

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

## SPCS Input on Uniform Misoperations Reporting

NERC System Protection and Control Subcommittee

November 19, 2010

116-390 Village Blvd., Princeton, NJ 08540  
609.452.8060 | 609.452.9550 fax

## Table of Contents

---

|   |          |
|---|----------|
| <b>1. Background .....</b>  | <b>1</b> |
| <b>2. Reporting Template .....</b>  | <b>1</b> |
| <b>3. Misoperation Categories .....</b>                                     | <b>1</b> |
| <b>4. Cause Codes .....</b>   | <b>2</b> |
| <b>5. Applicability .....</b>   | <b>4</b> |
| <b>APPENDIX A – Draft Reporting Template with SPCS Comments.....</b>        | <b>5</b> |
| <b>APPENDIX B – System Protection and Control Subcommittee Roster .....</b> | <b>7</b> |

---

---

## 1. Background

The NERC System Protection and Control Subcommittee (SPCS) was requested to provide input to the ERO Reliability Assessment and Performance Analysis (ERO-RAPA) Group regarding development of a consistent format and specification for Registered Entities to report protection system misoperation data to the Regions under NERC Reliability Standards PRC-003 and PRC-004. The SPCS assigned a team to develop proposals for SPCS consideration and the full SPCS discussed these proposals during its November 9-11, 2010 meeting. SPCS recommendations were forwarded by e-mail on November 10. This report provides formal documentation of the recommendations forwarded previously.

---

## 2. Reporting Template

SPCS comments on the ERO-RAPA Group proposed template are provided in an additional column added by the SPCS for this purpose. The SPCS agrees with the information to be collected in the template provided the template is used to collect data under PRC-004 (as is currently planned). However, in the event that agreement is not reached by the regions on a common reporting format and the template is used to collect data specifically for the purpose of reliability metric ALR4-1, then the template should collect only the data required for the metric; i.e., in this case the Corrective Action Plan information should be excluded from the template.

The SPCS comments provided in the template are focused primarily on ensuring that enough clarity is provided to obtain consistent reporting of information. The SPCS is available to review these comments with the ERO-RAPA Group and provide more detail. The work necessary to fully develop the format includes items such as development of drop-down boxes, etc., and the SPCS is available to work with NERC Staff or the ERO-RAPA Group to develop the specifics.

The template, with SPCS comments, is provided in Attachment A of this report.

---

## 3. Misoperation Categories

The SPCS recommends four misoperation categories as presented below in Table 1. The categories include two categories related to Protection System dependability and two

categories related to Protection System security. These four categories are very similar to what is currently used by most regions.

**Table 1: Misoperation Categories**

| Misoperation Categories   |
|---|
| Failure to Trip   |
| Slow trip (i.e., slower than required to meet TPL requirements) |
| Unnecessary Trip during fault                                   |
| Unnecessary Trip other than fault                               |

---

## 4. Cause Codes

The SPCS recommends six Cause Codes as presented below in Table 2. Cause codes also are based on current regional procedures. Adopting these six Cause Codes will require reporting more detail for some regions and less for others. The SPCS believes that these six Cause Codes strike a necessary balance between having enough Cause Codes to track meaningful trends in Protection System performance, while avoiding confusion and inconsistent reporting that may occur with too many Cause Codes.

