

Protection System Review Program – Beyond Zone 3

EHV Report

December 7, 2006

Prepared by the
System Protection and Control Task Force
of the
NERC Planning Committee

TABLE OF CONTENTS

Introduction	1
<i>Review Schedule for Circuits 200 kV and Above</i>	<i>2</i>
Executive Summary	3
<i>Table I — Summary Review Statistics</i>	<i>3</i>
Exception Review Summary	5
<i>Table II — SPCTF Exception Review Summary</i>	<i>5</i>
Appendix A — System Protection and Control Task Force	11

This report was approved by the Planning Committee on December 7, 2006.

INTRODUCTION

The NERC Planning Committee (PC) formed the System Protection and Control Task Force (SPCTF) to address NERC blackout Recommendation 8a and the US-Canada Task Force Recommendation 21a. The first stage of SPCTF work resulted in resolving NERC Recommendation 8a, which dealt with zone 3 relay loadability of transmission lines 200 kV and above. The SPCTF concluded that limiting the emergency loadability requirement of Recommendation 8a to only the zone 3 relays fails to adequately address the need of relays operating securely in the presence of emergency loading conditions, and need to be expanded. The PC approved the procedures for this additional “beyond Zone 3” work on July 20, 2004 as recommended in System Protection and Control Task Force’s Initial Recommendations Concerning NERC Recommendation 8A Loadability Requirements on Transmission Protective Relaying Systems (available at: <http://www.nerc.com/~filez/spctf.html>).

This second stage review includes all phase protection relays applied to trip directly or as a backup on the bulk electric power system, other than Zone 3, and the lower voltage “critical circuit” protection system review cited in US-Canada Task Force Recommendation 21a.

Details of the review program are contained in the *Protection System Review Program — Beyond Zone 3* report, approved by the PC in August, 2005. Similarly, the NERC Board of Trustees adopted the following resolution in August, 2005, approving the recommendations of that report.

Second Stage Relay Review Activities

6. *The Planning Committee, in conjunction with the NERC regions, is to oversee the completion of the second stage protection system review of distance and other phase-overcurrent relays on the EHV (200 kV and above) electric transmission system, including transformers with secondary windings of 200 kV and above, by the December 2006 Planning Committee meeting. The Transmission Protection System Owners (TPSOs) are to complete the implementation of their associated mitigation plans by December 31, 2007.*
7. *The Planning Committee, in conjunction with the NERC regions, is to oversee the completion of the second stage protection system review of distance and other phase-overcurrent relays on the operationally significant (as determined by the NERC regions) 100 to 200 kV transmission system, including operationally significant transformers with secondary windings of 100 to 200 kV, by the June 2007 PC meeting. The TPSOs are to complete the implementation of their associated mitigation plans by June 30, 2008.*

This EHV report covers the results of the protection system review for transmission circuits 200 kV and above. It contains the report of the transmission protection system owners on their EHV transmission system relay loadability mitigation and requests for temporary and technical exceptions.

Switch-onto-Fault Reporting Delayed

On June 7, 2006, a supplemental report was published by the SPCTF addressing additional technical considerations relating to switch-onto-fault relaying (SOTF). In order to allow adequate time for transmission system protection owners to carefully review SOTF, the required reporting of SOTF was delayed to the December 31, 2006 reporting date, which had previously been established for Operationally-Significant circuits, 100 kV to 200 kV.

Comment [RWC1]: Not necessary to capitalize here.

Review Schedule for Circuits 200 kV and Above

TPSOs are reviewing the relay loadability for circuits 200 kV and above (including transformers with low-side voltages 200 kV and above), and mitigating nonconforming protection systems under the following schedule:

August 31, 2005	Send the <i>Protection System Review Program – Beyond Zone 3</i> document, the revised <i>Relay Loadability Exceptions</i> (Version 1.2) document, and updated reporting forms to the regions.
June 30, 2006	TPSOs submit review status and report mitigation plans (including temporary exception requests) and submit technical exception requests to regions for review and acceptance.
August 31, 2006	Regions submit June 30 reports to SPCTF for review and approval.
December 2006	SPCTF to provide report on the 200 kV and above protection review to the PC for approval at the December 2006 PC meeting.
February 2007	PC to provide summary report to the NERC Board at its February 2007 meeting.
December 31, 2007	TPSOs complete mitigation (except where temporary exception requests have been approved).

