

# WECC Voltage Criteria

---



Caroline Marzinzik

[caroline@powerworld.com](mailto:caroline@powerworld.com)

217 384 6330 Ext. 12



**PowerWorld**  
Corporation

2001 South First Street  
Champaign, Illinois 61820  
+1 (217) 384.6330

# TPL-001-WECC-CRT-3

---



- WR1. 1.2.
  - Post-Contingency steady-state voltage deviation at each applicable BES bus serving load shall not exceed 8% for P1 events.
- WR1. 1.3.
  - Following fault clearing, the voltage shall recover to 80% of the pre-contingency voltage within 20 seconds of the initiating event for all P1 through P7 events, for each applicable BES bus serving load.

# TPL-001-WECC-CRT-3

---



- WR1. 1.4.
  - Following fault clearing and voltage recovery above 80%, voltage at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds, for all P1 through P7 events.

# TPL-001-WECC-CRT-3

---



- WR1. 1.5.
  - For Contingencies without a fault (P2.1 category event), voltage dips at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds.

# Categories



- Comma-separated user-specified strings (text)
- Used with steady-state and transient contingencies
- Steady-state contingencies
  - Can be assigned to both Contingencies and Custom Monitors
  - Specify which Custom Monitors are active for a contingency
  - No Categories specified for a contingency means that all Custom Monitors are active
  - No Categories specified for a Custom Monitor means that it is active for all contingencies
  - At least one matching category in both a contingency and Custom Monitor means that Custom Monitor is active for that contingency

# Categories



- Transient stability contingencies
  - Can be assigned to both Transient Contingencies and Transient Limit Monitors
  - Specify which Transient Limit Monitors are active for a transient contingency
  - No Categories specified for a transient contingency means that all Transient Limit Monitors are active
  - No Categories specified for a Transient Limit Monitor means that it is active for all transient contingencies
  - At least one matching category in both a transient contingency and Transient Limit Monitor means that Transient Limit Monitor is active for that transient contingency

# Steady-State Contingencies Categories



Contingency Analysis

Contingencies Options Results

	Label	Skip	Category	Processed	Solved	Post-CTG AUX	Islar Lo
1	L_000001One-000002TwoC1	NO	P0,P1	NO	NO	none	
2	L_000001One-000003ThreeC1	NO	P2	NO	NO	none	
3	L_000002Two-000003ThreeC1	NO	Mine	NO	NO	none	
4	L_000002Two-000004FourC1	NO	P0,P1,P2	NO	NO	none	
5	L_000002Two-000005FiveC1	NO		NO	NO	none	
6	L_000002Two-000006SixC1	NO		NO	NO	none	

Contingency Definition Dialog

Contingency Label: L\_000001One-000002TwoC1

Definition: Custom

Actions	Model Criteria	Status	Persisten	Time Delay
1 OPEN Line One 138.0 TO Two 138.0 CKT-1		CHECK	NO	0

Categories: P0,P1

Use specific solution options:  Define Solution Options

Ignore ALL contingency specific solution options:

Post-Contingency Auxiliary File:  Browse

This auxiliary file is loaded at the start of each contingency. Special post-contingency settings can be entered in this auxiliary file. Note: This option will override the Advanced Contingency Option

OK Save Delete Cancel Help

Specify categories with steady-state contingencies. Comma-separated strings that can be anything that the user wants.

# Custom Monitor Categories



Contingency Analysis

Contingencies Options Results

Modeling

- Basics
- Generator Post-Contingency AGC
- Bus Load Throw Over
- Generator Maximum MW Response
- Generator Line Drop and RCC
- Switched Shunt Post CTG
- Post-Contingency Auxiliary File
- Transient Models
- Limit Monitoring
  - Advanced Limit Monitoring
  - Monitoring Exceptions
  - Custom Monitors

Limit Monitoring Settings ...  When using Integrated Topology Processing, monitor only the primary bus for each superbus

Custom Monitors

Records Set Columns Options

Custom Monitors will only be recorded when in ac power flow mode and not using one of the linear calculation methods.

