

Mapping Document

Project 2010-05.1 Protection Systems: Phase 1 (Misoperations)

Revisions or Retirements to Already Approved Standards

This mapping document shows the translation of PRC-003-1 – Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems and PRC-004-2.1a – Analysis and Mitigation of Transmission and Generation Protection System Misoperations into the proposed PRC-004-3 – Protection System Misoperation Identification and Correction Reliability Standard. The following table identifies the sections of the approved standard that shall be added, retired, or revised when this standard is implemented. If the standard drafting team is recommending revisions to the standard, those changes are identified in the “Translation to PRC-004-3 or Other Action” column.

Standard: PRC-003-1 - Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems		
Requirement in Approved Standard	Translation to PRC-004-3 or Other Action	Comments
4. Applicability: 4.1. Regional Reliability Organization	4. Applicability: 4.1. Functional Entities: 4.1.1 Transmission Owner 4.1.2 Generator Owner 4.1.3 Distribution Provider	The proposed standard properly assigns responsibility to the registered entity functions that are responsible for Protection System Misoperation identification and correction. The Transmission Owner, Generator Owner, and Distribution Provider, by function, are Protection System asset owners and are in the best position be aware of and apply resources to review Protection System operations.

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Requirement in Approved Standard	Translation to PRC-004-3 or Other Action	Comments
<p>R1. Each Regional Reliability Organization shall establish, document and maintain its procedures for, review, analysis, reporting and mitigation of transmission and generation Protection System Misoperations. These procedures shall include the following elements:</p>		<p>The Requirements in the proposed PRC-004-3 standard by their results-based standard (RBS) construction requires performance that is implicit of having procedures for the analysis of Protection System operations (R1, R2, R3, and R4) and mitigation of identified Misoperations (R5 and R6). The proposed requirements also directs focus to areas most important to reliability.</p> <p>For example, Requirement R1 requires the applicable entity to initiate a review upon a Bulk Electric System (BES) interrupting device operation and identify any Misoperation. Requirement R2 requires the applicable entity to notify all other owners that share a Misoperation identification responsibility of the Composite Protection System when it determines (or is unsure) its Protection System component(s) did not cause the BES interrupting device operation or it cannot rule out a Misoperation. Requirement R3 requires the notified entity to identify any Misoperation of its Protection System component(s) similar to Requirement R1. Requirement R4 directs the applicable entity to</p>

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		<p>continue its investigative work to determine the cause(s) of an identified Misoperation, if not determined in R1 or R3, until the cause(s) is determined or the entity declares that it is unable to determine the cause.</p> <p>Requirements R5 and R6 for developing and implementing a Corrective Action Plan (CAP) are also implicit of having a documented procedure. The implicit performance required by Requirements R1 through R6 necessitate that an entity have procedures to accomplish the objectives of the proposed standard. Requiring the applicable entities to have procedures is an activity or task that does little, if anything, to benefit or protect the reliable operation of the BES.</p>
<p>R1.1. The Protection Systems to be reviewed and analyzed for Misoperations (due to their potential impact on BES reliability).</p>	<p>4.2. Facilities: 4.2.1 Protection Systems for BES Elements, with the following exclusions: 4.2.1.1 Non-protective functions that are embedded</p>	<p>The previous PRC-003-1, Requirement R1.1 required the Regional Reliability Organization (RRO) to identify the Protection Systems to be reviewed and analyzed for Misoperation.</p> <p>The applicable Facilities have been clarified in the proposed PRC-004-3 to include Protection Systems for</p>

