Company	Yes	

6. The SDT proposed a set of VRFs based on size delineation of units. Do you agree with this approach? Do you agree with the MVA levels? If you disagree with either the approach or the MVA levels, please explain in the comment area.

Summary Consideration:

There was no consensus on this issue.

The major comment issues raised are:

- There should be only a single VRF Different MVA break points or methodologies (MWh, percent of units, impact-based)

The GV SDT consideration for the major comment issues is:

- After consideration of comments and discussion with NERC staff, the SDT agrees with the minority position that a single VRF must be used for each Requirement. NERC Standard Processes Manual does not allow multiple VRFs for a Requirement regardless of the methodology used to separate them.

Organization	Yes or No	Question 6 Comment
Dominion	No I disagree with the approach	All generators identified in a transmission owner's restoration plan warrant a high VRF. Additionally, generators 500 MVA warrant a high, generators > 100 MVA but < 500 MVA warrant a medium and generators 100 MVA warranty a low VRF
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Northeast Power Coordinating Council	No I disagree with the approach	Both bullets should be checked above (form will not accept).
Response: Thank you for your comments. The nature of the disagreement is not understood.		
SERC Dynamics Review Subcommittee	No I disagree with	It is the aggregate impact of all an entity's units that matters. There should be only one VRF - HIGH. Consider the example where a plant consists of numerous medium sized (100-200 MVA) units with a common relay setting error.

Organization	Yes or No	Question 6 Comment
(DRS)	the approach	Even though the individual units are relatively small, there is a potentially large impact when the whole plant is considered.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
IRC Standards Review Committee	No I disagree with the approach	Size dependent VRFs do not reflect the potential reliability risk associated with more than one Medium size generating unit (>100 MVA and <500 MVA) failing to comply with the standard. Two of such units at, say, 400 MVA each, that trip unnecessarily will have a greater collective impact on the island frequency than the tripping of a 500 MVA unit.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Veolia Environmental Services	No I disagree with the approach	The delineation should be based on actual or potential impact to the BES of a unit tripping as determined by the BA and TOP modeling.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria. A VRF cannot be modified by BA's and TOP's on a case-by-case basis.		
Old Dominion Electric Cooperative	No I disagree with the approach	I assume this was because the bigger units have a bigger impact on reliability than the smaller units. I am fine with this approach, but might have a minor comment on the break levels.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Basin Electric Power Cooperative	No I disagree with the approach	This may be appropriate but I have not seen the supporting technical report so I cannot say that I agree. This is likely to be something that has to be applied on a case-by-case basis, with consideration given to how many units would be excluded in some geographic area. There is some latitude to make exceptions, but in the future, we may have many more units that fit this category, and then this exclusion becomes a big issue.

Organization	Yes or No	Question 6 Comment
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRF's) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5), These VRF's were developed using NERC's VRF Criteria. Exceptions to Requirements R1 and R2 are only allowed for documented technical limitations (e.g. OEM documents indicating that operation within these requirements will damage the equipment).		
Progress Energy, Inc.	No I disagree with the approach	It is the aggregate impact of all an entity's units that matters. There should be only one VRF - HIGH. Consider the example where a plant consists of numerous medium (100-200 MVA) units with a common relay setting error. WECC have relatively small units, but potentially large impact when the whole plant is affected.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5).		
Hydro-Québec TransEnergie (HQT)	No I disagree with the approach	Given the potential impact on survivability of an island, and the need to lower the unit capacity thresholds for which this standard is applicable, as recommended in the comment to Question 5, it is suggested that the folowing Violation Risk Factor thresholds be applied:High > 100 MVAMedium > 20 MVA and < 100 MVA Lower < 20 MVA Given the potential impact on survivability of an island, and the recommendation in our response to Question 5 to lower the unit capacity thresholds for which this standard is applicable, we recommend the following Violation Risk Factor thresholds:High >100 MVAMedium > 20 MVA and 100 MVALower 20 MVA
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Duke Energy	No I disagree with the approach	It is the aggregate impact of all an entity's units that matters. There should be only one VRF - HIGH.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5).		
Independent Electricity System Operator	No I disagree with the approach	Size dependent VRFs do not reflect the potential reliability risk associated with more than one Medium size generating unit (>100 MVA and <500 MVA) failing to comply with the standard. Two of such units at, say, 400 MVA each, that trip unnecessarily will have a greater collective impact on the island frequency than the tripping of a 500 MVA unit.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are		

Organization	Yes or No	Question 6 Comment
delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5).		
Ameren	No I disagree with the approach	Are they based on the individual unit or the aggregate at the Point of Interconnection? Average annual production (MWh) is a better indicator of their threat to the BES during UF or UV events. Larger units should not be penalized just because they are large. If large and generating many MWh then they're big and likely to be on-line for an event.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
US Bureau of Reclamation	No I disagree with the approach	If this approach is appropriate for this standard, it seems this approach should be used for all Standards applicable to generators.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Constellation Power Generation & Constellation Nuclear	No I disagree with the approach	
FirstEnergy	Yes I agree with the approach	A suggestion for SDT's consideration is that VRFs could be based on percentage of units not in compliance. A utility may have several large units (high VRF) and many small (low VRF) not in compliance.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		
Lakeland Electric	Yes I agree with the approach	The VRF levels should range from low to high based on unit size and how the unit size impacts BES.
Response: Thank you for your comments. Based on industry comment and conversation with NERC Staff, the SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level is assigned for R1, R2, and a new performance requirement (R5). These VRFs were developed using NERC's VRF Criteria.		

Organization	Yes or No	Question 6 Comment
Entergy Fossil Operations	Yes I agree with the approach	
PJM Interconnection	Yes I agree with the approach	
Kansas City Power & Light	Yes I agree with the approach	
MRO NERC Standards Review Subcommittee	Yes I agree with the approach	
Luminant Power	Yes I agree with the approach	
Southern Company	Yes I agree with the approach	
Converteam Naval Systems Inc.	Yes I agree with the approach	
Consumers Energy Company	Yes I agree with the approach	
E.ON U.S.	Yes I agree with the approach	
AWEA	Yes I agree with the approach	
Gainesville Regional Utilities	Yes I agree with the approach	
American Wind Energy Association	Yes I agree with the approach	

Organization	Yes or No	Question 6 Comment
Southern California Edison Company	Yes I agree with the approach	
Brazos Electric Power Cooperative	Yes I agree with the approach	
Manitoba Hydro	Yes I agree with the approach	
NIPSCo	Yes I agree with the approach	
Indiana Municipal Power Agency	Yes I agree with the approach	
Northeast Utilities	Yes I agree with the approach	
American Electric Power	Yes I agree with the approach	
New York Independent System Operator	Yes I agree with the approach	
American Transmission Company	Yes I agree with the approach	

6.1 Do you agree with the MVA levels?

Summary Consideration:

There was no consensus on this issue.

The major comment issues raised are:

- There should be only a single VRF
- Lower MVA break points should be used

The GV SDT consideration for the major comment issues is:

- As discussed in the Summary Consideration to Question 6, multiple VRFs for a Requirement are not allowed, so the responses to this question is no longer applicable. The SDT developed a single VRF for Requirements R1 and R2 based on the NERC VRF Criteria.

Organization	Yes or No	Question 6.1 Comment
Northeast Power Coordinating Council	No	Both bullets should be checked above (form will not accept).Given the potential impact on survivability of an island, and the need to lower the unit capacity thresholds for which this standard is applicable, as recommended in the comment to Question 5, it is suggested that the folowing Violation Risk Factor thresholds be applied:High > 100 MVAMedium > 20 MVA and < 100 MVA Lower < 20 MVA Given the potential impact on survivability of an island, and the recommendation in our response to Question 5 to lower the unit capacity thresholds for which this standard is applicable, we recommend the following Violation Risk Factor thresholds:High >100 MVAMedium > 20 MVA and 100 MVALower 20 MVA
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
SERC Dynamics Review Subcommittee (DRS)	No	There should not be levels
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		

Organization	Yes or No	Question 6.1 Comment
Kansas City Power & Light	No	What is the basis for the MVA levels proposed by the standard here?
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5). The SDT did not have a technical basis for assigning a given level, and was asking stakeholders for assistance.		
IRC Standards Review Committee	No	Please see above comments. We suggest that the same VRFs apply to all units that meet the Applicability criteria.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Southern Company	No	The VRF levels should range from low to high based on size of unit. Low risk 100-200MVA. Medium risk 200-500 MVA. High risk >500MVA.
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Gainesville Regional Utilities	No	I believe that > than 100 mva should only be included
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Veolia Environmental Services	No	Size should not be a factor, only practical impact to the BES.
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Basin Electric Power Cooperative	No	see above comment
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement, the Violation Severity Levels (VSLs) will be delineated by a Generator Owner's cumulative capacity (nameplate MVA) that did not meet the defined requirements.		
Progress Energy, Inc.	No	There should not be levels.