	Name	Category	Object Type	Object Name	Variablename	Pre Filter
1	Voltage 8% Decrease	P1	Bus		BusPUVolt	Bus Contains Load
2	Voltage 8% Increase	P1	Bus		BusPUVolt	Bus Contains Load

Specify categories with Custom Monitors. Comma-separated strings that can be anything that the user wants.

Custom Monitor

Custom Monitor Name: Voltage 8% Decrease

Enabled Rename

Categories: P1

Choose Object

All objects of Element Type  
 Specific object

Element Type: Bus

7 entries  
Sort by  Name  Number

Filter: Advanced Bus

Use PreFilters Quick Define Remove

Search Next Search All

You can use wildcard characters \* or ?

1 (One)  
2 (Two)  
3 (Three)  
4 (Four)  
5 (Five)  
6 (Six)

Choose a Field: Find... Voltage Per Unit Magnitude

Choose a Pre Filter: Modify Bus Contains Load

Choose a Post Filter: Add

Report violations if the increase in field value > 0.00  
 Report violations if the decrease in field value > 8.00

Meaning of Change Values  
 Change from Initial Value  
 % Change from Initial Value

OK Help Cancel



# Transient Stability Contingencies Categories



Transient Stability Analysis

Simulation Status: Not Initialized

Run Transient Stability | Pause | Abort | Restore Reference | For Contingency: Find My Transient Contingency

Select Step: Simulation, Control, Definitions, Violations, Options, Result Storage, Plots, Results from RAM, Transient Limit Monitors, States/Manual Control, Validation, SMIB Eigenvalues, Modal Analysis, Dynamic Simulator Options

Simulation: Add... Delete... Rename... Clone Contingency...

Control: Definitions Violations

Simulation Time Values: Start Time (seconds): 0.000, End Time (seconds): 10.000, Time Step (cycles): 0.500. Specify Time Step in: Seconds, Cycles.

Summary Results: Generation, Load, Tripped, Isolated.

Categories: P0,P1 Change...

Transient Contingency Elements: Insert, Clear All, Insert Apply/Clear/Open, Time Shift (seconds): 0.000

Object Pretty	Time (Cycles)	Time (Seconds)	Object	Description	Enabled
1 Bus One	60.0	1.000000	Bus 'One_138.0'	FAULT 3PB SOLID	CHECK
2 Bus One	66.0	1.100000	Bus 'One_138.0'	OPEN	CHECK

Process Contingencies:  One Contingency at a time,  Multiple Contingencies

Specify categories with Transient Stability contingencies. Comma-separated strings that can be anything that the user wants.

Transient Stability Analysis

Simulation Status: Not Initialized

Run Transient Stability | Pause | Abort | Restore Reference

Select Step: Simulation, Options, Result Storage, Plots, Results from RAM, Transient Limit Monitors, Validation, SMIB Eigenvalues, Modal Analysis, Dynamic Simulator Options

Simulation: Add... Delete... Rename... Clone Contingency...

Control: Definitions Violations

Transient Contingencies:

Name	Category	Start Time	End Time	Cycles for Step	Time Step	Skip	Processed	Solved	Reason Not Solved	Violations	Tripped
1 My Transient Contingency	P0,P1	0.000000	10.000000	YES	0.500000	NO	NO	NO		0	

Transient Contingency Elements: Insert, Clear All, Insert Apply/Clear/Open, Time Shift (seconds): 0.000

Object Pretty	Time (Cycles)	Time (Seconds)	Object	Description	Enabled
1 Bus One	60.0	1.000000	Bus 'One_138.0'	FAULT 3PB SOLID	CHECK
2 Bus One	66.0	1.100000	Bus 'One_138.0'	OPEN	CHECK

Transient Contingency Monitor Violations: Limit Monitor Name, None

Process Contingencies:  One Contingency at a time,  Multiple Contingencies

Save All Settings To | Load All Settings From | Show Transient Contour Toolbar | Auto Insert... | ? Help | Close

