NPCC, Inc.

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September 28, 2012

RE: Notice of Open Process Review of Draft Revised NPCC Reliability Reference Directory #7 - Special Protection System

Ladies and Gentlemen:

In accordance with the NPCC Reliability Assessment Program, the Task Force on System Protection has completed a comprehensive review of NPCC Directory #7 (D7) and is posting it in the NPCC Open Process Review for comments. A major part of this review is to bring Directory #7 requirements in line with the Bulk Power System Protection Criteria, Directory #4 approved by Members in 2009. Attached is a copy of the draft revised D7 with changes highlighted. Below is a summary of the proposed changes.

Section 5 NPCC "Full Member", More Stringent Criteria and Appendix A Guide
Beside the noted changes to bring requirements in line with Directory 4 and other clarifying editorial changes made throughout the document, major additions/clarifications/changes made to D7 include:

1. Addition of requirement on communication medium outside the substation perimeter – Section 5.11.1.1.2.
2. Clarification on the use of single communication tower for radio communication systems used by two protection groups - Section 5.11.1.5.1.
3. Addition of another provision for route diversity – Section 5.11.1.5.2.
4. Addition of clarifying requirements for cable separation in Section 5.12.3
5. Maintenance aspects removed and will be taken up in the review of the Maintenance Criteria for Bulk Power System Protection, Directory #3.
6. Addition of new Section 7 - Compliance Requirements. The requirements proposed in this section have been reviewed with the Compliance Committee and the Reliability Standard Committee and have received their support. The development of these requirements clarify the compliance expectation so that the current structure of the protection criteria and objectives can be maintained to establish the desired level of system protection reliability while at the same time encourage innovation and creativity in the protection designs.
7. Deletion of Definition of Terms consistent with Directory #4.

Appendix A: Guidance for Consideration in SPS Design

1. Addition of a new guide 2.5.1.2 concerning fire barrier used to separate cabling in a common raceway.
2. Maintenance aspects removed and will be taken up in the review of Directory #3.
3. Addition of a new guide 2.9 in support of the new requirement 5.11.1.1.2.

Appendix B – Procedure for the Review of a Special Protection System
TFCP has proposed a comprehensive update to the overall SPS review procedure including the process flow diagram and the addition of a process to retire an SPS.

Appendix C – Procedure for Reporting to TFSP New and Modified Special Protection Systems
This reporting and review process is currently a part of Appendix B. It is now separated into its own Appendix with a new introduction section and other minor editorial changes.

The NPCC Open Process Review may be accessed through:

https://www.npcc.org/Standards/SitePages/NonStandardsList.aspx

A clean version is also attached for your convenience. All comments must be submitted electronically through the NPCC Web site. Comments will be received for forty-five days through Monday, November 12, 2012, and they will be addressed by the NPCC Task Force on System Protection.

Thank you for your assistance.

Yours very truly,

Daren

Daren Verner, Chairman
Task Force on System Protection

Attachments

cc: Task Force on System Protection
Task Force on Coordination of Planning

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NPCC
Regional Reliability Reference Directory # 7
Special Protection Systems

Task Force on System Protection Revision Review Record
December 27, 2007
Draft Sept 27, 2012
For Open Process Review

~~**2007**~~**Draft Sept 27, 2012**

Adopted by the Members of the Northeast Power Coordinating Council Inc., this December 27, 2007, based on recommendation by the Reliability Coordinating Committee, in accordance with Section VIII of the NPCC Amended and Restated Bylaws dated July 24, 2007 and as amended to date.

Revision History

Version	Date	Action	Change Tracking (New, Errata or Revisions)
0	12/27/07		New

Table of Contents

Draft Sept 27, 2012

1.0 Introduction

1.1 Title Special Protection Systems

1.2 Directory Number -7

1.3 Objective

~~Provide~~This directory provides the basic criteria for **Special Protection Systems (SPSs)** such that the **Bulk** ~~–~~**Power System** in NPCC Inc. member **Areas** is operated reliably. It is not a design specification. (consistent with language in D4, 1.3)

1.4 Effective Date Immediately upon Approval by the NPCC Full Members

Compliance Guidance Statement- Protection system designs submitted to the TFSP prior to the date of this revision are not subject to the TFSP documentation requirements described in Section 7, Compliance Requirements R1, R2, and R3.