EXECUTIVE SUMMARY

All NERC regions reported that the TPSOs had certified completion of the EHV (200 kV and above) beyond Zone 3 relay loadability review, and had provided summary reports and requests for temporary and technical exceptions to the NERC regions as of June 30, 2006. One TPSO within MRO and two TPSOs within WECC that are known to own EHV protection systems (based on Zone 3 relay review submittals) did not submit review summaries to the regions. Those entities are noted in the SPCTF review summary table of this report.

Comment [RWC2]: Don't capitalize zone except in titles

Key findings are as follows:

- A total of 11,499 EHV terminals were examined by the TPSOs in the EHV Zone 3 relay loadability reviews.
- Of these, 2,530 (22%) were found to be nonconforming with the loadability criteria.
- Only 270 (2.4% of terminals examined) technical exceptions were requested. Of those, 169 were approved by the regions and 101 are still pending additional documentation.
- The nonconformance of the remaining 2,296 terminals is being mitigated through settings changes, disabling functions, or equipment changes/additions, or other methods.
- A total of 65 temporary exceptions were requested for equipment changes and additions beyond 2007. Of those, 49 were approved by the regions and 16 remain pending a mitigation schedule.
- Follow up on temporary exceptions and ongoing reviews of technical exceptions that require annual review (due to changes in system conditions) will be part of the “ongoing work” of the SPCTF.

The following table shows the statistics for the review of the Zone 3 relay loadability for EHV circuits 200 kV and above.

Table I — Summary Review Statistics

Item Reviewed	EHV Zone 3	EHV Beyond Zone 3
Terminals reviewed	10,914	11,499
Nonconforming terminals	2,182	2,530
Nonconforming terminals as a percentage of terminals reviewed	20.0%	22.0 %
Technical exception requests	297	270
Accepted by region/SPCTF	297	169
Unresolved	0	101
Terminals requiring mitigation	1,885	2,293
Settings changes	1,520	1,926
Function disabled	65	77

Item Reviewed	EHV Zone 3	EHV Beyond Zone 3
Equipment replacement or addition	287	263
Other types of mitigation	13	27
Temporary exception (beyond 2007) requests	130	65
Accepted by region/SPCTF	130	49
Unresolved	0	16

Note that in some cases, settings changes were necessary for some terminals to qualify for technical exceptions.

EXCEPTION REVIEW SUMMARY

The following is a summary of the SPCTF review of the regional submittals of the TPSO review of their EHV protection system. It shows the status of all requests for temporary and technical exceptions. Also noted are TPSOs that did not submit reviews to the regions or had anomalies in their submittals.

Table II — SPCTF Exception Review Summary

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
ERCOT	Regional Summary	No temporary exceptions were requested by ERCOT TPSOs.	No technical exceptions were requested by ERCOT TPSOs.	6 mitigations were completed prior to 6/30/06.
				14 mitigations are in progress, due for completion by 12/31/07.
FRCC	Regional Summary	No temporary exceptions were requested by FRCC TPSOs.	No technical exceptions were requested by FRCC TPSOs.	55 mitigations were completed prior to 6/30/06.
				4 mitigations are in progress, due for completion by 12/31/07.
MRO	Regional Summary			87 mitigations are in progress, due for completion by 12/31/07.
	Manitoba Hydro		Requested 21 technical exceptions. Approval pending additional documentation and review by MRO.	

Exception Review Summary

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
MRO (cont.)	MDU	Requested and granted 4 temporary exceptions.		4 temporary exceptions due for mitigation by 12/31/08.
	Minnkota Power	Requested 16 temporary exceptions. Not approved due to lack of schedule for mitigation.	Requested 2 technical exceptions. Approval pending additional documentation and review by MRO.	
	SaskPower			No submittal on EHV review.
NPCC	Regional Summary			23 mitigations were completed prior to 6/30/06. 164 mitigations are in progress, due for completion by 12/31/07.
	NYPA		Requested and granted 4 technical exceptions.	None
	Rochester NYSEG		Requested and granted 4 technical exceptions.	None
	TransÉnergie		Requested 78 technical exceptions. Approval pending additional documentation and review by NPCC.	

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
RFC	Regional Summary			11 mitigations were completed prior to 6/30/06. 396 mitigations are in progress, due for completion by 12/31/07.
	AEP	Requested and granted 10 temporary exceptions.		10 temporary exceptions due for mitigation by 12/31/08.
	Exelon (ComEd)		Requested and granted 10 technical exceptions.	None
	First Energy	Requested 1 temporary exception.	Requested and granted 20 technical exceptions.	1 temporary exception due for mitigation by 10/1/08.
	METC	Requested and granted 14 temporary exceptions.	Requested and granted 16 technical exceptions.	14 temporary exceptions due for mitigation by 12/31/08.
	NIPSCO		Requested and granted 2 technical exceptions.	None
SERC	Regional Summary			17 mitigations were completed prior to 6/30/06. 1,002 mitigations are in progress, due for completion by 12/31/07.
	Ameren		Requested and granted 1 technical exception.	None
	Duke Energy Carolinas	Requested and granted 12 temporary exceptions.	Requested and granted 6 technical exceptions.	12 temporary exceptions due for mitigation by 12/31/08.