# Transient Limit Monitor Categories



Transient Stability Analysis

Simulation Status: Not Initialized

Run Transient Stability | Pause | Abort | Restore Reference | For Contingency: Find | My Transient Contingency

Select Step

- Simulation
- Options
- Result Storage
- Plots
- Results from RAM
- Transient Limit Monitors
  - Transient Limit Monitors
  - Monitor Violations
- States/Manual Control
- Validation
- SMIB Eigenvalues
- Modal Analysis
- Dynamic Simulator Options

Transient Limit Monitors

	Name	Active	Category	Abort	Abort Delay
1	WECC Category B Voltage Dip No	NO		Log	0.00
2	WECC Category B Voltage Dip Load	NO		Log	0.00
3	WECC Category B Voltage Dip Load	NO		Log	0.00
4	WECC Category B Frequency	NO		Log	0.00
5	WR1. 1.3.	YES		Log	0.00
6	WR1. 1.4. Part 1	YES		Log	0.00
7	WR1. 1.4. Part 2	YES		Log	0.00
8	WR1. 1.5. Part 1	YES	P2.1	Log	0.00
9	WR1. 1.5. Part 2	YES	P2.1	Log	0.00

Transient Limit Monitoring Dialog

Name: WR1. 1.5. Part 1

Save | Save As | Rename | Delete

Active | Categories: P2.1

Objects and Field Monitored

Device Type: Bus | Filter objects for monitoring:  All,  Meets Filter,  Load Buses Only,  Non Load Buses Only,  Area/Zone Filters

Field: V pu | Define Filter...

Action To Take:  Log Violation Only,  Abort Simulation,  Trip (Open) Device | Use a time delay of 0.00 Seconds | Maximum number of violations of this limit monitor to store: 100

Limit Value: 70.00 % | Limit Duration Units:  Seconds,  Cycles | Initial Value | Violation | Limit Value | Limit Duration

Limit Type:  Lower,  Upper | Meaning of the values specified:  Actual value,  Percent of initial value,  Deviation from initial value,  Percent deviation from initial value,  ABS: After using meaning, take absolute value

Show Special Triggers to Start or Stop Transient Limit Monitoring

OK | Help | Cancel

Specify categories with Transient Limit Monitors. Comma-separated strings that can be anything that the user wants.

# WR1. 1.2.



- Could be done with Advanced Limit Monitoring if not limited to a particular type of contingency (P1)
- Monitoring this criteria for only load buses can be achieved through Limit Group settings

Always report as a violation if the ...

Increase in line/transformer flows >=	999.00	%
Decrease in low bus voltage >=	8.00	%
Increase in high bus voltage >=	8.00	%
Increase in interface flows >=	999.00	%

Voltage change criteria can be specified for all contingencies or for Limit Groups used by only load buses

- Custom Monitors can monitor based on category and only load buses

# WR1. 1.2.



Custom Monitors allow specification of specific categories to use with particular contingencies AND can filter to only monitor load buses

Custom Monitor dialog for "Voltage 8% Decrease". The dialog is titled "Custom Monitor" and has a close button (X) in the top right corner. The "Custom Monitor Name" field contains "Voltage 8% Decrease". The "Enabled" checkbox is checked. The "Categories" field contains "P1". The "Choose Object" section has "All objects of Element Type" selected. The "Element Type" dropdown is set to "Bus". The "Filter" dropdown is set to "Advanced" and "Bus". The "Choose a Field:" dropdown is set to "Voltage\Per Unit Magnitude". The "Choose a Pre Filter:" dropdown is set to "Bus Contains Load". The "Choose a Post Filter:" dropdown is empty. The "Report violations if the increase in field value >" checkbox is unchecked, and the "Report violations if the decrease in field value >" checkbox is checked. The "Meaning of Change Values" section has "Change from Initial Value" selected. The "OK", "Help", and "Cancel" buttons are at the bottom.