**Table 2: Cause Codes**

| Cause Codes                           | Cause Code Description   |
|---------------------------------------|--|
| Incorrect setting/logic/design errors | This category includes misoperations due to “engineering” errors by the protection system owner. These include setting errors, errors in documentation, and errors in application. Examples would include uncoordinated settings, incorrect schematics, or multiple CT grounds in the design.  |
| Relay failures/malfunctions           | This category includes misoperations due to improper operation of the relays themselves. These may be due to component failures, physical damage to a device, firmware problems, or manufacturer errors. Examples would include misoperations caused by changes in relay characteristic due to capacitor aging, misfiring thyristors, damage due to water from a leaking roof, relay power supply failure, or internal wiring error. Failures of auxiliary tripping relays fall under this category. |
| Communication failures                | This category includes misoperations due to failures in the communication systems associated with protection schemes inclusive of transmitters and receivers. Examples would include misoperations caused by loss of carrier, spurious transfer trips associated with noise, Telco errors resulting in malperformance of communications over leased lines, or microwave problems associated with weather conditions.   |
| As-left personnel error               | This category includes misoperations due to the condition the protection system was left in following maintenance or construction procedures. These include test switches left open, wiring errors not associated with incorrect drawings, carrier grounds left in place, or settings placed in the wrong relay.   |
| AC system                             | This category includes misoperations due to problems in the ac inputs to the protection system. Examples would include misoperations associated with CT saturation, loss of potential, or rodent damaged wiring in voltage or current circuit.   |
| DC system                             | This category includes misoperations due to problems in the DC control circuits. These include problems in the battery or charging systems, trip wiring to breakers, or loss of dc power to a relay or communication device.   |
| Unknown/unexplainable                 | Requires extensive documentation of investigative actions if this cause code is utilized.  |

## 5. Applicability

During its discussion the SPCS noted that input had not been requested on the subject of the system Elements for which Protection System misoperations should be reported. The SPCS noted that because regional differences presently exist, it is necessary to provide guidance on this subject to achieve uniform reporting. The SPCS has previously provided input on this subject during its review of PRC-003, PRC-004, and PRC-016.<sup>1</sup> The SPCS discussed this subject and decided to update its previous recommendation to reflect FERC communications, modifications to the NERC Statement of Compliance Registry Criteria, and other industry developments that have occurred since May 2009.

The SPCS proposes that reporting of misoperations under PRC-004 apply to the Protection Systems defined below.

Protection Systems which trip:

- a. Transmission system elements 100 kV and above
  - b. Transformers with 100 kV or higher on the secondary side
  - c. Generators that meet the definition in the NERC Statement of Compliance Registry Criteria and are connected to the transmission system at 100 kV or higher
  - d. Generator step-up transformers for generators that meet the definition in the NERC Statement of Compliance Registry Criteria and are connected to the transmission system at 100 kV or higher
- 

---

<sup>1</sup> [NERC SPCS Assessment of Standards: PRC-003-1, PRC-004-1, and PRC-016-1](#), May 22, 2009.

## APPENDIX A – Draft Reporting Template with SPCS Comments

| Field Name Common to All Regions<br>Entity Name | Necessary Field Name<br>Entity Name                                       | Other Desired Information*<br>Field Name | Information Explanation<br>Name of Entity which owns the facility  | SPCS Comments   |
|---|---|--|--|---|
| Misoperation Date                               | Misoperation Date   |  | Enter the date of the Misoperation   |   |
|   | Misoperation Time   |  | Enter the time of the Misoperation in (24 hr.) HH:MM:SS format   |   |
|   | Time Zone   |  | The time zone of the reported time of the Misoperation   | <i>Include a drop-down menu for time zone entry (include GMT as one of the drop-down entries).</i>  |
|   |   | Equipment lost                           | Names of the equipment becoming unavailable due to the event   | <i>Need to provide more specific instructions: e.g., define transmission lines by terminals and voltage; define transformers by substation name and terminal voltages</i> |
|   | Facility Name<br>Location of<br>Misoperation)                             |  | Identify the name of the facility (i.e., substation or generating station) where the Misoperation occurred                           | <i>Suggest using another term than "facility" to avoid confusion with NERC defined term, "Facility"</i>   |
|   | Equipment Name<br>(protected by<br>Protection System that<br>Misoperated) |  | Identify by name the generator, transmission line, transformer, bus or equipment protected by the Protection System that Misoperated | <i>Need to provide more specific instructions: e.g., define transmission lines by terminals and voltage; define transformers by substation name and terminal voltages</i> |
|   | Equipment Type  |  | Type of equipment being protected ( e.g. Generator, Line, Capacitor, Transformer, Bus, Inductor, or Other)                           | <i>In order to obtain consistency in naming; dropdown menus will be helpful</i>   |
|   | Facility Voltage  |  | System voltage (in kV) of the protected element (if transformer, high side kV)   |   |
| Event Description                               | Description of<br>Event   |  | Provide a brief description of the event and Misoperation  |   |
|   | Protection Systems that<br>Misoperated                                    |  | Information on the Protection Systems that Misoperated including relay types and protection schemes                                  | <i>In order to obtain consistency in naming; dropdown menus will be helpful</i>   |
|   | Misoperation Category   |  | Categories include (but not limited to): Failure to Trip, Slow Trip,   | <i>The SPCS recommends four Misoperation Categories (Failure</i>  |