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	<p>within a Protection System.</p> <p>4.2.1.2 Protective functions intended to operate as a control function during switching.</p> <p>4.2.1.3 Special Protection Systems (SPS).</p> <p>4.2.1.4 Remedial Action Schemes (RAS).</p> <p>4.2.2 Underfrequency load shedding (UFLS) that is intended to trip one or more BES Elements.</p>	<p>BES Elements. Additional language is provided for clarity that non-protective functions and those protective functions that are intended to operate as a control function (e.g., a reverse power relay operated to remove a generating unit from service as opposed to providing anti-motoring protection) are not applicable. The standard’s Applicability is further clarified to include underfrequency load shedding (UFLS) that is intended to trip one or more BES Elements to be more precise. Protection Systems associated with Special Protection Systems (SPS) and Remedial Action Schemes (RAS) are excluded and will be addressed in phase two of this project and have been excluded in the Applicability.</p>
<p>(Continued)</p> <p>R1.1. The Protection Systems to be reviewed and analyzed for Misoperations (due to their potential impact on BES reliability).</p>	<p>R1. Each Transmission Owner, Generator Owner, and Distribution Provider that owns a BES interrupting device that operated under the circumstances in 1.1 through 1.3 shall, within 120 calendar days of the BES interrupting device operation, identify whether its</p>	<p>The applicable entities will be required to identify whether a Misoperation occurred for each BES interrupting device operation which meet criteria 1.1 through 1.3. Requirement R1 is most clearly the direct carryover from the PRC-003-1 Reliability Standard which involves the “owner” of the Protection System. The previous standard was silent on the responsibilities of other Protection System owners and had no provision for</p>

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	<p>Protection System component(s) caused a Misoperation:</p> <p>1.1 The BES interrupting device operation was caused by a Protection System or by manual intervention in response to a Protection System failure to operate; and</p> <p>1.2 The BES interrupting device owner owns all or part of the Composite Protection System; and</p> <p>1.3 The BES interrupting device owner identified that its Protection System component(s) caused the BES interrupting device(s) operation or was caused by manual intervention in response to a Protection System failure to operate.</p>	<p>ensuring that other owners had a responsibility to be involved in the review and analysis.</p>
<p>(Continued)</p> <p>R1.1. The Protection Systems to be reviewed and analyzed</p>	<p>R2. Transmission Owner, Generator Owner, and Distribution Provider that owns a BES interrupting device that operated</p>	<p>Requirement R2 asserts a responsibility on the initiating entity (i.e., BES interrupting device owner) to notify other owners of the Composite Protection System when</p>

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for Misoperations (due to their potential impact on BES reliability).	<p>shall, within 120 calendar days of the BES interrupting device operation, provide notification as described in 2.1 and 2.2.</p> <p>2.1 When a BES interrupting device operation by a Composite Protection System or by manual intervention in response to a Protection System failure to operate, notification of the operation shall be provided to the other owner(s) that share Misoperation identification responsibility for the Composite Protection System under the following circumstances:</p> <p>2.1.1 The BES interrupting device owner shares the Composite Protection System ownership with any other entity; and</p>	<p>the cause of a Protection System operation was not caused (or is undetermined) by the BES interrupting device owner and when a Misoperation is identified (or cannot be ruled out) in accordance with Part 2.1, including sub-parts 2.1.1 through 2.1.3.</p>

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	<p>2.1.2 The BES interrupting device owner has determined that a Misoperation occurred or cannot rule out a Misoperation; and</p> <p>2.1.3 The BES interrupting device owner has determined that its Protection System component(s) did not cause the BES interrupting device(s) operation or cannot determine whether its Protection System components caused the BES interrupting device(s) operation.</p> <p>2.2 For a BES interrupting device operation by a Protection System component intended to operate as backup protection for a condition on another entity's BES Element, notification of the operation shall</p>	<p>(Part 2.2) Since Requirement R1 initiates the reliability activity upon the operation of a BES interrupting device, Requirement R1 does not address the case of a Protection System failure where a remote BES interrupting device operates.</p> <p>The second Part 2.2 of Requirement R2 is a provision to require notification to the other owners when a remote BES interrupting device operates as backup protection for a condition on another entity's BES Element. This generally indicates that another BES interrupting device has most likely failed to operate. Part 2.2 requires the other owner for which backup protection was provided to be notified, thus initiating the reliability activity to</p>