Organization	Yes or No	Question 6.1 Comment
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Hydro-Québec TransEnergie (HQT)	No	Given the potential impact on survivability of an island, and the need to lower the unit capacity thresholds for which this standard is applicable, as recommended in the comment to Question 5, it is suggested that the folowing Violation Risk Factor thresholds be applied: High > 100 MVA Medium > 20 MVA and < 100 MVA Lower < 20 MVA Given the potential impact on survivability of an island, and the recommendation in our response to Question 5 to lower the unit capacity thresholds for which this standard is applicable, we recommend the following Violation Risk Factor thresholds: High >100 MVA Medium > 20 MVA and 100 MVA Lower 20 MVA
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
American Electric Power	No	The MVA levels appear to be arbitrary. What is the basis that the SDT used to establish these MVA thresholds?
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5). The SDT did not have a technical basis for assigning a given level, and was asking stakeholders for assistance.		
Duke Energy	No	It is the aggregate impact of all an entity's units that matters. There should be only one VRF - HIGH.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Independent Electricity System Operator	No	Please see above comments. We suggest that the same VRFs apply to all units that meet the Applicability criteria.
Response: Thank you for your comments. The SDT agrees that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5)..		
Ameren	No	See above
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		

Organization	Yes or No	Question 6.1 Comment
Constellation Power Generation & Constellation Nuclear	No	
Old Dominion Electric Cooperative	Yes	Might have a minor tweak in the future.
Response: Thank you for your comments. The SDT has determined that a single VRF is more appropriate. As such, the Violation Risk Factors (VRFs) no longer are delineated by MVA level. Instead, a single VRF level will be assigned and for R1, R2, and a new performance requirement (R5).		
Luminant Power	Yes	
Entergy Fossil Operations	Yes	
PJM Interconnection	Yes	
Dominion	Yes	
MRO NERC Standards Review Subcommittee	Yes	
FirstEnergy	Yes	
Converteam Naval Systems Inc.	Yes	
Consumers Energy Company	Yes	
E.ON U.S.	Yes	
AWEA	Yes	
American Wind Energy Association	Yes	
Southern California Edison Company	Yes	

Organization	Yes or No	Question 6.1 Comment
Lakeland Electric	Yes	
Manitoba Hydro	Yes	
NIPSCo	Yes	
New York Independent System Operator	Yes	
American Transmission Company	Yes	

7. If you are aware of any regional variances that would be required as a result of this standard please identify the regional variance here.

Summary Consideration:

Most responders, knew of no required regional variances, several commented on the potential need for variances. .

The issues associated with the majority of the comments received are:

1. There are some regional geographical differences.
2. There is concern about UFLS standards that are being developed in the various regions pending the conclusion of UF studies. These study results may indicate the need for regional variances.

Some other comment issues are:

1. One commenter suggests the SDT wait for the regions to complete their UF studies before going forward with PRC-024.
2. One commenter indicates that FRCC has suspended development of the regional version of PRC-024.
3. Certain regional UFLS drafts include requirements for non-conforming generators to acquire “load-shed” service. These drafts do not identify the GO/GOP in the applicability section, and it is not certain that any entity can offer a “load-shed” service.

The GV SDT considerations for these issues are:

The SDT is aware that some regions have stopped developing their Standards because of the efforts at NERC to develop similar continent-wide standards**.**

The SDT notes that the NERC Standard Processes manual, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) fhas provisions for entities to submit a request for a variance. However, Regional Standards will need to be addressed at the regional level unless the region desires to seek a variance through the NERC Standard Development Process.

Organization	Question 7 Regional Variance
NERC System Protection and Control	The FRCC UFLS has a requirement for generators to remain on line for 1 second with frequency down to 57.5 Hz.

Organization	Question 7 Regional Variance
Subcommittee (SPCS)	Regional differences are developing as the Regions perform studies to current UFLS strategies while considering the coordination requirements of generator underfrequency tripping. To date, NPCC and FRCC may be the only regions that have completed their studies. It is recommended that PRC- 024-1 wait on going forward in the standards process until the regions conclude their studies and develop their requirements based on their particular portions of the interconnected power system.
Response: The SDT thanks you for your comments. The SDT is aware that some regions have stopped developing their Standards because of the efforts at NERC to develop similar Standards. Therefore, it may not be practical to wait to develop NERC Standards until the regions have concluded their respective studies. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 ((http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) has provisions for the Regions to submit a request for a Variance.	
Dominion	We are not aware of any. However, we are aware that a number of regions have draft UFLS standards that apply to generators despite the fact NERC Reliability Standards PRC-007, PRC-008 and PRC-009 do not contain either GO or GOP in the applicability section. These regional drafts contain provisions that require non-conforming generators to acquire 'load shed' service. We have repeatedly cited our inability to find any entity that would offer such service as well as technical difficulties in developing a UFLS predicted upon such a service. Despite our comments, the latest drafts continue to require non-conforming generators to acquire 'load shed' service.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32)has provisions for the regions to submit a request for a variance. However, Regional Standards will need to be addressed at the regional level unless the region desires to seek a regional through the NERC Standard Development Process.	
Northeast Power Coordinating Council	We are aware that a number of regions have draft UFLS standards that apply to generators despite the fact NERC Reliability Standards PRC-007, PRC-008 and PRC-009 do not contain either GO or GOP in the applicability section. These regional drafts contain provisions that require non-conforming generators to acquire 'load shed' service. We have repeatedly cited our inability to find any entity that would offer such service as well as technical difficulties in developing a UFLS predicated upon such a service. Despite our comments, the latest drafts continue to require non-conforming generators to acquire 'load shed' service. The Quebec Interconnection, within the Eastern Interconnection, would need different settings from the ones listed in Attachment 1 to coordinate with its UFLS program.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32)has provisions for the regions to submit a request for a variance. However, Regional Standards will need to be addressed at the regional level unless the region desires to seek a variance through the NERC Standard Development Process.	

Organization	Question 7 Regional Variance
Kansas City Power & Light	Not aware of any regional differences.
Response: The SDT thanks you for your comments.	
MRO NERC Standards Review Subcommittee	If a region has performed a detailed system study of the Under Frequency protection systems in their region and developed protective settings based off the characteristics developed in the study, the region should be allowed to deviate from the Generator Protection curve in Attachment 1.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32)has provisions for the regions to submit a request for a variance.	
Constellation Power Generation & Constellation Nuclear	We are not aware of any. However, we are aware that a number of regions have draft UFLS standards that apply to generators despite the fact NERC Reliability Standards PRC-007, PRC-008 and PRC-009 do not contain either GO or GOP in the applicability section. These regional drafts contain provisions that require non-conforming generators to acquire 'load shed' service. We have repeatedly cited our inability to find any entity that would offer such service as well as technical difficulties in developing a UFLS predicted upon such a service. Despite our comments, the latest drafts continue to require non-conforming generators to acquire 'load shed' service.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) has provisions for the regions to submit a request for a variance. However, Regional Standards will need to be addressed at the regional level unless the region desires to seek a variance through the NERC Standard Development Process.	
Progress Energy, Inc.	No. FRCC has suspended work on a regional version of PRC-024. The regional version will have to reviewed and compared to the NERC standard once developed.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) has provisions for the regions to submit a request for a variance, should the regions decide to do so.	
Basin Electric Power Cooperative	See the detailed answer provided to question 2. It covers the need for regional variance.
Response: The SDT thanks you for your comments.	

