

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

Princeton Forrestal Village, 116-390 Village Boulevard, Princeton, New Jersey 08540-5731

System Protection and Control Task Force's Initial Recommendations Concerning NERC Recommendation 8A Loadability Requirements on Transmission Protective Relaying Systems

The NERC Planning Committee approved these recommendations on July 20, 2004.

Recommendation 8a: All transmission owners shall, no later than September 30, 2004, evaluate the zone 3 relay settings on all transmission lines operating at 230 kV and above for the purpose of verifying that each zone 3 relay is not set to trip on load under extreme emergency conditions.⁶ In each case that a zone 3 relay is set so as to trip on load under extreme conditions, the transmission operator shall reset, upgrade, replace, or otherwise mitigate the overreach of those relays as soon as possible and on a priority basis, but no later than December 31, 2005. Upon completing analysis of its application of zone 3 relays, each transmission owner may no later than December 31, 2004 submit justification to NERC for applying zone 3 relays outside of these recommended parameters. The Planning Committee shall review such exceptions to ensure they do not increase the risk of widening a cascading failure of the power system.

⁶ The NERC investigation team recommends that the zone 3 relay, if used, should not operate at or below 150% of the emergency ampere rating of a line, assuming a .85 per unit voltage and a line phase angle of 30 degrees.

There is substantial confusion and widely varying interpretations being made throughout the industry on two points of Recommendation 8a. One issue was the definition of “emergency ampere rating of a line” in footnote 6. The June 22, 2004 letter (Attachment A) from the SPCTF chairman Charles Rogers to all transmission owners and operators addressed this clarification.

The second point of confusion has to do with whether or not the loadability requirement was limited to Zone 3 relays, or should it apply to other relays as well? During the first two conference calls of the System Protection and Control Task Force (SPCTF), there were differences of opinion as to the intent on these two subjects, but after collaboration and sharing of various sources of information, the SPCTF has reached a unified opinion as to what we believe the “spirit of the intent” was concerning Recommendation 8a and to the recommended course of action that should be taken.

SPCTF also felt it important to clarify the expectations for reporting on the implementation of Recommendation 8a including the involvement of the Regions, the timetable, and which entities should report. The following recommendations are intended to clarify points.

Recommendations

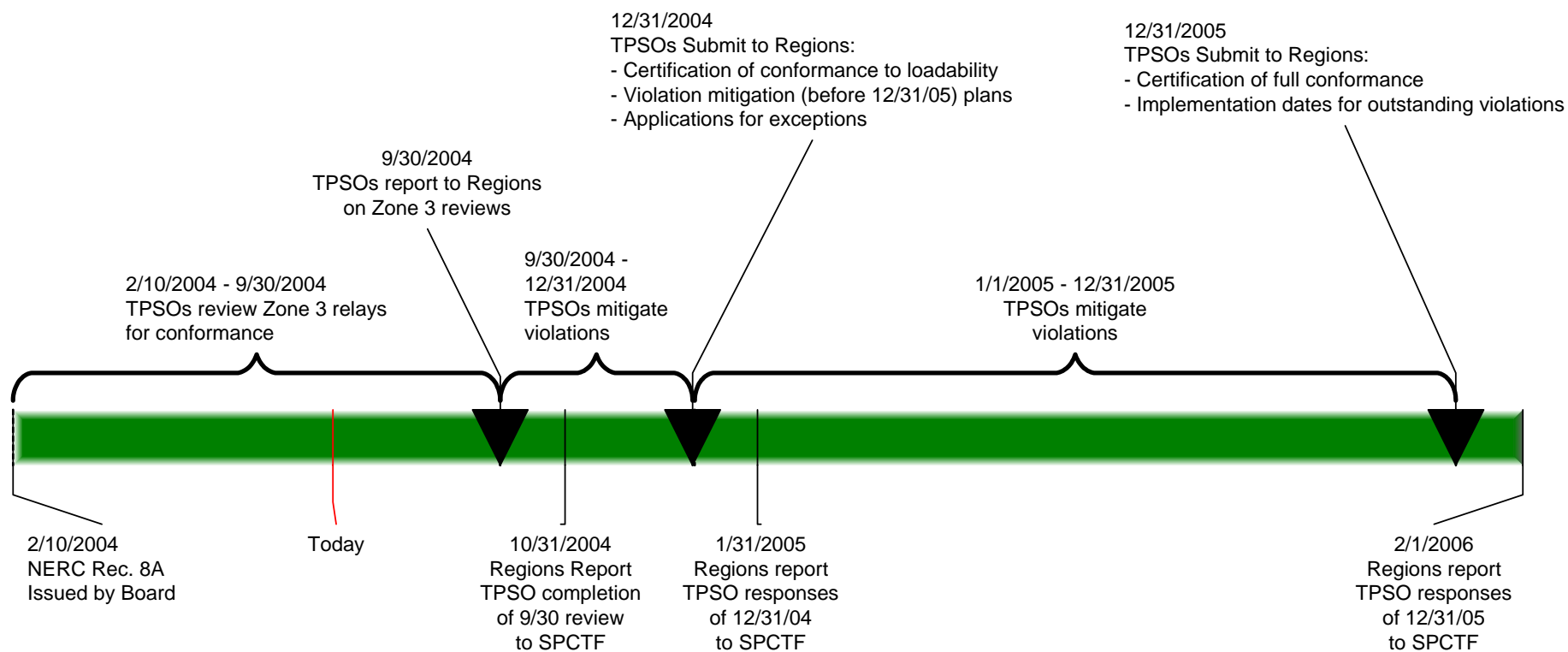
Transmission owners, operators, and transmission protection system owners¹, collectively referred to as TPSOs, are responsible for adhering to Recommendation 8a, as modified in this document, and reporting on their implementation.