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	be provided to the other Protection System owner(s) for which that backup protection was provided.	identify a possible Misoperation under Requirement R3 by the other owner(s).
(Continued) R1.1. The Protection Systems to be reviewed and analyzed for Misoperations (due to their potential impact on BES reliability).	R3. Each Transmission Owner, Generator Owner, and Distribution Provider that receives notification, pursuant to Requirement R2 shall, within the later of 60 calendar days of notification or 120 calendar days of the BES interrupting device(s) operation, identify whether its Protection System component(s) caused a Misoperation.	Requirement R3 places responsibility on the applicable entity that receives notification to review its Protection System component(s) for Misoperations similar to Requirement R1. It is common practice for the BES interrupting device owner that initiates the review to be in communication and collaboration with other Protection System component(s) owners during its review within the 120 calendar day period. The shorter 60 calendar day period for the notified entity assures that in the rare case where the notifying entity takes the majority of its allotted time (120 calendar days) to review an operation, the receiving entity will always have a minimum and reasonable time (60 calendar days) to conduct its review.
(Continued) R1.1. The Protection Systems to be reviewed and analyzed	R4. Each Transmission Owner, Generator Owner, and Distribution Provider that has not determined the cause(s) of a	Requirement R4 is essentially a new requirement to determine the cause(s) of a Misoperation where the previous requirements (i.e., R1 or R3) failed to reveal the

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for Misoperations (due to their potential impact on BES reliability).	<p>Misoperation, for a Misoperation identified in accordance with Requirement R1 or R3, shall perform investigative action(s) to determine the cause(s) of the Misoperation at least once every two full calendar quarters after the Misoperation was first identified, until one of the following completes the investigation:</p> <ul style="list-style-type: none"> • The identification of the cause(s) of the Misoperation; or • A declaration that no cause was identified. 	<p>cause(s) of a Misoperation. In most cases, the cause(s) of a Misoperation will be revealed during the course of review and when the cause(s) is not readily apparent, the applicable entity is required in Requirement R4 to conduct at least one investigative action every two full calendar quarters until the entity determines the cause(s) or declares that it could not determine the cause.</p>
R1.2. Data reporting requirements (periodicity and format) for Misoperations.	None.	<p>NERC Rules of Procedure, Section 1600 Request for Information or Data will replace the reporting obligations of the applicable entities. As such, reporting to Regional Entities will end and continent-wide single reporting to the Electric Reliability Organization (ERO) will be required. The ERO will analyze the data to: develop meaningful metrics; identify trends in Protection System performance that negatively impact reliability; identify</p>

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		remediation techniques; and publicize lessons learned for the industry. Metrics will be validated and shared with each Regional Entity. The removal of the data collection from the standard does not result in a reduction of reliability.
R1.3. Process for review, analysis follow up, and documentation of Corrective Action Plans for Misoperations.	<p>R5. Each Transmission Owner, Generator Owner, and Distribution Provider that owns the Protection System component(s) that caused the Misoperation shall, within 60 calendar days of first identifying a cause of the Misoperation:</p> <ul style="list-style-type: none"> • Develop a Corrective Action Plan (CAP) for the identified Protection System component(s), and an evaluation of the CAP’s applicability to the entity’s other Protection Systems including other locations, or • Explain in a declaration why corrective actions are beyond the 	<p>The proposed PRC-004-3, Requirement R5 provides a step not apparent in the previous PRC-003-1 which is the development of a Corrective Action Plan (CAP) within 60 calendar days of first identifying the Misoperation cause. Requirement R5 also requires each applicable entity to perform an evaluation of the CAP’s applicability to the entity’s other Protection Systems, including those at other locations.</p> <p>Furthermore, Requirement R5 accounts for those cases why corrective actions are beyond the entity’s control or would not improve BES reliability and that no further corrective actions will be taken. This could be a result of a cause created by a non-registered third party, such as a communication provider. Also, should implementing the changes not improve BES reliability, the entity may</p>