Organization	Question 7 Regional Variance
Hydro-Québec TransEnergie (HQT)	Yes, the Quebec Interconnection, within the Eastern Interconnection, would need different settings than the ones depicted in the Attachment 1 to coordinate with its UFLS program.We are also aware that a number of regions have draft UFLS standards that apply to generators despite the fact NERC Reliability Standards PRC-007, PRC-008 and PRC-009 do not contain either GO or GOP in the applicability section. These regional drafts contain provisions that require non-conforming generators to acquire 'load shed' service. We have repeatedly cited our inability to find any entity that would offer such service as well as technical difficulties in developing a UFLS predicted upon such a service. Despite our comments, the latest drafts continue to require non-conforming generators to acquire 'load shed' service.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) has provisions for the Regions to submit a request for a Variance. However, Regional Standards will need to be addressed at the Regional Level unless the Region desires to seek a Variance through the NERC Standard Development Process.	
Ameren	It seems that geography (e.g. peninsulas, coastal areas) and load sparcity, and dense load served by distant generation have been significant factors in blackout events. As such, regional differences do exist.
Response: The SDT thanks you for your comments. The NERC Reliability Standards Development Procedure, approved by FERC on September 3, 2010 (http://www.nerc.com/docs/standards/sar/Appendix_3A_Standard_Processes_Manual_20100903_2_.pdf, see page 32) has provisions for the regions to submit a request for a variance, should the region decide to do so.	
IRC Standards Review Committee	None
Luminant Power	NA
Southern Company	No.
Consumers Energy Company	No.
Old Dominion Electric Cooperative	No.
Lakeland Electric	No
Manitoba Hydro	none
American Electric Power	No known regional variances

Organization	Question 7 Regional Variance
Duke Energy	None
Independent Electricity System Operator	None

8. If you aware of any conflicts between the proposed standard and any regulatory function, rule order, tariff, rate schedule, legislative requirement or agreement, please identify the conflict here.

Summary Consideration:

There were several commenters who stated they were aware of agreements between some generators and their respective Transmission Owners that contain frequency coordination requirements that differ from those in Table 1. The SDT answered this concern with: "The Generator Verification SDT has worked closely with the UFLS SDT to insure coordination of this Standard with the UFLS Standard. When the UFLS standard is approved and in effect entities will be required to comply. The SDT believes the drafted standard allows for exceptions due to technical limitations per Requirement R5 (R3 in the revised standard). Several commenters gave concerns that Nuclear Plant Requirements may conflict. The SDT answered this concern with: "The SDT is aware that Nuclear Plant licensing issues may not allow a generator to meet the requirements of this Standard and this might be an acceptable basis for exclusion. However, the Nuclear Power Plant owner would be expected to review these limitations and assure that a less restrictive set-point is not possible.

Organization	Question 8 Conflict
Dominion	Yes. We are aware of agreements between some generators and their respective transmission owners that contain frequency coordination requirements that differ from those in Table 1, and that, in some cases, the transmission facility(ies) that connects the generator to the BES has underfrequency tripping that would operate prior to the levels shown in Table 1, thus negating any modification that a generator might make to conform. We suggest that this standard also exempt these GOs from meeting R1 and R2 and that R5 be modified to allow for such exception.
Response: Thank you for your comments to this question. The Generator Verification SDT has worked closely with the UFLS SDT to insure coordination of this Standard with the UFLS standard. When the UFLS Standard is approved and in effect entities will be required to comply. The SDT believes the drafted Standard allows for exceptions due to technical limitations per Requirement R5 (R3 in the revised standard).	
Northeast Power Coordinating Council	Yes. We are aware of agreements between some generators and their respective transmission owners that contain frequency coordination requirements that differ from those in Table 1, and that, in some cases, the transmission facility(ies) that connects the generator to the BES has underfrequency tripping that would operate prior to the levels shown in Table 1, thus negating any modification that a generator might make to conform. We suggest that this standard also exempt these GOs from meeting R1 and R2 and that R5 be modified to allow for such exception.
Response: Thank you for your comments to this question. The Generator Verification SDT has worked closely with the UFLS SDT to insure coordination of this Standard with the UFLS Standard. When the UFLS standard is approved and in effect entities will be required to comply. The SDT believes the drafted Standard allows for exceptions due to technical limitations per Requirement R5 (R3 in the revised standard).	
FirstEnergy	This standard may need to be coordinated with current efforts to revise standard PRC-006-1, and with the Regional

Organization	Question 8 Conflict
	standards being developed for UFLS, such as RFC's PRC-006-RFC-01.
Response: Thank you for your comments. The SDT has worked closely with the NERC UFLS team to ensure a coordinated effort is being conducted.	
Constellation Power Generation & Constellation Nuclear	Yes. We are aware of agreements between some generators and their respective transmission owners that contain frequency coordination requirements that differ from those in Table 1, and that, in some cases, the transmission facility(ies) that connects the generator to the BES has underfrequency tripping that would operate prior to the levels shown in Table 1, thus negating any modification that a generator might make to conform. We suggest that this standard also exempt these GOs from meeting R1 and R2 and that R5 be modified to allow for such exception.
Response: Thank you for your comments. The Generator Verification SDT has worked closely with the UFLS SDT to insure coordination of this Standard with the UFLS Standard. When the UFLS standard is approved and in effect entities will be required to comply. The SDT believes the drafted Standard allows for exceptions due to technical limitations per Requirement R5 (R3 in the revised standard).	
Southern Company	Nuclear Plant Requirements may conflict.
Response: Thank you for your comments. The SDT is aware that Nuclear Plant licensing issues may not allow a generator to meet the requirements of this Standard and this might be an acceptable basis for an exclusion. The Nuclear Power Plant owner would be expected to review these limitations and assure that a less restrictive set-point is not possible that would permit coordination with this Standard while still protecting the nuclear plant. The SDT will discuss and investigate the inclusion of this concern in R5 (R3 in the revised standard).	
Basin Electric Power Cooperative	The proposed generation off-nominal frequency criteria conflicts with the MRO UFLS program, and will not work for programs that need to shed more than 30% of system load. Technically this is not a conflict with regulatory functions, rule order, tariff, rate schedule, legislative requirement or agreement; but it is a conflict with our efforts to design an appropriate load shedding program for the MRO region.
Response: Thank you for your comments. The SDT has worked closely with the NERC UFLS team to ensure a coordinated effort is being conducted.	
Progress Energy, Inc.	Yes, if the standard is extended to other plant equipment NRC nuclear plant licenses will be in conflict.
Response: Thank you for your comments to this question. The SDT is aware of these concerns.	
Hydro-Québec TransEnergie (HQT)	Yes. We are aware of agreements between some generators and their respective transmission owners that contain frequency coordination requirements that differ from those in Table 1, and that, in some cases, the transmission facility(ies) that connects the generator to the BES has underfrequency tripping that would operate prior to the levels shown in Table 1, thus negating any modification that a generator might make to conform. We suggest that this

Organization	Question 8 Conflict
	standard also exempt these GOs from meeting R1 and R2 and that R5 be modified to allow for such exception.
Response: Thank you for your comments to this question. The Generator Verification SDT has worked closely with the UFLS SDT to insure coordination of this sSandard with the UFLS Standard. When the UFLS Standard is approved and in effect entities will be required to comply. The SDT believes the drafted Standard allows for exceptions due to technical limitations per Requirement R5 (R3 in the revised standard).	
Ameren	Nuclear Plant Requirements may conflict.Footnote 2 refers to the agreements for which the GO is not responsible. Also, grandfathered generation of more vertically integrated entities and/or in certain states may not have such formal agreements.
Response: Thank you for your comments to this question. The SDT is aware that Nuclear Plant licensing issues may not allow a generator to meet the requirements of this Standard and this might be an acceptable basis for an exclusion. The SDT will discuss and investigate the inclusion of this concern in R5. The SDT disagrees with the comment referencing footnote 2, and believes the GO (Generator Owner) is responsible for these actions.	
First Solar	The requirements are inconsistent with UL 1741 and IEEE 1547 as applied to existing solar PV inverter design. Compliance withn the proposed Standard would require an industry re-design and recognition from the Interconnecting Transmission Owner that projects would not meet these other standards. Additionally the Standard should provide for a phase in period for inverter based PV facilities so that such redesign can be accommodated.
Response: The standard criteria are applicable to voltage on the BES. The UL and IEEE standards will likely need to be considered if a plant performance Standard were to be developed.	
Kansas City Power & Light	Not aware of any conflicts.
MRO NERC Standards Review Subcommittee	No known conflict at this time.
IRC Standards Review Committee	None
Luminant Power	NA
Consumers Energy Company	No.
Old Dominion Electric Cooperative	No.
Lakeland Electric	No

Organization	Question 8 Conflict
Manitoba Hydro	none
American Electric Power	No known conflicts
Duke Energy	None
Independent Electricity System Operator	None

9. Are there other improvements that the SDT should consider for this revision of PRC-024-1 that you haven't already identified in response to other questions? If yes, please provide in the comment area.