Custom Monitor dialog for "Voltage 8% Increase". The dialog is titled "Custom Monitor" and has a close button (X) in the top right corner. The "Custom Monitor Name" field contains "Voltage 8% Increase". The "Enabled" checkbox is checked. The "Categories" field contains "P1". The "Choose Object" section has "All objects of Element Type" selected. The "Element Type" dropdown is set to "Bus". The "Filter" dropdown is set to "Advanced" and "Bus". The "Choose a Field:" dropdown is set to "Voltage\Per Unit Magnitude". The "Choose a Pre Filter:" dropdown is set to "Bus Contains Load". The "Choose a Post Filter:" dropdown is empty. The "Report violations if the increase in field value >" checkbox is checked, and the "Report violations if the decrease in field value >" checkbox is unchecked. The "Meaning of Change Values" section has "Change from Initial Value" selected. The "OK", "Help", and "Cancel" buttons are at the bottom.

# WR1. 1.3.



Transient Limit Monitoring Dialog

Name: WR1. 1.3.

Buttons: Save, Save As, Rename, Delete

Active Categories: [ ]

Objects and Field Monitored

Device Type: Bus

Field: V pu

Filter objects for monitoring

All

Meets Filter

Load Buses Only

Non Load Buses Only

Area/Zone Filters

Define Filter...

Action To Take

Log Violation Only

Abort Simulation

Trip (Open) Device

Use a time delay of: 0.00 Seconds

Maximum number of violations of this limit monitor to store: 100

Limit Value: 80.00 %

Limit Duration: 20.0000 Seconds

Limit Duration Units:  Seconds  Cycles

Limit Type:  Lower  Upper

Meaning of the values specified

Actual value

Percent of initial value

Deviation from initial value

Percent deviation from initial value

ABS: After using meaning, take absolute value

Show Special Triggers to Start or Stop Transient Limit Monitoring

Buttons: OK, Help, Cancel

Following fault clearing, the voltage shall recover to 80% of the pre-contingency voltage within 20 seconds of the initiating event for all P1 through P7 events, for each applicable BES bus serving load.

# WR1. 1.4. Part 1



Transient Limit Monitoring Dialog

Name: WR1. 1.4. Part 1

Buttons: Save, Save As, Rename, Delete

Active

Categories: [Empty]

Objects and Field Monitored

Device Type: Bus

Field: V pu

Filter objects for monitoring

All

Meets Filter

Load Buses Only

Non Load Buses Only

Area/Zone Filters

Action To Take

Log Violation Only

Abort Simulation

Trip (Open) Device

Use a time delay of: 0.00 Seconds

Maximum number of violations of this limit monitor to store: 100

Limit Value: 70.00 %

Limit Duration: 30.00 Cycles

Limit Duration Units:  Cycles

Initial Value: [Graph]

Violation: [Graph]

Limit Value: [Graph]

Limit Duration: [Graph]

Limit Type:  Lower

Upper

Meaning of the values specified

Actual value

Percent of initial value

Deviation from initial value

Percent deviation from initial value

ABS: After using meaning, take absolute value

Hide Special Triggers to Start or Stop Transient Limit Monitoring

Special Triggers to Start or Stop Transient Limit Monitoring	Use	Value
Stop monitoring if a value is above	<input type="checkbox"/>	0.00 %
Start monitoring if a value is above	<input checked="" type="checkbox"/>	80.00 %
Stop monitoring if a value is below	<input type="checkbox"/>	0.00 %
Start monitoring if a value is below	<input type="checkbox"/>	0.00 %

Buttons: OK, Help, Cancel

Following fault clearing and voltage recovery above 80%, voltage at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds, for all P1 through P7 events.