| Field Name<br>Common to All<br>Regions<br>Entity Name | Necessary<br>Field Name<br>Entity Name         | Other Desired<br>Information*<br>Field Name | Information<br>Explanation<br>Name of Entity which<br>owns the facility              | SPCS Comments   |
|---|--|---|--|---|
|   |  |   | Unnecessary Trip During Fault,<br>Unnecessary Trip Other than<br>Fault, Under Review | <i>to Trip; Slow trip (i.e., slower<br/>than required to meet TPL<br/>requirements); Unnecessary Trip<br/>during fault; Unnecessary Trip<br/>other than fault</i>   |
|   | Cause(s) of<br>Misoperation                    |   | Identification of the root cause(s)<br>of the Misoperation                           | <i>Reporting the Cause of<br/>Misoperation should include two<br/>fields: one for a description and<br/>one to enter the Cause Code<br/>(SPCS recommends six Cause<br/>Codes)</i>   |
| Corrective Action<br>Plan and<br>Investigation        | Corrective Action<br>Plan and<br>Investigation |   | Identify the investigations and<br>corrective actions taken or being<br>taken        | <i>Corrective Action Plan<br/>information is appropriate for<br/>inclusion in the template for<br/>reporting under PRC-004-1. If<br/>the regions do not reach<br/>agreement and the template is<br/>used for a Section 1600 Data<br/>Request to collect data for<br/>ALR4-1, then the Corrective<br/>Action Plan information should<br/>be deleted from the template.</i> |
|   | Proposed<br>Completion Date                    |   | If corrective actions are not<br>complete, estimate when they will<br>be complete    | <i>See note above.</i>  |
|   | Completion Date                                |   | If corrective actions are complete,<br>enter the completion date                     | <i>See note above.</i>  |
|   | Reported By                                    |   | Enter the name of the person filling<br>out the report                               |   |
|   | Phone  |   | Enter the reporting person's phone<br>number   |   |
|   | E-Mail   |   | Enter the reporting E-MAIL<br>address  |   |
|   | Date Reported                                  |   | The date that the Misoperation<br>is/was reported to the Region                      |   |
|   |  |   |  |   |



## APPENDIX B – System Protection and Control Subcommittee Roster

**Jonathan Sykes**

*Chairman*  
Manager of System Protection  
Pacific Gas and Electric Company

**William J. Miller**

*Vice-Chairman*  
Principal Engineer  
Exelon Corporation

**John Mulhausen**

*RE – FRCC*  
Manager, Design and Standards  
Florida Power & Light Co.

**Richard Quest**

*RE – MRO*  
Engineer  
Xcel Energy, Inc.

**Daniel Jesberg**

*RE – MRO – Alternate*  
Engineer  
Midwest Reliability Organization

**Bryan J. Gwyn**

*RE – NPCC*  
Manager, Protection Standards and Support  
National Grid USA

**Jeff Iler**

*RE – RFC*  
Senior Engineer  
American Electric Power

**Philip B. Winston**

*RE – SERC*  
Chief Engineer, Protection and Control  
Southern Company

**Joe Spencer**

*RE – SERC -- Alternate*  
Manager of Planning and Engineering  
SERC Reliability Corporation

**Lynn Schroeder**

*RE – SPP*  
Manager – Substation Protection and Control  
Westar Energy

**Samuel Francis**

*RE – TRE*  
System Protection Specialist  
Oncor Electric Delivery

**Baj Agrawal**

*RE – WECC*  
Principal Engineer  
Arizona Public Service Company

**John L. Ciuffo**

*Canada Provincial*  
Manager, P&C Strategies and Standards  
Hydro One, Inc.