Summary Consideration:

There were many different suggestions to improve upon the proposed Standard. They are summarized as follows:

- The Standard should only apply asynchronous generators.
- The Standard could lead to relays being activated needlessly.
- The Standard should apply at the generator terminals, not the POI.
- Consider other UFLS Standards activities.
- Consider over frequency setting at 63 hertz.
- Do not trip on under voltage.
- Provide additional technical detail.
- Provide clarity on relay settings.
- Clarify language.
- Concerns with generator damage, Standard exemptions, and who approves them.
- Steady state versus dynamic simulation.
- Implementation schedule concerns.
- Concerns over who reports what to whom.
- Transient vs. steady state applicability.
- Regional vs. NERC requirements.
- Reactive power requirements.

Organization	Yes or No	Question 9 Comment
Entergy Fossil Operations	Yes	Do away with this standard.

Organization	Yes or No	Question 9 Comment
Response: Thank you for comment. This Standard is an extension of work done in Phase III/IV and is deemed of value.		
NERC System Protection and Control Subcommittee (SPCS)	Yes	PRC-024 should only apply to non-synchronous machines. Coordination of synchronous generator voltage and frequency protective relay settings with transmission protection systems should be addressed along with all other coordination in PRC-001 Protection coordination. SPCS is preparing a Technical Reference paper on such coordination that is expected to be completed in June, 2009. Generator voltage and frequency protective relays are included in that that paper. The Attachment 2 voltage ride through curve was developed, to SPCS understanding, by compiling a number of system events delineating those events whereby the tripping of generators would exacerbate the event. It does not appear that the SDT analyzed data from the August 14, 2003 Northeast Blackout. Actual data from the event in Michigan, before the system cascaded and broke apart revealed 345 kV system voltages of less than 0.9 per unit. Some generators in Michigan tripped by undervoltage relays set at 0.9 per unit that significantly accelerated the cascade. Even those generators along the western fringe of the soon-to-be separated power system were of event more concern; data indicated these large units were experiencing 345-kV voltages of less than 0.9 per unit. Those generators did not trip because they did not have undervoltage relaying set to trip. Had these units tripped on undervoltage relaying, the event would have extended much further to the west of the actual impacted area. The Standard requires generator relays to be set based on a voltage at the interconnection point to the BES. However the relays are typically connected to a voltage source at the generator, not the BES interconnection. The translation from generator terminal voltage to a point of interconnection voltage is not a direct relationship. It will vary depending upon the assumption made for generator real and reactive output, or the distance to the point of interconnection. The Standard gives no direction regarding these assumptions. The voltage to be sensed must be the generator terminal voltage. IEEE C50.13 describes the standards to which the modern generators were built. This standard recommends reducing unit output after ascertaining the presence of an undervoltage alarm. This standard does not recommend unit tripping. Totally different relay settings will be obtained with different generator output assumptions. This lack of consistency will make it impossible to determine if compliance to the Standard is achieved. SPCS also have concerns with the overfrequency curve in Attachment 1 in light of the August 14, 2003 Northeast Cascade and Blackout. During the sequence of events an island formed consisting of portions of western New York and eastern Ontario with a significant generation-load mismatch. The surplus generation in the island resulted in an overfrequency condition to which several large generating units responded to arrest the overfrequency at 63 Hz. Had those units been set to trip on the proposed curve on August 14, the units would have tripped prematurely potentially leading to a collapse of the island. While the overfrequency curve may be acceptable as a floor for setting the overfrequency relays, there should also be a requirement to coordinate the overfrequency tripping with the unit controls and unit capability to maximize the ability of machines to control overfrequency while operating within their capability. Undervoltage alarms as experienced by hydro, fossil, combustion, and nuclear units are an indicator of possible thermal issues within the generator. Other alarms from RTDs and hydrogen pressure are better indicators. Manufacturers recommend operator action up to and including reduction in unit output rather than a unit trip. Tripping units on undervoltage is not recommended by the IEEE C37.102 standard on generator protection. Rather C37.102 also recommends alarm. Each type of unit, hydro, fossil, nuclear, combustion, and renewable generator have different thermal issues relating to system undervoltage. A single curve over-simplifies the issue to the point that system reliability is degraded. If any curve is included, it should be focused only on wind turbines as they have voltage ride through controls. Attachment 2 requires voltage evaluation at the system voltage level. Concerning Attachment 1, SPCS believes this is mainly present to insure that generator tripping will not interfere with UFLS programs. There should be a

Organization	Yes or No	Question 9 Comment
		statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." SPCS suggests that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs. The SDT has not described how the curve was compiled. Technical committees within the IEEE went to great lengths to describe the turbine blading off-frequency limitation curves. Every manufacturer submitted their curve and a family of curves was created that showed distinct curves for each manufacturer. The NERC 1978 document, "Underfrequency and Undervoltage Relay Applications Large Turbine Generators included a collection of individual manufacturer which when plotted together provided a prospective on the widely varying limits of the various turbines. There is a danger of misinterpretation to use one curve. In PRC-024-1 there was no description stating how the curve was developed. If a machine is not at risk and if a UFLS simulation shows that the bottom frequency will occur outside of the "one size fits all curve" then there should be a provision to use the manufacturer's curve rather than shed more load just to fit the attachment 1 curve.A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective devised, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and Voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer. Concerning A.R1.2 and Attachment 1, the language refers to a “no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. SPCS would suggest that setting directly on the curves should be permitted. For example, if 1.0 seconds at 57.8 Hz is directly on the curve, failure to deal with this question will result in pointless and counterproductive settings such as 1.0 seconds at 57.79 Hz. SPCS suggests "Setting directly on the curves is permitted, and settings outside the curves are permitted." Concerning A.R2, this Standard addresses setting of Voltage relays based on Voltage at the point of interconnection, which is not directly translatable to Voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard. Simply setting the generator protection relay at 0.90 per unit may, in fact, be an incorrect setting to achieve the desired performance. Settings must include allowances for all equipment tolerances: voltage transformer errors, relay tolerances, and testing instrumentation errors. The actual setting needed to account for such variances may require that the relay be actually set to trip at 0.84 or 0.86, or some other seemingly conflicting value, in order to achieve the goal of not tripping at 0.90 per unit.

Response: Thank you for your comment. The SDT has captured what we believe are the main points of your comment s and has provided responses below:

- **Apply only to asynchronous generators (synchronous gen goes to PRC-001) –** The SDT has taken the direction to develop a Standard that is technology neutral. PRC-001 currently addresses communication coordination review but not relay setting or generator performance specifically.
- **The Standard could lead to relays being activated needlessly –** The SDT agrees and has modified the proposed Standard to emphasize this point. If the GO has this relay equipment installed and has chosen to trip the generator with it, then the settings shall be determined in accordance with this Standard.