In all cases, adherence to NERC Recommendation 8a shall not relieve the TPSOs of the responsibility to adequately protect the bulk transmission system.

1. Each Region shall summarize the responses of its TPSOs and report to NERC on the each TPO's implementation of Recommendation 8a in the following manner:
 - a. By September 30, 2004 — Each TPO shall report to its Region on the review of its relaying systems in accordance with NERC Recommendation 8a, as modified in this document.
 - b. By October 31, 2004 — Each Region shall report to the NERC SPCTF on each TPO's evaluation of its relaying as of September 30, 2004, under Recommendation 8a, as modified in this document. That report shall include a list of the non-respondent and respondent TPSOs.
 - c. By December 31, 2004 — Each TPO shall submit to its Region one or more of the following:
 - i. Certification that its system meets all of the requirements of the loadability criteria.
 - ii. Identify non-conformance that will be mitigated by December 31, 2005.
 - iii. Identify non-conformance for which technical or temporary exceptions are being applied.
 - d. By January 31, 2005 — Each Region shall summarize and forward to the NERC SPCTF the responses due from the TPSOs on December 31, 2004. Regions should report on any non-respondent TPSOs.
 - e. By December 31, 2005 — Each TPO shall submit to its Region one or more of the following:
 - i. Certifications that all non-conformances cited for mitigation by December 31, 2004, have been mitigated.
 - ii. Exception mitigation dates for any relay systems that do not conform to Recommendation 8a and/or justify why a late temporary or technical exception should be granted.
 - f. By January 31, 2006 — Each Region shall summarize and forward to the NERC SPCTF the responses due from the TPSOs on December 31, 2005. Regions should report on any non-respondent TPSOs that have not already certified their systems fully conforming to Recommendation 8a, as modified in this document.

¹ Transmission protection system owners include customers owning transmission protection systems.

Loadability Compliance Timeline



2. The loadability requirement in Recommendation 8a pertains only to thermal limits of facilities. On longer transmission lines, other factors such as system stability, voltage drop, or var consumption may be the limiting factor as to the power transfer capability of the line. The SPCTF proposes creation of two classes of exceptions:
 - a. **Temporary Exceptions** would allow for a delayed implementation schedule for facilities that require modification due to the inability to complete the work within the prescribed time frame because of facility clearance or work force issues. Temporary exceptions may also be granted for application of temporary mitigation plans until full implementation can be achieved.
 - b. **Technical Exceptions** would be justified on technical merit where facilities could not under any reasonable contingency be loaded to a level that would initiate a protective relay operation, under current system conditions. Technical exceptions would be subject to review in light of future system changes.

The SPCTF will develop² (for the Planning Committees approval) the criteria by which facilities will receive an automatic technical exception to the thermal loading criteria based on these other factors. These criteria should be developed and communicated to the TPSOs by September 30, 2004.