**Sungsoo Kim**

*Canada Provincial*  
Section Manager – Protections and Technical Compliance  
Ontario Power Generation Inc.

**Michael J. McDonald**

*Investor-Owned Utility*  
Principal Engineer, System Protection  
Ameren Services Company

**Charles W. Rogers**

*Transmission Dependent Utility*  
Principal Engineer  
Consumers Energy Co.

**Joe T. Uchiyama**

*U.S. Federal*  
Senior Electrical Engineer  
U.S. Bureau of Reclamation

**Joshua L. Wooten**

*U.S. Federal*  
Manager of System Protection and Analysis  
Tennessee Valley Authority

**Daniel McNeely**

*U.S. Federal – Alternate*  
Engineer - System Protection and Analysis  
Tennessee Valley Authority

**Philip J. Tatro**

*NERC Staff Coordinator*  
Senior Performance and Analysis Engineer  
NERC

**Robert W. Cummings**

*NERC Staff*  
Director of System Analysis and Reliability Initiatives  
NERC

**Jonathan D. Gardell**

*Subject Matter Expert – NERC Consultant*  
Associate Consultant – Quanta Technology  
President – Gardell Power Consulting, Inc.

**Jim Ingleson**

*Subject Matter Expert*  
RLC Engineering

**W. O. (Bill) Kennedy**

*Subject Matter Expert*  
Principal  
b7kennedy & Associates Inc.

**Eric A Udren**

*Subject Matter Expert*  
Executive Advisor  
Quanta Technology

**Tom Wiedman**

*Subject Matter Expert – NERC Consultant*  
President  
Wiedman Power System Consulting, Ltd.

**Murty Yalla**

*Subject Matter Expert*  
President  
Beckwith Electric Company Inc.

**Forrest Brock**

*Observer*  
Transmission Compliance Specialist  
Western Farmers Electric Coop.

**Mark Fidrych**

*Observer*  
Manager of Performance Reviews and Metrics  
North American Transmission Forum

**David Angell**

*Correspondent*  
T&D Planning Engineering Leader  
Idaho Power Company

**Hasnain Ashrafi**

*Correspondent*  
Engineer  
Sargent & Lundy

**Deven Bhan**

*Correspondent*  
Electrical Engineer  
Western Area Power Administration

**Larry Brusseau**

*Correspondent*  
Standards Manager  
Midwest Reliability Organization

**Dac-Phuoc Bui**

*Correspondent*  
Engineer, System Protection  
Hydro-Québec TransÉnergie

**Sara Filling**

*Correspondent*  
Director, System Protection & Automation  
Baltimore Gas & Electric Company

**Jeanne Harshbarger**

*Correspondent*  
System Protection Engineer  
Puget Sound Energy, Inc.

**Fred Ipock**

*Correspondent*  
Senior Engineer - Substations & Protection  
City Utilities of Springfield, Missouri

**Lorissa Jones**

*Correspondent*  
Bonneville Power Administration

**Mark Lauby**

*Correspondent*  
Director, Reliability Assessment and Performance Analysis  
NERC

**Lynn Oelker**

*Correspondent*  
EON-US

**James Roberts**

*Correspondent*  
Transmission Planning  
Tennessee Valley Authority

**Mahmood Safi**

*Correspondent*  
Omaha Public Power District

**Saurabh Sauksena**

*Correspondent*  
National Grid

**Dean Sikes**

*Correspondent*  
Manager, Transmission Protection, Apparatus, and  
Metering  
Cleco Power, LLC

**Evan T. Sage**

*Correspondent*  
Consulting Engineer  
Potomac Electric Power Company

**Bob Stuart**

*Correspondent*  
Senior Director – Transmission  
BrightSource Energy, Inc.

**Guy Zito**

*Correspondent*  
Assistant Vice President of Standards  
NPCC