Organization	Yes or No	Question 9 Comment
• **POI issue –** The SDT has provided additional assumptions for the calculation of relay settings on the basis of the voltage as measured at the POI. It is provided in Attachment 2 of the revised Standard. The SDT specifically chose the point of interconnection because that is where the faults that this standard is intended to address occur. • **Over frequency setting at 63 hertz –** The SDT selected 62.5 hertz as a compromise level to account for the majority of generators installed in the system. This Standard does not require generators to set over-frequency relays. • **Alarm and not trip on under-Voltage –** The proposed Standard does not compel GOs to have or set under-voltage relays to trip generators. The SDT believes it would be inappropriate to prohibit the protection of the generator through the setting of protective relays. • **Include provision that UFLS shall not be interfered with –** At the recommendation of FERC and NERC, the SDT has coordinated the UF relay curve with the NERC UFLS SDT members' input. • **Delay this Standard until regional UFLS work is completed –** See above. The UFLS standard has been approved by stakeholders. • **Want more technical detail on development of curves –** A WECC white paper formed the basis of the development of the curves for this Standard, along with additional data from SERC, Xcel Energy, AWEA, GE and AREVA. This information is available upon request. • **Seek clarity regarding setting on the line or anywhere up to line –** We agree and the Standard was modified to provide improved clarity. • **Specify relay settings that account for various equipment tolerances –** There is room between the manufacturer capability curves and the settings limits curves that allows relays to be set to accommodate tolerances.		
PJM Interconnection	Yes	In R2.2.1, replace -greater- with -faster- or -slower-, whichever is correct. In R2.2.3 replace -intended- with -required-. In R4, replace -written- with -documented-. In R5, add an -s- to -System- in the parentheses. In R3, R4 and R5 - Concerned with the GO responsibility to send to their RC, PC, TO and TP. Would rather see the GO responsibility be to just to respond to any RC, PC, TO and TP requests.
Response: Thank you for your comment. The SDT has modified the Standard to address the language concerns. The SDT prefers the choice of "written" as opposed to "documented" in R4. The term "Protection System" is a defined NERC Glossary term. In R3 and R5 all the named entities must receive the information. In R4 we agree that only the requesting entity must receive the information.		
Dominion	Yes	We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that "For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected" We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system under voltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator (2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations? If the standard is intended to apply to volts per hertz

Organization	Yes or No	Question 9 Comment
		relays, suggest: 1. Revising footnote 1 to specifically include volts per hertz relays. 2. Revise Steps 4.2.1 and 4.2.2 to specifically include volts per hertz relays. 3. That the standard should incorporate specific guidance for facilities using volts per hertz logics and include a graph showing the voltage and frequency excursions in terms of volts per hertz.
Response: Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions, addressing the auxiliary systems concern. With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either. The SDT agrees and has added volts per hertz relays among the listed items in footnote 1.		
Northeast Power Coordinating Council	Yes	Referencing R5 and R6 of the Standard: The Reliability Coordinator should be give veto power over exceptions to the requirements herein. Should the Generator Owner/Operator not be able to, or be unwilling to, make changes to setpoints to come into compliance with this Standard, the Reliability Coordinator should be given the authority to invoke required mitigation, such as requiring the Generator Owner/Operator to contract for compensatory load shedding up to the total amount of MW of each generating unit that fails to comply with the required setpoints. In addition, The "Off-Nominal Frequency Capability Curve" in Attachment 1 does not coordinate with the underfrequency load shedding (UFLS) program design parameters proposed by the NERC Underfrequency Load Shedding Standard Drafting Team for Project 2007-01. The misccoordination occurs in the time range approximately between 5 and 10 seconds. This miscoordination can be eliminated by extending the horizontal line at 57.8 Hz to 5 seconds and revising the diagonal line to have endpoints at 57.8 Hz/5s and 59.5 Hz/1800s. This modification will provide coordination with the UFLS program design parameters while still maintaining coordination with turbine-generator capability. Due to the time scale on the graph in Attachment 2, the curves do not indicate the time at which the transient overvoltage and undervoltage requirements end, at which point the continuous voltage requirements would be applicable. Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to infer that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled. > A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective devised, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this question will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of voltage relays based on voltage at the

Organization	Yes or No	Question 9 Comment
		point of interconnection, which is not directly translatable to voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard. We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that "For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected" We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system undervoltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator?(2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations?
Response: Thank you for your comments. The SDT has captured what we believe are the main points of your comment sand has provided responses below: • **RC should have veto power over exemptions** – The SDT believes it is the responsibility of the GO to determine the capability of the existing unit. The judgment as to validity of an exemption is a compliance matter. • **RC should have authority to decide mitigation, e.g., compensatory load shedding –** The SDT believes mitigation of inability to comply with a Standard is a compliance matter. • **UFLS mis-coordination –** The UFLS SDT and this Standard Drafting Team conferred and resolved the mis-coordination. The resolution that was mutually agreed upon is for the UFLS SDT to modify its Standard to accommodate the frequency curve in this Standard. • **PRC-024 should not interfere with UFLS –** The two teams have coordinated the frequency curves and strategies. • **State that settings shall be determined to prevent machine damage in consultation with manufacturers' recommendation. –** The SDT developed the curves in accordance with manufacturer's recommendations and the Standard includes an exemption process for existing generators. • **Are settings permitted on the curve?** No, settings are not permitted on the curve/line and the Standard has been modified to reflect this more clearly. • **POI versus gen terminal –** The SDT specifically chose the point of interconnection because that is where the faults that this standard is intended to address occur. • **Aux systems relays and Steady state versus dynamic simulation –** Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions, addressing the auxiliary systems concern. With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either. The SDT agrees and has added volts per hertz relays among the listed items in footnote 1.		
SERC Dynamics Review Subcommittee (DRS)	Yes	1. We recommend deleting the proposed section R2.2.2. If not deleted, change: "meet a shorter voltage ride through" to "meet a less stringent voltage ride through". 2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be

Organization	Yes or No	Question 9 Comment
		provided before they are made in the field. 3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request"
Response: Thank you for your comments. **1. The SDT agrees and has modified the Standard to reflect this.** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable duration for the Time Horizon of the PA.** **3. The SDT agrees and has modified the Standard to reflect this.**		
Kansas City Power & Light	Yes	Please consider including the Balancing Authority as an entity for the Generator Owner to provide settings information in requirements R3 & R4 since the BA is an entity that has a direct relationship with the operational status of generating stations. R5: Do not agree with the bulleted item where increasing the capability of a generator by 10% is a reason for exemption expiration. As an example, turbine or boiler enhancements can result in greater efficiencies and resulting in an increase of generator capability with no change to the generator or its protection capabilities whatsoever. Recommend removal of this bulleted item. R5: The generator exciter voltage regulator contains protective relay settings such as Volts/Hertz, undervoltage, overvoltage, underfrequency that will also trip the Unit. Is the exciter voltage regulator considered to be part of the generator protective relay system? If so, would a limitation of the exciter voltage regulator be allowed as an exception to the standard or, since the protective system is excluded, would R5 mandate that the exciter voltage regulator be replaced to remove the exception? This issue should be clarified in R5.
Response: The SDT does not observe a reliability need to provide these setting data to the Balancing Authority. **The SDT intends for a GO that decides to increase capability of its unit by a significant amount (now 10%) to also address the technical limitation cited in its exemption.** **The NERC Glossary definition of Protective System does not appear to include voltage regulator. However the SDT intends this Standard to include exciter voltage regulator functions and relays that directly trip the generator based on frequency and voltage excursions.**		
MRO NERC Standards Review Subcommittee	Yes	It would be good to have the option of measuring the voltage at the Generator bus or POI. With the understanding that the voltage must be maintained of the POI.
Response: Thank you for your comment. The SDT agrees that it is the voltage at the POI that must be maintained.		

Organization	Yes or No	Question 9 Comment
FirstEnergy	Yes	1. FE's consensus is that the PRC-024 allowable under-frequency vs. time tripping curve is too tight. By too tight, we mean that the LP turbine buckets and blades are much more tolerant of off freq operation than the proposed tables. Comparing them to the old ECAR curves and allowable tripping times shows they are more stringent. Given how seldom these events occur, (never happened yet in the Eastern Interconnect) expending more of this capacity appears justified. 2. Section A5 Implementation schedule - it may not give sufficient time to implement these requirements. We suggest an additional year as follows: no less than 33% within 2 years of effective date no less than 66% within 3 years of effective date no less than 100% within 4 years of effective date 3. R1.2 Should say off-nominal not off-normal. 4. R2.1 Suggest changing the word "measured" to "experienced". 5. In R5, we suggest changing the first bullet to read: "The equipment causing the limitation is modified, upgraded or replaced with equipment that removes the technical limitation.", and then delete the second bullet. 6. Requirements 3, 4 and 6 specify that the Generator Owner shall provide information to RCs, PCs, TOPs, and TPs that monitor or model the associated unit; however, there is no requirement for these entities to identify themselves to the Generator Owner. How will the Generator Owner know they have identified all of the entities that need the information? 7. In R5, the Generator Owner is granted an exception from requirements R1 or R2 simply by providing documentation of a equipment limitations. There is no independent view of the appropriateness of this exception. The drafting team should consider requiring independent verification of the equipment limitation prior to the granting of an exception to the requirements of the standard. 8. Sec. D References - Is this intended to be part of the standard? If so, it would be helpful if it was linked to the white paper so that we can review it. 9. In Requirements R3 through R6, the SDT may want to consider adding the Transmission Owner as another entity who may need this information. 10. R2.2.1 may need to be re-worded as it requires that protection trip in no greater than 9 cycles. We are not aware of a disadvantage to the system if the tripping takes longer than 9 cycles.