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
SERC (cont.)	Entergy			Showed no terminals reviewed, but showed 620 terminals nonconforming, to be mitigated by 12/31/07.
	Georgia Power		Requested and granted 1 technical exception.	None
	Progress Energy Carolinas		Requested and granted 1 technical exception.	None
SPP	Regional Summary			90 mitigations are in progress, due for completion by 12/31/07.
	WEPL		Requested and granted 1 technical exception.	None
WECC	General			29 mitigations were completed prior to 6/30/06. 346 mitigations are in progress, due for completion by 12/31/07.
	ATCO Electric		Requested and granted 2 technical exceptions.	None

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
WECC (cont.)	British Columbia Transmission		Requested and granted 32 technical exceptions.	None
	Comision Federal De Electricidad (CFE)			No submittal on EHV review.
	Deseret G&T Coop		Requested and granted 1 technical exception.	None
	Idaho Power		Requested and granted 7 technical exceptions.	None
	Imperial Irrigation District			No submittal on EHV review.
	PacifiCorp	Requested and granted 8 temporary exceptions.	Requested and granted 3 technical exceptions.	8 temporary exceptions due for mitigation by 12/31/08.
	PG&E		Requested and granted 3 technical exceptions.	None
	SCE		Requested and granted 3 technical exceptions.	None

Region	TPSO	Temporary Exceptions	Technical Exceptions	Pending Mitigations
WECC (cont.)	Sierra Pacific Power		Requested and granted 26 technical exceptions.	None
	Tri-State G&T		Requested and granted 20 technical exceptions.	None
	WAPA RMR		Requested and granted 2 technical exceptions.	None

APPENDIX A — SYSTEM PROTECTION AND CONTROL TASK FORCE

Charles W. Rogers

Chairman / RFC-ECAR Representative
Principal Engineer
Consumers Energy Co.

W. Mark Carpenter

Vice Chairman / ERCOT Representative
System Protection Manager
TXU Electric Delivery Co.

John Mulhausen

FRCC Representative
Manager, Design and Standards
Florida Power & Light Co.

Joseph M. Burdis

ISO/RTO Representative
Senior Consultant / Engineer, Transmission
and Interconnection Planning
PJM Interconnection, L.L.C.

William J. Miller

RFC-MAIN Representative
Consulting Engineer
Exelon Corporation

Deven Bhan

MRO Representative
Electrical Engineer, System Protection
Western Area Power Administration

Philip Tatro

NPCC Representative
Consulting Engineer
National Grid USA

Philip B. Winston

SERC Representative
Manager, Protection and Control
Georgia Power Company

Fred Ipock

SPP Representative
Senior Engineer - Substations & Protection
Springfield City Utilities (Missouri)

David Angell

WECC Representative
T&D Planning Engineering Leader
Idaho Power Company

Joe Uchiyama

Electrical Engineer
U.S. Bureau of Reclamation

Eric Udren

Senior Principal Consultant
KEMA Consulting

John L. Ciuffo

Canada Member-At-Large
Manager Reliability Standards (P&C/Telecom)
Hydro One, Inc.

Jim Ingleson

ISO/RTO Representative
Senior Electric System Planning Engineer
New York Independent System Operator

Evan T. Sage

Investor Owned Utility
Consulting Engineer
Potomac Electric Power Company

James D. Roberts

Federal
Transmission Planning
Tennessee Valley Authority

Tom Wiedman

NERC Consultant
Wiedman Power System Consulting Ltd.

Henry (Hank) Miller

RFC-ECAR Alternate
Principal Electrical Engineer
AEP Service Corp.

Baj Agrawal

WECC Alternate
Principal Engineer
Arizona Public Service Company

Michael J. McDonald

Senior Principal Engineer, System Protection
Ameren Services Company

Jonathan Sykes

Senior Principal Engineer, System Protection
Salt River Project

W. O. (Bill) Kennedy

Canada Member-At-Large
Principal
b7kennedy & Associates Inc.

Bob Stuart

NERC Blackout Investigation Team
Director of Business Development, Principal
T&D Consultant
Elequant,