1.5 Background

This directory establishes the basic **protection** criteria for ~~**Special Protection Systems**. It is not intended to be a design specification. It is recognized that responsible entities in certain **Areas** may choose to apply more rigid criteria because of local considerations~~**SPSs**.

Guidance for consideration in the implementation of these criteria is provided in Appendix A, and the procedure for reviewing new and revised ~~**Special Protection Systems**~~**SPSs** is provided in Appendix B and Appendix C.

1.6 Applicability

1.6.1~~–~~ Functional Entities

Transmission ~~Owner,~~ Owners

Generator ~~Owner,~~ Owners

Distribution ~~Provider~~Providers

1.6.2 Facilities

1.6.2.1 New Facilities

The standard requirements and criteria stipulated in this Directory apply to all new Type I and Type II ~~**Special Protection Systems (**~~**SPSs**~~)~~ as defined below. In the application of Type II **SPSs**, ~~their~~ security is the prime concern (see Section 3.3.1 of this document). As such, Sections ~~3.3.1.1, 3.3~~5.2.1, 5.6.3, ~~3.3.3~~5.7.2, ~~3.3.6~~5.10 and ~~3.3.8.1~~5.12 in this document do not apply to Type II. Each new Type I or Type II **Special Protection System** shall be reported to the Task Force on System Protection. It is recommended that this reporting be in accordance with the procedure stipulated in Appendix C of this Directory using the appropriate portion of the "Protection System Review Form" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

1.6.2.2 Existing Facilities

It is the responsibility of individual ~~Transmission Owners (TO), Generator Owners (GO) and Distribution Providers (DP)~~companies to assess their existing ~~**Special Protection Systems**~~**SPSs** and to make modifications which are required to meet the intent of these ~~standards~~criteria as follows:

~~a.~~ 1.6.2.2.1 Planned Renewal or Upgrade to Existing Facilities

It is recognized ~~that~~ there may be **SPSs,** which existed prior to each TO's, GO's, and DP's

adoption of the *Special Protection System Criteria*, that do not meet these criteria. If any ~~Special Protection Systems~~SPSs or sub-systems of these facilities are replaced as part of a planned renewal or upgrade to the facility and do not meet all of these criteria, then an assessment shall be conducted for those criteria that are not met. The result of this assessment shall be reported ~~on TFSP Form #1-5~~. It is recommended that this reporting be in accordance with the procedure stipulated in Section 4.0 of Appendix C of this Directory using the appropriate portion of the "Protection System Review Form" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

~~b.~~ 1.6.2.2.2 SPS Re-classified to Type I or Type II

These requirements apply to all existing **SPS**s which are reclassified as Type I or Type II due to system changes. A mitigation plan shall be required to bring such ~~a~~an **SPS** into compliance with these criteria.

~~c.~~ For Type I **SPS**, where the owner of the SPS has determined that the cost and risks involved to implement physical separation, as per Section 5.12, cannot be justified, the reason for this determination and an assessment shall be reported to the TFSP. It is recommended this reporting be in accordance with the procedure stipulated in Appendix C of this Directory using the appropriate portion of the "Protection System Review forms" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

1.6.2.2.4 In-kind Replacement of SPS Equipment

~~–~~If a component of an SPS ~~equipment~~ is replaced

"in-kind" as a result of an un-planned event, then it is not required to upgrade the associated **protection system** to comply with these criteria.