# WR1. 1.4. Part 2



Transient Limit Monitoring Dialog

Name: WR1. 1.4. Part 2

Buttons: Save, Save As, Rename, Delete

Active Categories: [ ]

Objects and Field Monitored

Device Type: Bus

Field: V pu

Filter objects for monitoring

All

Master Filter

Load Buses Only

Non-load buses Only

Area/Zone Filters

Action To Take

Log Violation Only

Abort Simulation

Trip (Open) Device

Use a time delay of: 0.00 Seconds

Maximum number of violations of this limit monitor to store: 100

Limit Value: 80.00 %

Limit Duration: 2.0000 Seconds

Limit Duration Units:  Seconds  Cycles

Limit Type:  Lower  Upper

Meaning of the values specified

Actual value

Percent of initial value

Deviation from initial value

Percent deviation from initial value

ABS: After using meaning, take absolute value

Hide Special Triggers to Start or Stop Transient Limit Monitoring

Special Triggers to Start or Stop Transient Limit Monitoring	Use	Value
Stop monitoring if a value is above	<input type="checkbox"/>	0.00 %
Start monitoring if a value is above	<input checked="" type="checkbox"/>	80.00 %
Stop monitoring if a value is below	<input type="checkbox"/>	0.00 %
Start monitoring if a value is below	<input type="checkbox"/>	0.00 %

Buttons: OK, Help, Cancel

Following fault clearing and voltage recovery above 80%, voltage at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds, for all P1 through P7 events.

# WR1. 1.5. Part 1



Transient Limit Monitoring Dialog

Name: WR1. 1.5. Part 1

Buttons: Save, Save As, Rename, Delete

Active Categories: P2.1

Objects and Field Monitored

Device Type: Bus

Field: V pu

Filter objects for monitoring

All

Meets Filter

Load Buses Only

Non Load Buses Only

Area/Zone Filters

Define Filter...

Action To Take

Log Violation Only

Abort Simulation

Trip (Open) Device

Use a time delay of: 0.00 Seconds

Maximum number of violations of this limit monitor to store: 100

Limit Value: 70.00 %

Limit Duration: 30.00 Cycles

Limit Duration Units:  Cycles

Limit Type:  Lower

Meaning of the values specified

Actual value

Percent of initial value

Deviation from initial value

Percent deviation from initial value

ABS: After using meaning, take absolute value

Show Special Triggers to Start or Stop Transient Limit Monitoring

Buttons: OK, Help, Cancel

For Contingencies without a fault (P2.1 category event), voltage dips at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds.



# WR1. 1.5. Part 2



Transient Limit Monitoring Dialog

Name: WR1. 1.5. Part 2

Buttons: Save, Save As, Rename, Delete

Active    Categories: P2.1

Objects and Field Monitored

Device Type: Bus

Field: V pu

Filter objects for monitoring:

- All
- Meets Filter
- Load Buses Only
- Non Load Buses Only
- Area/Zone Filters

Action To Take:

- Log Violation Only
- Abort Simulation
- Trip (Open) Device

Use a time delay of: 0.00 Seconds

Maximum number of violations of this limit monitor to store: 100

Limit Value: 80.00 %

Limit Duration: 2.0000 Seconds

Limit Duration Units:

- Seconds
- Cycles

Limit Type:

- Lower
- Upper

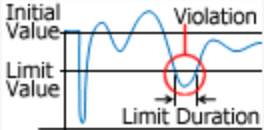
Meaning of the values specified:

- Actual value
- Percent of initial value
- Deviation from initial value
- Percent deviation from initial value

ABS: After using meaning, take absolute value

Show Special Triggers to Start or Stop Transient Limit Monitoring

Buttons: OK, Help, Cancel



For Contingencies without a fault (P2.1 category event), voltage dips at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds.

# More Information

---



- Once the new WECC criteria becomes official we will add built-in transient limit monitors similar to existing built-in WECC criteria
- More information about Transient Limit Monitors can be found at:  
<http://www.powerworld.com/training/online-training/transient-stability/transient-limit-monitors>
- More information about Custom Monitors can be found at:  
[http://www.powerworld.com/WebHelp/#MainDocumentation\\_HTML/Custom\\_Monitors.htm](http://www.powerworld.com/WebHelp/#MainDocumentation_HTML/Custom_Monitors.htm)