Response:

1. **The SDT intends for GOs to set their relays as tight as possible and not merely on the curve/line.**
2. **The SDT set the timeframe by consensus among team members and the companies they represent. Stakeholder comments have not thus far objected to the implementation schedule. On this basis the SDT is leaving the schedule as proposed.**
3. **The SDT agrees and has made the change.**

Organization	Yes or No	Question 9 Comment
4. The SDT has modified the language in R2. **5. The intent of R5 (now R3 in the revised standard) is to require eliminating the exception if the generator is upgraded by 10% or more.** **6. The GO is expected to know what entity is its RC, PC, TO, and TP.** **7. The drafting team considered requiring an independent evaluation of existing generator exceptions and determined that it is not practical.** **8. No referenced documents are part of the Standard.** **9. The SDT considered including the Transmission Owner and determined that the Transmission Operator is the appropriate organization to receive the information.** **10. The 9 cycle maximum clearing time is intentional. It is not a system consideration, it is because generators cannot withstand zero voltage at the POI for long periods of time.**		
IRC Standards Review Committee	Yes	a. R5: The wording "the Generator Owner is granted an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation once it provides documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit, within 30 days of identifying the equipment limitation." is not written in a way to hold an entity responsible for any action. We suggest to reword it such that it places a responsibility to the Generator to seek approval for an exception, as follows: "the Generator Owner shall obtain approval for an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation through the submission of documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit within 30 days of identifying the equipment limitation. Along with this proposed change, there is also a need for the entities receiving the approval request to respond to the request. Another requirement is needed to complete this process. b. The latter part of R5 should be reworded to hold an entity responsible for the needed actions associated with expiring the exception such that the requirement is measurable and enforceable. c. R6: It is unclear to us what purpose this requirement serves. If R5 is to be revised as we suggest (see above), then the "limitation" in question will be presented with technical justification in the request for approval. The receiving entities (RC, PC, TOP and TP) will have a chance to accept or reject the request with due consideration of the technical argument. This is part of the approval request process; hence we do not see the need for R6 if R5 is to be reworded. If a remand process needs to be stipulated, then inclusion in R5 a requirement for the receiving entity(ies) to respond to the request - either approving or disproving the with a rationale, would suffice.
Response: Thank you for your comment. **a. The required action is for the GO to provide documentation of the equipment limitation. The SDT believes it is the GO's responsibility to determine any limitations on existing generators' ability to meet the Standard.**		

Organization	Yes or No	Question 9 Comment
b. The GO is responsible for meeting the requirements when an exception expires. **c. R6 (R4 in the revised standard) provides the RC, PC, TO, and TP with an opportunity to seek clarification concerning existing generator limitations in meeting the Standard.**		
Constellation Power Generation & Constellation Nuclear	Yes	The 4 kV protection that includes under frequency and under voltage relays trip the generator in some of our plants. The SDT needs to clarify whether this standard applies to such protection.
Response: Thank you for your comment. The Standard applies to setting of voltage and frequency relays that directly protect the generator.		
Southern Company	Yes	1. We recommend deleting the proposed section R2.2.2. If not deleted, change "meet a shorter voltage ride through" to "meet a less stringent voltage ride through". 2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be provided before they are made in the field. 3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request" 4. How did the SDT translate the transient voltage excursion plot to the cumulative voltage curve? 5. The voltage ride through curve was said to be cumulative, this should be specified on the curve.6. How can we prove that our static voltage curve coordinates with this cumulative curve 7. Implementation schedule we believe that the unit size should be considered, and that the most critical units should be worked on first. Completing 33% each year is too ambitious for those members that have > 300 units. 8. What regions are working on voltage ride through and Underfrequency (ufls and undefrequency tripping of generators) 9. Should the PRC-024 SDT wait until the regions have completed their work? 10. Generator engineers do not see a relevance for a voltage ride-through for any generator other than wind.
Response: Thank you for your comment. **1. The SDT agrees and has modified the Standard to reflect this.** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable duration for the time horizon of the PA.** **3. The SDT agrees and has modified the Standard to reflect this.**		

Organization	Yes or No	Question 9 Comment
4. The SDT analyzed the amount of time the voltage remained outside of the required range in each of the events modeled. **5. The SDT has clarified the language.** **6. A cumulative curve was selected to coordinate with relays that measure elapsed time.** **7. The SDT set the timeframe by consensus among team members and the companies they represent. Stakeholder comments have not thus far objected to the implementation schedule. On this basis the SDT is leaving the schedule as proposed.** **8. At the recommendation of FERC and NERC, the SDT has coordinated the UF relay curve with the NERC UFLS SDT members input.** **9. At the recommendation of FERC and NERC, the SDT has coordinated the UF relay curve with the NERC UFLS SDT members' input.** **10. The SDT has taken the direction to develop a Standard that is technology neutral.**		
Converteam Naval Systems Inc.	Yes	0. (Overall) This is a good document that has good background study and contains a lot of expertise;1. (Voltage definition inconsistency)In the LVRT curves, it talks about the voltage at the point of interconnection. However, in R2.1 it uses voltage at the generator terminals. I think there is a little inconsistency between these two. It would be good to just use one of them, preferably the former one. The reason is that different generator plants might have different impedance between the generator terminals and the points of interconnection, so defining the voltage at the terminals poses a little unfairness. Another part of the reason is that for transmission protection purpose, it should ends at the point of interconnection.2. (Voltage range inconsistency)The voltage range is 0.9-1.1pu in the VRT curve, but it says 0.95-1.05 in R2.1. It would be good to make it consistent.3. (Date point missing) In the table supporting the VRT curves, the 0.95 and 1.05pu data are missing.4. (Priority) WECC and MRO have different VRT curves. Which one will override which one at the end? Will the NERC PRC-024 take priority than the Regional Entities? 5. Was reactive power support during faults considered in the draft group? Will it be required in the future Thanks
Response: Thank you for your comment. **0. Thank you!** **1. The Standard applies to transient voltage excursions at the POI. R2.1 addresses steady state voltages at the generator terminals.** **2. The VRT curve addresses the transient voltage event. R2.1 addresses steady state conditions, outside the range of the VRT curve.** **3. The table addresses the transient voltage event and does not address steady state conditions.** **4. This proposed standard is a NERC standard. The SDT is not addressing current or future regional Standards.** **5. The Standard addresses voltage ride through. Reactive power and voltage support are important considerations in determining if a generator will meet the Standard. Methods to meet the Standard requirement are not specified in the Standard.**		
Consumers Energy	Yes	Please see comments on Question 3.

Organization	Yes or No	Question 9 Comment
Company		
Response: Thank you for your comment. Please see responses to Question 3.		
Old Dominion Electric Cooperative	Yes	Provide some insight on Technical Exceptions for generators that cannot met these requirements (the CIP TFE process might be useful in this)
Response: Thank you for your comment. The SDT believes it is the responsibility of the GO to determine the capability of the existing units to meet the Standard.		
Southern California Edison Company	Yes	The curves and tables in the attachments require additional clarification.
Response: Thank you for your comments. Additional clarification has been added.		
Progress Energy, Inc.	Yes	1. Recommend deleting proposed R2.2.2. If not deleted the language needs to be clarified as follows: "meet a shorter voltage ride through" should be changed to "meet a less stringent voltage ride through".2. In R3, change "within 30 calendar days of any change" to "at least 30 calendar days prior to any change". The changes should be provided before they are made in the field.3. In M4, change "entities listed in Requirement 4" to "entities listed in Requirement 4 that provide a written request"4. The purpose and the applicability of the standard needs to be revised to clearly specify that the scope of PRC-024-1 only applies to main generator protective relaying and excludes protective functions associated with plant auxiliary equipment.
Response: Thank you for your comments. **1. The SDT agrees and has modified the Standard to reflect this.** **2. The SDT intends this requirement to ensure timely notification of equipment changes to the PA and 30 days is a reasonable during for the time horizon of the PA.** **3. The SDT agrees and has modified the Standard to reflect this.** **4. The Standard has been modified and now applies to overall new generator performance.**		
NIPSCo	Yes	R4 These groups should already have this information. The coordinators or planners should have proof and be able to provide this information now.R5 Normally would not accumulate enough time in the under-frequency zone to be a danger to the turbine blades but under unusual circumstances might accumulate too much time and not be able to continue to operate in the under-frequency region that is being specified. We might not have enough time to wait for the 30 day period.