3. The SPCTF, under the direction of the NERC Planning Committee, should evaluate any exceptions requests made by the TPSOs to the Zone 3 loadability requirements. It is hoped that there will only be a few exception requests that are not covered in the “automatic technical exception criteria” that will be developed in *Item 2* above.
4. Those companies that request exceptions by December 31, 2004, if those exceptions are denied, will have twelve (12) months to implement the requirements after the request is denied.
5. Since Recommendation 8a refers to Zone 3 relays only on lines 230 kV and above, those relays should be the only relays that fall under the September 30, 2004, December 31, 2004, and December 31, 2005 time requirements cited in *Item 1* above. The term Zone 3 relay should be defined as “any distance relay (forward or reverse) acting as remote backup (as defined in IEEE Standard C37.113, excerpted below), regardless of the nomenclature used or any relay that is intentionally set to protect facilities beyond the protected line.”

IEEE Guide for Protective Relaying – Standard C37.113

Section 5.3.7.1 – Remote Backup

“This form of protection relies on the remote relaying on adjacent circuits to overreach the primary zones of protection. Tripping is delayed to allow for the primary protection to operate. The effects of infeed from adjacent lines must be taken into account to ensure complete coverage. In some cases, if the remote backup relays cannot completely cover the protected zone under normal conditions, they must at least be able to operate sequentially. Obviously, this leads to lengthy delays in the clearing of faults. A serious drawback of remote backup protection is the complete loss of supply to the affected substations, because all lines into the station have to be opened to remotely clear the fault.”

² By September 1, 2004, the SPCTF will propose the recommended criterion to the Planning Committee for its approval.

6. All other distance relays (other than Zone 3) on lines 230 kV and above that can trip directly or as part of a pilot tripping scheme that could violate the loadability criteria should likewise be identified, exception requests made, and corrections made. It is clear that the mitigation of these relays will take longer than the timeframe established for the Zone 3 relays. The SPCTF will propose an implementation timeframe later this year after the loadability requirement and exception criteria for the Zone 3 relays is more clearly defined. In no case will this implementation timeframe call for completion of corrective action for these other distance relays before December 31, 2006.
7. In addition to the other distance relays mentioned in *Item 6* above, the SPCTF recommends that all phase-overcurrent relays used on the transmission system at 230 kV and above be included in the review of *Item 6* above and be governed by the same processes and timeline. These relays are sometimes used as backup protection for transmission lines and series or network transformers. The loadability requirement applies to transformers with secondary windings of 230 kV and above. The actual transformer loadability requirements will be developed by the SPCTF.
8. Once the exception criteria in *Item 2* above are approved by the Planning Committee, the SPCTF will propose (for Planning Committee approval) the timeline for the review of all other relays in *Items 6 and 7* above.
9. Each Regional Council should apply the loadability criteria (including the automatic technical exceptions) to all other distance and overcurrent relays at 230 kV and above, as described in *Items 6 and 7*. These criteria should be applied to any modifications or additions to the transmission system and its protection.
10. Each Regional Council should identify critical lines 115 kV and above (but less than 230 kV) that should fall under this loadability criteria and administer the guidelines for all relaying elements (including Zone 3) associated with these lines to more fully conform to Recommendation 21, part A, from the *US – Canada Power System Outage Task Force Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations*, issued in April 2004.

US – Canada Recommendation 21, Part A

“Make more effective and wider use of system protection measures.”

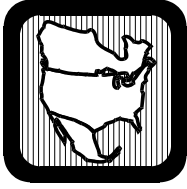
“In its requirements of February 10, 2004, NERC:

- A. Directed all transmission owners to evaluate the settings of zone 3 relays on all transmission lines of 230 kV and higher.”

“Task Force:

Recommends that NERC broaden the review to include operationally significant 115 kV and 138 kV lines, e.g., lines that are part of monitored flowgates or interfaces. Transmission owners should also look for zone 2 relays set to operate like zone 3s.”

11. The timeline for *Item 10* will be established by the SPCTF in conjunction with the timeline developed for *Items 6 and 8* above.



NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

Princeton Forrestal Village, 116-390 Village Boulevard, Princeton, New Jersey 08540-5731

June 18, 2004

TO: Transmission Owners and Operators

Clarification of the transmission line emergency ampere rating to be used to determine compliance with loadability requirements for Zone 3 relays (Blackout Recommendation 8a)

On February 10, 2004, the NERC Board of Trustees approved a series of recommendations following the August 14, 2003 blackout. Recommendation 8a (below) involves the evaluation of Zone 3 relay settings to ensure that these relays do not trip at load levels lower than desired.