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	entity's control or would not improve BES reliability, and that no further corrective actions will be taken.	document in a declaration that a CAP is not practical. The entity must explain in a declaration why no further action will be taken.
(Continued) R1.3. Process for review, analysis follow up, and documentation of Corrective Action Plans for Misoperations.	R6. Each Transmission Owner, Generator Owner, and Distribution Provider shall implement each CAP developed in Requirement R5, and update each CAP if actions or timetables change, until completed.	Requirement R6 requires the implementation of the CAP. The applicable entity must update the CAP if actions or timetables change until the CAP is completed.
R1.4. Identification of the Regional Reliability Organization group responsible for the procedures and the process for approval of the procedures.	None.	The proposed PRC-004-3 now requires the applicable entities (GO, DP, and TO) to individually address Misoperations of its Protection Systems for BES Elements without regard to the Region or Regions in which it owns Protection Systems for BES Elements. The proposed PRC-004-3 Reliability Standard, revised definition of "Misoperation," and new definition of "Composite Protection System" provide sufficient clarity to entities; therefore, there is no reliability benefit to obtain the Regional Entity's (formerly Regional Reliability

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		Organization or RRO) approval of procedures. Each applicable entity will be measured on its performance with the proposed PRC-004-3 requirements.
R2. Each Regional Reliability Organization shall maintain and periodically update documentation of its procedures for review, analysis, reporting, and mitigation of transmission and generation Protection System Misoperations.	4. Applicability: 4.1. Functional Entities: 4.1.1 Transmission Owner 4.1.2 Generator Owner 4.1.3 Distribution Provider	The proposed PRC-004-3 implicitly requires each applicable entity to have its own procedures and processes; therefore, there is no need to have a specific requirement for dictating the updating of such procedures or processes by the previous Regional Reliability Organization (now Regional Entity) or applicable entities. Requiring the applicable entities to update procedures is an activity or task that does little, if anything, to benefit or protect the reliable operation of the BES.
R3. Each Regional Reliability Organization shall distribute procedures in Requirement 1 and any changes to those procedures, to the affected Transmission	None.	The proposed PRC-004-3 implicitly requires each applicable entity to have its own procedures and processes; therefore, there is no longer a need to distribute such procedures or processes by the previous Regional Reliability Organization (now Regional Entity) to the applicable entities. Requiring the applicable entities to distribute procedures is an activity or task that does

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Owners, Distribution Providers that own transmission Protection Systems, and Generator Owners within 30 calendar days of approval of those procedures.		little, if anything, to benefit or protect the reliable operation of the BES.

Standard: PRC-004-2.1a - Analysis and Mitigation of Transmission and Generation Protection System Misoperations		
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<p>4. Applicability:</p> <p>4.1. Transmission Owner</p> <p>4.2. Distribution Provider that owns a transmission Protection System</p> <p>4.3. Generator Owner</p>	<p>4. Applicability:</p> <p>4.1. Functional Entities:</p> <p>4.1.1 Transmission Owner</p> <p>4.1.2 Generator Owner</p> <p>4.1.3 Distribution Provider</p> <p>4.2. Facilities:</p> <p>4.2.1 Protection Systems for BES Elements, with the following exclusions:</p> <p>4.2.1.1 Non-protective functions that are embedded within a Protection System.</p> <p>4.2.1.2 Protective functions intended to operate as a control function during switching.</p> <p>4.2.1.3 Special Protection Systems (SPS).</p> <p>4.2.1.4 Remedial Action Schemes (RAS).</p>	<p>The same applicable entities will transition to the new PRC-004-3 standard. The clause about the Distribution Provider <i>“that owns a transmission Protection System”</i> has been removed because it was ambiguous. This clause is replaced by <i>“Protection Systems for BES Elements”</i> found in Section 4.2, Facilities and applies to all the applicable entities. Having the Applicability section address Facilities specifically removes the ambiguity of what a <i>“transmission Protection System”</i> includes. The proposed PRC-004-3 standard is specific that it includes those Protection Systems for BES Elements, including UFLS that is intended to trip one or more BES Elements.</p> <p>Additional language is provided for clarity that non-protective functions and those protective functions that are intended to operate as a control function (e.g., a reverse power relay operated to remove a generating unit from service) are not applicable. The standard’s Applicability is further clarified to include underfrequency load shedding (UFLS) that is intended to trip one or more BES Elements to be more precise. Protection Systems associated with Special Protection Systems (SPS) and</p>