Organization	Yes or No	Question 9 Comment
Response: Thank you for your comment. • **The purpose of the Standard is to assure that the relay setting information is available to the groups that require it.** • **Existing generators that are not able to meet the Standard are able to obtain an exception.**		
Northeast Utilities	Yes	R2.2.1 seems to imply that a generator must set an undervoltage trip with a time delay of no more than 9 cycles. This seems to conflict with the intent of PRC-024. Is the intent perhaps to require the TO to clear Zone 1 faults in no more than 9 cycles? Or is the intent to allow the GO to set the time delay as low as 9 cycles and no less? I suggest the latter.R3, R4, and R5 - This information should be provided to the owner of any UFLS or UVLS as well.
Response: Thank you for your comment. The intent is to allow TOs to reduce the required 9 cycle ride through requirement in cases where transmission system design allows faster clearing.		
Hydro-Québec TransEnergie (HQT)	Yes	Referencing R5 and R6 of the Standard: The Reliability Coordinator should be give veto power over exceptions to the requirements herein. Should the Generator Owner/Operator not be able to, or be unwilling to, make changes to setpoints to come into compliance with this Standard, the Reliability Coordinator should be given the authority to invoke required mitigation, such as requiring the Generator Owner/Operator to contract for compensatory load shedding up to the total amount of MW of each generating unit that fails to comply with the required setpoints. In addition, The "Off-Nominal Frequency Capability Curve" in Attachment 1 does not coordinate with the underfrequency load shedding (UFLS) program design parameters proposed by the NERC Underfrequency Load Shedding Standard Drafting Team for Project 2007-01. The misccoordination occurs in the time range approximatley between 5 and 10 seconds. This miscoordination can be eliminated by extending the horizontal line at 57.8 Hz to 5 seconds and revising the diagonal line to have endpoints at 57.8 Hz/5s and 59.5 Hz/1800s. This modification will provide coordination with the UFLS program design parameters while still maintaining coordination with turbine-generator capability. Due to the time scale on the graph in Attachment 2, the curves do not indicate the time at which the transient overvoltage and undervoltage requirements end, at which point the continuous voltage requirements would be applicable. Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to infer that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled. > A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective devised, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration applies to both frequency and voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations

Organization	Yes or No	Question 9 Comment
		which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this question will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of voltage relays based on voltage at the point of interconnection, which is not directly translatable to voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard. We would like to commend the SDT for recognizing that there may be technical reasons that prevent a generator from meeting requirements 1 and 2 and allowing an exemption when technical basis is provided (R5). There is a paragraph on the second page which states that " For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected "We have the following questions: (1) Do the relays mentioned in the statement above include auxiliary system undervoltage relays? It appears the voltage relay part of the standard is limited to only relays that directly trip the generator and not relays that trip auxiliaries. Is that the intent? What if the relay was attached to an auxiliary bus, but tripped the generator?(2) How is that only steady state evaluations are enough? How do you study voltage recovery characteristics without dynamic simulations?
Response: Thank you for your comment. • **The GO has the responsibility for determining the capability of existing generators and their ability to meet this Standard. How the power system deals with the inability of an existing generator to meet the Standard requirements is not addressed in this Standard.** • **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.** • **The voltage curve ends at 1000 seconds. Steady state limits apply after 600 seconds.** • **Clarification has been added that the Standard does not require voltage or frequency protective relays to be installed or enabled.** • **Clarification has been added concerning setting relays exactly on the curve.** • **Clarification has been added concerning assumptions to be made when calculating generator terminal voltage settings that correspond to required POI limits.** • **The Standard has been modified to also be a new generator performance standard.** • **With respect to steady state evaluations versus dynamic simulations, the Standard does not preclude the application of either.**		
AESO	Yes	In addition to the SRC ISO/RTO comments the AESO would like to add: As we understand it, the intent of this standard is to ensure that the generators ride through certain levels of frequency and voltage excursions, yet it only addresses the generator protection. We feel it must also address the protection and capabilities of the auxiliaries, unit transformers, lines, etc. If any of these trip off due

Organization	Yes or No	Question 9 Comment
		to the same excursions that the generator is required to ride through, then the generator will be down and the standard will not have achieved its goal.
Response: Thank you for your comment. Based on industry input, the Standard has been modified to require new generators to ride through voltage and frequency excursions.		
Duke Energy	Yes	The issue typically addressed by international grid codes is an over-all plant performance standard and plant dynamic studies are performed to evaluate the impact on in-plant systems. Standards applicable to only generator protection might give a false sense that a plant could survive the transients and the reliability of the BES would be just as adversely impacted if large plants were to trip for causes other than a main generator relay. The basis and reliability benefit for voltage ride through transients should be clarified. Generator UF relays must coordinate with grid UFLS relaying. Some areas may apply UVLS and logic dictates that the coordination of that protection with a generator ride through criteria should be specified. Recommend that the scope of "equipment" that can be granted an exception be limited in some way or explicitly qualified. Otherwise, plant performance can be dictated by less-consequential auxiliary equipment (e.g. variable speed drives with UV settings per manufacturer standard instructions). Because R5 grants exception automatically in response to the GO providing documentation of any limitation. R5 bullet 2 - recommend changing "generator nameplate capacity rating" to "generator gross Real Power capability". The existing words are too general and including 'nameplate' is confusing.
Response: Thank you for your comment. • **The Standard has been modified to require new generators to ride through voltage and frequency excursions.** • **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.** • **The GO has the responsibility for determining the capability of existing generators and their ability to meet this Standard.** • **The term “nameplate capacity” is not used in the revised standard.**		
New York Independent System Operator	Yes	Here are several other points that have come up regarding other parts of PRC-024-1 that were not covered above:> Concerning Attachment 1, we believe this is mainly present to insure that generator tripping will not interfere with UFLS programs. There should be a statement that settings should not interfere with UFLS program in effect. Also on Attachment 1, this is now labeled "Off Nominal Frequency Capability Curve." We wish to suggest that the word "capability" in this label is potentially misleading. This is not a machine capability curve. There should be a statement that protective device settings should be based on machine damage considerations and should be arrived at in consultation with the machine manufacturer. The curve presents limits to those settings which are designed to prevent interference with UFLS programs, and the curve should be so labeled.> A.R1 and A.R2 wording could be taken to require that such relaying should be enabled and set. The phrase "Installed relaying not to trip during" could be taken to mean that such relaying is assumed to be, or should be, installed. Also, in the case of generator multifunction protective device, such relaying is always installed but it is not appropriate in many cases that it be enabled and set. Note this consideration