1.6.3 Responsibility

Whenever changes are anticipated in generating sources, transmission facilities, or operating conditions, Generator Owners and Transmission Owners shall review those **SPS** applications (i.e., settings, ac, and dc supplies) which can reasonably be expected to be impacted by those changes. (proposed additional language consistent with D4, 1.6.3)

1.6.4 Classification of **Special Protection Systems**

~~**Special Protection Systems**~~**SPSs** are sub-divided into three types. Reference can be made to the NPCC *~~Basic Criteria for Design and Operation of Interconnected~~the Bulk Power ~~Systems (Document A-2)~~System* (Directory #1) and NERC TPL Standards, where design criteria contingencies ~~are described in Section 5.0;~~ operating criteria contingencies, ~~in Section 6.0;~~ and extreme contingencies~~, in Section 7.0 of Document A-2.~~ are described.

Type I ~~A **Special Protection System**~~An **SPS** which recognizes or anticipates abnormal system conditions resulting from design and operating criteria **contingencies**, and whose misoperation or failure to operate would have a **significant adverse impact** outside of the **local area**. The corrective ~~action~~actions taken by ~~the **Special Protection System**~~an **SPS** along with the actions taken by other **protection systems** are intended to return power system parameters to a stable and recoverable state.

Type II ~~A **Special Protection System**~~ An **SPS** which recognizes or anticipates abnormal system conditions resulting from extreme **contingencies** or other extreme causes, and whose misoperation or failure to operate would have a **significant adverse impact** outside of the

local area.

Type III ~~**Special Protection System**~~ An **SPS** whose misoperation or failure~~-~~ to operate results in no **significant adverse impact** outside the **local area**. The practices contained in this document for a Type I **SPS** should be considered but are not required for a Type III **SPS**. It should be recognized that a Type III **SPS** may, due to system changes, become Type I or Type II.

2.0~~-~~ Terms Defined in this Directory

The ~~following~~definitions of terms ~~are defined~~found in this Directory~~. Their definitions are provided~~ appearing in ~~Attachment 1.~~ bold typeface, can be found in NPCC *Glossary of Terms*.

~~**Bulk Power System**~~
~~**Contingency**~~
~~**Fault**~~
~~**Operating Procedures**~~
~~**Protection**~~
~~**Special Protection System (SPS)**~~
~~**Teleprotection**~~

3.0 NERC ERO Reliability Standard Requirements

~~3.1~~ The NERC ERO Reliability Standards containing Requirements that are associated with this Directory include, but may not be limited to:

~~3.1.1 PRC-012-0 Special Protection System Review Procedure~~

~~3.1.2 PRC-013-0 Special Protection System Database~~

~~3.1.3 PRC-014-0 Special Protection System Assessment~~

~~3.1.4 PRC-015-0 Special Protection System Data and Documentation~~

~~**System**~~**SPS** is capable of performing its intended function while itself experiencing a single failure. (This requirement does not apply to Type II **SPSs**.)

~~3.3.1~~

5.2.2 Multiple **protection groups** that are used to obtain redundancy within ~~a **Special Protection System**~~an **SPS** shall not share any of the same ~~component~~components.

5.3 Criteria for Security (added section label consistent with D4, 5.3)

5.3.1~~.3~~ A ~~**Special Protection System**~~Type II **SPS** shall be designed to avoid false operation while itself experiencing a ~~credible~~single component failure.~~-~~

~~3.3~~5.4 Criteria for Dependability and Security (added section label consistent with D4, 5.4)

5.4.1~~.4~~ The thermal capability of all ~~**Special Protection System**~~**SPS** components shall be adequate to withstand the rated maximum short time and continuous loading ~~conditions to which~~of the associated ~~power system~~**protected elements** ~~may be subjected~~.

~~3.3.1.~~5.4.2 Communication link availability, critical control switch ~~and~~, test switch positions, and trip circuit integrity~~,~~ shall be ~~monitored~~annunciated to ~~allow prompt attention by~~a 24-hour Operations center so that operating personnel can be notified and can initiate appropriate ~~operating authorities~~actions.

~~3.3.1.6 When remote access to **Special Protection Systems** is possible, the design shall include security measures to minimize the probability of unauthorized access to the **Special Protection System**.~~

~~3.3.1.7~~5.5 Criteria for Operating Time and Arming(added section label consistent with D4, 5.5)

5.5.1 An **SPS** shall be designed to take corrective action(s) within times determined by ~~–~~studies with due regard to security, dependability, and selectivity.