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	<p>4.2.2 Underfrequency load shedding (UFLS) that is intended to trip one or more BES Elements.</p>	<p>Remedial Action Schemes (RAS) are addressed in phase two of this project and have been excluded in the Applicability.</p>
<p>R1. The Transmission Owner and any Distribution Provider that owns a transmission Protection System shall each analyze its transmission Protection System Misoperations and shall develop and implement a Corrective Action Plan to avoid future Misoperations of a similar nature according to the Regional Entity’s procedures.</p> <p>R2. The Generator Owner shall analyze its generator and generator</p>	<p>R1. Each Transmission Owner, Generator Owner, and Distribution Provider that owns a BES interrupting device that operated under the circumstances in 1.1 through 1.3 shall, within 120 calendar days of the BES interrupting device operation, identify whether its Protection System component(s) caused a Misoperation:</p> <p>1.1 The BES interrupting device operation was caused by a Protection System or by manual intervention in response to a Protection System failure to operate; and</p> <p>1.2 The BES interrupting device owner owns all or part of the Composite Protection System; and</p>	<p>The currently approved standard PRC-004-2.1a, Requirements R1 and R2 include three levels of performance which is analyze (Protection System operations), develop (CAP), and implement (CAP). The proposed standard, which includes the same three applicable entities (DP, GO, and TO), divides the three levels of performance into six discrete Requirements. Requirement R1 provides the “analyze” portion, requiring the initiating BES interrupting device owner to review its Protection System for each BES interrupting device operation that meets the three criteria (i.e., 1.1 through 1.3).</p>

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interconnection Facility Protection System Misoperations, and shall develop and implement a Corrective Action Plan to avoid future Misoperations of a similar nature according to the Regional Entity's procedures.	<p>1.3 The BES interrupting device owner identified that its Protection System component(s) caused the BES interrupting device(s) operation or was caused by manual intervention in response to a Protection System failure to operate.</p> <p>R2. Transmission Owner, Generator Owner, and Distribution Provider that owns a BES interrupting device that operated shall, within 120 calendar days of the BES interrupting device operation, provide notification as described in 2.1 and 2.2.</p> <p>2.1 When a BES interrupting device operation by a Composite Protection System or by manual intervention in response to a Protection System failure to operate, notification of the operation shall be provided to the</p>	<p>The "analyze" portion is further clarified in the proposed Requirement R2 by ensuring that any other owners of the Composite Protection System are notified when the cause of a Protection System operation was not caused (or is undetermined) by the BES interrupting device owner and when a Misoperation is identified (or cannot be ruled out) in accordance with Part 2.1, including sub-parts 2.1.1 through 2.1.3.</p>

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	<p>other owner(s) that share Misoperation identification responsibility for the Composite Protection System under the following circumstances:</p> <p>2.1.1 The BES interrupting device owner shares the Composite Protection System ownership with any other entity; and</p> <p>2.1.2 The BES interrupting device owner has determined that a Misoperation occurred or cannot rule out a Misoperation; and</p> <p>2.1.3 The BES interrupting device owner has determined that its Protection System component(s) did not cause the BES interrupting device(s) operation or cannot determine whether</p>	

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	<p>its Protection System components caused the BES interrupting device(s) operation.</p> <p>2.2 For a BES interrupting device operation by a Protection System component intended to operate as backup protection for a condition on another entity’s BES Element, notification of the operation shall be provided to the other Protection System owner(s) for which that backup protection was provided.</p> <p>R3. Each Transmission Owner, Generator Owner, and Distribution Provider that receives notification, pursuant to Requirement R2 shall, within the later of 60 calendar days of notification or 120 calendar days of the BES interrupting device(s) operation, identify whether its Protection System component(s) caused a Misoperation.</p>	<p>(Part 2.2) Since Requirement R1 initiates the reliability activity upon the operation of a BES interrupting device, Requirement R1 does not address the case of a Protection System failure where a remote BES interrupting device operates.</p> <p>The second Part 2.2 of Requirement R2 is a provision to require notification to the other owners when a remote BES interrupting device operates as backup protection for a condition on another entity’s BES Element. This generally indicates that another BES interrupting device has most likely failed to operate. Part 2.2 requires the other owner for which backup protection was provided to be notified, thus initiating the reliability activity to identify a possible Misoperation under Requirement R3 by the other owner.</p> <p>Requirement R3 places responsibility on the applicable entity that receives notification to review its Protection System component(s) for Misoperations similar to Requirement R1. It is common practice for the BES interrupting device owner that initiates the review to be</p>