NERC Recommendation 8a: All transmission owners shall, no later than September 30, 2004, evaluate the zone 3 relay settings on all transmission lines operating at 230 kV and above for the purpose of verifying that each zone 3 relay is not set to trip on load under extreme emergency conditions⁶. In each case that a zone 3 relay is set so as to trip on load under extreme conditions, the transmission operator shall reset, upgrade, replace, or otherwise mitigate the overreach of those relays as soon as possible and on a priority basis, but no later than December 31, 2005. Upon completing analysis of its application of zone 3 relays, each transmission owner may no later than December 31, 2004 submit justification to NERC for applying zone 3 relays outside of these recommended parameters. The Planning Committee shall review such exceptions to ensure they do not increase the risk of widening a cascading failure of the power system.

⁶ The NERC investigation team recommends that the zone 3 relay, if used, should not operate at or below 150% of the emergency ampere rating of a line, assuming a .85 per unit voltage and a line phase angle of 30 degrees.

In the draft meeting minutes of the March 23-24, 2004 NERC Planning Committee meeting, Exhibit R indicated that the emergency ampere rating of the line referred to in footnote 6 was the “long term summer emergency ampere rating of the line.” Some, but not all, interested parties were aware of this exhibit, and based their evaluations on their summer long-term emergency limit.

In May, the System Protection and Control Task Force (SPCTF) was established by the NERC Planning Committee to address the issues associated with Recommendation 8 in its entirety. As a part of that work, after discussion with the Executive Committee of the Planning Committee, the definition of “emergency ampere rating” of a line in Footnote 6 is to be clarified as:

Emergency Ampere Rating — “The highest seasonal ampere circuit rating (that most closely approximates a 4-hour rating) that must be accommodated by relay settings to prevent incursion.” That rating will typically be the winter short-term (four-hour) emergency rating of the line and series elements. The line rating should be determined by the lowest ampere rated device in the line (conductor, airswitch, breaker³, wavetrap, series transformer, series capacitors, reactors, etc) or by the sag design limit of the transmission line for the selected conditions. The evaluation of all Zone 3 relays should use whatever ampere rating currently used that most closely approximates a 4-hour rating.

Recommendation 8a calls for an evaluation of the Zone 3 relay settings on lines operating 230 kV and above to verify that they meet the loadability requirement as outlined in Footnote 6 by September 30, 2004. It is desirable that this evaluation be done against the loadability criteria using the “emergency ampere rating” as defined above. However, since this rating was not clearly defined prior to now, it is acceptable to complete this evaluation using whatever “emergency ampere rating” that you chose to use. In your evaluation, please state the basis of the current level used (i.e. long term summer rating, 15 minute summer rating, etc.).

However, prior to December 31, 2004, you should complete the evaluation of all Zone 3 relays against the definition for “emergency ampere rating” stated above and submit justification for any Zone 3 relays that are applied outside the Recommendation 8 parameters.

The SPCTF recognizes that in many cases, especially on longer transmission lines, other factors, such as system stability, voltage drop, or VAr consumption, may be the realistic limiting factor for the power transfer capability of the line. The SPCTF will develop (for the Planning Committee’s approval) the criteria where facilities will receive exceptions to the thermal loading criteria based on these other factors. The SPCTF will develop that criteria and communicate to the transmission owners by October 30, 2004.

Also, the NERC Planning Committee and the SPCTF agree that the other distance relays used on the transmission system should conform to the same loadability criteria that are applied to the Zone 3 relays. However, the SPCTF will develop an appropriate compliance timeframe for the Planning Committee’s consideration. As the Zone 3 evaluation is performed, the SPCTF recommends that the other distance relays that can initiate a trip operation be evaluated to determine their settings relative to the loadability criteria.

³ Where parallel breakers are used to terminate a transmission line, the lowest ampere rated breaker should be used to determine if the breaker is the most limiting element on the line, assuming the higher rated breaker is open.

If there are any questions, please contact the SPCTF through Bob Cummings of the NERC Staff at Bob.Cummings@NERC.net.

Sincerely,

A handwritten signature in black ink that reads "Charles W. Rogers". The signature is written in a cursive, flowing style.

Charles W. Rogers
SPCTF Chairman

CWR:rwc

cc: Planning Committee
Operating Committee
SPCTF
Regional Managers