Organization	Yes or No	Question 9 Comment
		applies to both frequency and Voltage. In general, this Standard should take care to point out that any protection application should be based on actual specific machine protective considerations which should be arrived at in consultation with the machine manufacturer.> Concerning A.R1.2 and Attachment 1, the language refers to a 'no trip zone" between curves, and obviously there is a permissible trip zone outside the curves. Questions will arise on permissibility of settings which are actually on the curves. We would suggest that setting directly on the curves should be permitted. For example, if 1.0 s. at 57.8 Hz is directly on the curve, failure to deal with this questions will result in pointless and counterproductive settings such as 1.0 s. at 57.79 Hz. We suggest "Setting directly on the curves are permitted, and settings outside the curves are permitted."> Concerning A.R2, this Standard addresses setting of Voltage relays based on Voltage at the point of interconnection, which is not directly translatable to Voltage at the generator terminals. The generator real and reactive power output will affect the relationship, and this is not dealt with in this Standard.
Response: Thank you for your comment. • **The UFLS SDT and this Standard Drafting Team conferred and have coordinated the frequency curves and strategies.** • **Determining existing generator capability is the responsibility of the GO.** • **Clarification has been added to make it clearer that the Standard does not require installing voltage or frequency protection relays nor does it require setting any relays at the curve values.**		
Xcel Energy	Yes	Please clarify if there is an expectation/requirement for new units to install voltage and frequency protective relays.
Response: Thank you for your comment. There is no requirement for any generator to install or have voltage or frequency protective relays. Clarification has been added.		
CenterPoint Energy	Yes	a) CenterPoint Energy is concerned with what appears to be a lack of consistency and coordination between standards efforts. Considering PRC-023, CenterPoint Energy believes it is illogical to have transmission relay loadability requirements based on 0.85 pu system voltage for an extended period (such as, 15 minutes) to allow system operators to take remedial actions, while exempting generators from comparable requirements. For another example, it appears this proposed standard is not consistent with that being proposed for under-frequency load shedding systems that can help prevent cascading outages. b) Requirements, such as R2.2.1 and R2.2.2, are essentially fill-in-the-blank, location-specific criteria that are unnecessary and could have unintended consequences. Location-specific criteria can change over time with additions and modifications of the transmission system. Entities will have no incentives to voluntarily exceed the minimum required criteria, even though their plant has a greater ride-though capability. R2.2.1 further allows relaying to be set on actual fault clearing times, instead of the 9 cycles indicated in Attachment 2. In addition, R2.2.2 allows the use of location-specific criteria, but only if such criteria are less stringent. CenterPoint Energy believes NERC reliability standards should not include fill-in-the-blank, location-specific criteria. CenterPoint Energy recommends modifying R2.2.1 to reference Attachment 2 and to clarify the ride-through criteria is zero voltage for 0.15 seconds (9 cycles). CenterPoint Energy recommends deleting R2.2.2. c) R5 allows generating plants to meet less stringent criteria if generator

Organization	Yes or No	Question 9 Comment
		manufacturer literature indicates limitations, which would further erode system support from generation resources. It does not appear there is any process to substantiate the legitimacy of such limitations. CenterPoint Energy recommends deleting R5 and associated references.
Response: Thank you for your comment. **a) The Standard has been modified to require new generators to ride through voltage and frequency excursions. The SDT has coordinated the development of the UF relay curve with UFLS SDT.** **b) Requirements R2.2.1 and R 2.2.2 (new R2.1.2) allow the TO to relax the voltage ride through requirements in specific cases where the transmission system is designed to accommodate reduced generator performance.** **c) New R3 exempts existing generators that are not capable of meeting the Standard's requirements from having to do so. The GO is responsible for determining the generator's capabilities.**		
Independent Electricity System Operator	Yes	a. R5: The wording "the Generator Owner is granted an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation once it provides documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit, within 30 days of identifying the equipment limitation." is not written in a way to hold an entity responsible for any action. We suggest to reword it such that it places a responsibility to the Generator to seek approval for an exception, as follows:"the Generator Owner shall obtain approval for an exception for that unit from meeting the portion of Requirement R1 or R2 for that limitation through the submission of documentation of the equipment limitation(s) to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit within 30 days of identifying the equipment limitation." The requirement for getting non-conforming protection approved should be so stipulated to put the onus for mitigating actions on the Generator Owners. For example, in the case of non-conforming underfrequency settings, the requesting Generator Owner should be required to demonstrate that mitigating (i.e. arrangements for additional compensating load shedding) measures have been arranged with the Balancing Authority in their submission. Equipment settings that infringe upon the curves may be implemented only after approval is granted by the appropriate entities. Along with this proposed change, there is also a need for the entities receiving the approval request to respond to the request. Another requirement is needed to complete this process. b. The latter part of R5 should be reworded to hold an entity responsible for the needed actions associated with expiring the exception such that the requirement is measurable and enforceable. c. R6: It is unclear to us what purpose this requirement serves. If R5 is to be revised as we suggest (see above), then the "limitation" in question will be presented with technical justification in the request for approval. The receiving entities (RC, PC, TOP and TP) will have a chance to accept or reject the request with due consideration of the technical argument. This is part of the approval request process, hence we do not see the need for R6 if R5 is to be reworded. If a remand process needs to be stipulated, then inclusion in R5 a requirement for the receiving entity(ies) to respond to the request - either approving or disproving the with a rationale, would suffice.
Response: Thank you for your comment.		

Organization	Yes or No	Question 9 Comment
a) The required action in new R3 is for the GO to provide documentation of the equipment limitation(s) to the RC, PC, TO, and TP. The GO is not required to seek approval. **b) The SDT believes that new R3 is measurable and enforceable.** **c) The purpose of new R3 is to exempt existing generators that are not capable of meeting the Standard from having to do so.**		
Ameren	Yes	This standard could be ineffective if someone's auxiliary power protection trips out on low voltage or frequency and brings the unit down before the generator protection. Those settings on the aux buses are there to protect the equipment from failure since most of the downstream loads such as motors and electronics won't ride through an excursion as well as large T/G sets. We suggest that ANSI/IEEE Standards C37.102, C50.12, and C50.13 should be used and listed as references to this Standard. Reporting mechanism in R3 and R4 raises some commercial concerns. We prefer a secure repository of reporting to the RRO. Then only those who do have valid reasons for studies or monitoring could be granted access to the information. Footnote 1 expands 'protective relays' definition to include voltage regulator, etc. Instead state that only direct trip elements (functions) in the voltage regulator and exciter are included, if that's the intent. It should be made very clear.
Response: Thank you for your comment. • **The Standard has been modified to require new generators to ride through voltage and frequency excursions.** • **The SDT recognizes that the information required to be reported must be protected appropriately and expects the receiving organizations will fulfill all of their information protection obligations.** • **Clarification has been added to footnote 1.**		
PPL Energy Plus	Yes	PPL is concerned with the following concepts in the standard: 1) The standard applies equally to asynchronous and synchronous machines, salient pole and round rotor machines, photovoltaic, and other resources and as such the standard does not appear to recognize that these technologies respond differently to voltage and frequency excursions. 2) Better clarity of generator owner and transmission owner roles regarding changing existing fault clearing times is needed in the proposed standard. 3) R2.2 requires further clarity regarding relay settings. 4) R3 and R4 look the same. 5) The reference paper under Section D needs a thorough review by the industry.
Response: Thank you for your comment. **1. The SDT has taken the direction to develop a Standard that is technology neutral.** **2. The TO is allowed to relax the relay setting standard (shorter durations or higher minimum voltages and or lower maximum voltages) if the full capability of the standards is not required in specific instances.** **3. Further clarification has been added.**		

Organization	Yes or No	Question 9 Comment
4. Old R3 and old R4 are combined into the new R6. **5. The SDT welcomes thorough industry review of the reference paper.**		
US Bureau of Reclamation	Yes	Requirements R3 and R4 place a coordinating role on the Generator Owner to provide trip settings to four entities, the Reliability Coordinator, Planning Coordinator, Transmission Operator, and Transmission Planner. We believe it is more appropriate for the Generator Owner to coordinate settings with a single Transmission entity since the purpose of the Standard is "... to support transmission system stability during voltage and frequency excursions." and for the Transmission entity to further coordinate if necessary. The Transmission entity is in a better position to know what additional entities, if any should be involved. For the data points provided in the Attachment 2, HVRT DURATION and LVRT DURATION, we recommend both time and voltage units of measure be provided.
Response: Thank you for your comment. Old R3 and old R4 are combined into the new R6. The SDT agrees with the comment and has added clarification to the voltage and time units in Attachment 2		
American Transmission Company	No	It would be beneficial to have the option of measuring the voltage at the generator bus or point of interconnection (POI), with the understanding that the proper voltage must be maintained at the POI.
Response: Thank you for your comment. The SDT specifically chose the point of interconnection because that is where the faults occur that this Standard is intended to address. The SDT has provided additional assumptions for the calculation of relay settings on the basis of the voltage as measured at the POI.		
E.ON U.S.	No	
AWEA	No	
Luminant Power	No	
American Wind Energy Association	No	
Veolia Environmental Services	No	
Lakeland Electric	No	

Organization	Yes or No	Question 9 Comment
Manitoba Hydro	No	
American Electric Power	No	