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	<p>R4. Each Transmission Owner, Generator Owner, and Distribution Provider that has not determined the cause(s) of a Misoperation, for a Misoperation identified in accordance with Requirement R1 or R3, shall perform investigative action(s) to determine the cause(s) of the Misoperation at least once every two full calendar quarters after the Misoperation was first identified, until one of the following completes the investigation:</p> <ul style="list-style-type: none"> • The identification of the cause(s) of the Misoperation; or • A declaration that no cause was identified. <p>R5. Each Transmission Owner, Generator Owner, and Distribution Provider that owns the Protection System component(s) that caused the Misoperation shall, within 60 calendar</p>	<p>in communication and collaboration with other Protection System component(s) owners during its review within the 120 calendar day period. The shorter 60 calendar day period for the notified entity assures that in the rare case where the notifying entity takes the majority of its allotted time (120 calendar days) to review an operation, the receiving entity will always have a minimum and reasonable time (60 calendar days) to conduct its review.</p> <p>Requirement R4 is essentially a new requirement to determine the cause(s) of a Misoperation where the previous requirements (i.e., R1 or R3) failed to reveal the cause(s) of an identified Misoperation. In most cases, the cause(s) of a Misoperation will be revealed during the course of review and when the cause(s) is not readily apparent, the applicable entity is required in Requirement R4 to conduct at least one investigative action every two full calendar quarters until the entity determines the cause(s) or declares that it could not determine the cause.</p>

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	<p>days of first identifying a cause of the Misoperation:</p> <ul style="list-style-type: none"> • Develop a Corrective Action Plan (CAP) for the identified Protection System component(s), and an evaluation of the CAP’s applicability to the entity’s other Protection Systems including other locations, or • Explain in a declaration why corrective actions are beyond the entity’s control or would not improve BES reliability, and that no further corrective actions will be taken. <p>R6. Each Transmission Owner, Generator Owner, and Distribution Provider shall implement each CAP developed in Requirement R5, and update each CAP if actions or timetables change, until completed.</p>	<p>The proposed PRC-004-3, Requirement R5 provides a step not apparent in the previous PRC-003-1 which is the development of a Corrective Action Plan (CAP) within 60 calendar days of first identifying the Misoperation cause. Requirement R5 also requires each applicable entity to perform an evaluation of the CAP’s applicability to the entity’s other Protection Systems, including those Protection Systems at other locations.</p> <p>Furthermore, Requirement R5 accounts for those cases why corrective actions are beyond the entity’s control or would not improve BES reliability and that no further corrective actions will be taken. This could be a result of a cause created by a non-registered third party, such as a communication provider. Also, should implementing the changes not improve BES reliability, the entity must document in a declaration that a CAP actions are beyond the entity’s control or would not improve BES reliability. The entity must explain in a declaration why no further action will be taken.</p>

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		Requirement R6 requires the implementation of the CAP. The applicable entity must update the CAP if actions or timetables change until the CAP is completed.
R3. The Transmission Owner, any Distribution Provider that owns a transmission Protection System, and the Generator Owner shall each provide to its Regional Entity, documentation of its Misoperations analyses and Corrective Action Plans according to the Regional Entity's procedures.	None.	Since the NERC Rules of Procedure, Section 1600 Request for Data or Information will replace the reporting obligations, NERC will receive the data on a periodic basis, analyze, establish metrics, and share results accordingly with the Regional Entities as well as industry. Having reporting obligations as a Requirement is an activity or task that does little, if anything, to benefit or protect the reliable operation of the BES.