~~3.3.1.8~~5.5.2 Status of **SPS** arming shall be ~~monitored to allow prompt attention by~~annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate ~~operating authorities.~~actions.

5.5.3~~.3.1.9~~ An **SPS** shall be equipped with means to enable its arming and to independently verify ~~the~~its arming.

~~3.3.2~~ 5.6 Current Transformer Criteria

Current transformers (CTs) associated with ~~**Special Protection Systems**~~**an SPS** shall have adequate steady-state and transient characteristics for their intended function~~.~~ as follows:

~~3.3.2~~5.6.1 The output of each current transformer secondary winding shall be designed to remain within acceptable limits for the connected burdens under all anticipated currents, including **fault** currents, to ensure correct operation of the ~~**Special Protection System**~~**SPS**.

~~3.3.2~~5.6.2 The thermal and mechanical capabilities of the CT at the operating tap shall be adequate to prevent damage under maximum **fault** conditions and normal or **emergency** system loading conditions.

~~3.3.2~~5.6.3 For **protection groups** to be independent, they shall be supplied from separate ~~–~~current transformer secondary windings. (This requirement does not apply to Type II **SPSs**.)

~~3.3.2~~

5.6.4 Interconnected current transformer secondary wiring shall be grounded at only ~~-~~one point.

~~3.3.3~~ 5.7 Voltage Transformer and Potential Device Criteria

Voltage transformers and potential devices associated with ~~**Special Protection Systems**~~**an SPS** shall have adequate steady-state and transient characteristics for their intended ~~functions.~~function as follows:

~~3.3.3~~5.7.1 Voltage transformers and potential devices shall have adequate volt-ampere capacity to supply the connected burden while maintaining their **relay** accuracy over their specified primary voltage range.

~~3.3.3~~5.7.2 If ~~a **Special Protection System**~~an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, each of the **protection groups** shall be supplied from separate voltage sources.

The **protection groups** may be supplied from separate secondary windings on one transformer or potential device, provided all of the following requirements are met: (This Section does not apply to Type II **SPS**.)

~~.~~

5.7.2.1 Complete loss of ~~one~~ that voltage transformer or ~~more phase voltages~~potential device does not prevent ~~operation of~~ **both** ~~SPS~~ **protection groups** from performing the intended function;

~~.~~ 5.7.2.2 Each secondary winding has sufficient capacity to permit fuse **protection** of the circuit;

~~.~~ 5.7.2.3 Each secondary winding circuit is adequately fuse protected.

~~3.3.3~~5.7.3 The wiring from each voltage transformer secondary winding shall not be grounded at more than one point.

~~3.3.3.4 Voltage transformer installations should be designed with due regard to ferroresonance.~~

~~3.3.4~~ 5.8 Battery and Direct Current (dc) Supply Criteria

~~dc~~DC supplies associated with ~~a **Special Protection System**~~an **SPS** shall be designed to have a high degree of dependability as follows~~.~~:

~~3.3.4~~5.8.1 If ~~a **Special Protection System**~~an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, no single battery or dc power supply failure shall prevent the independent **protection groups** from performing the intended function. Each battery shall be provided with its own charger. Physical separation shall be maintained between the two station batteries or dc power supplies used to supply the independent **protection groups**. (This section does not apply to Type II **SPS**.) (proposed additional language consistent with D4, 5.8.1)

~~3.3.4~~5.8.2 Each battery shall have sufficient capacity to permit operation of ~~the **Special Protection System**~~an **SPS**, in the event of a loss of its battery charger or the ac supply source, for the period of time necessary to transfer the load to the other battery or re-establish the supply source. Each station battery and its associated charger shall have sufficient capacity to supply

the total dc load of the station. (proposed additional language consistent with D4, 5.8.2)

5.8.3 ~~3.3~~A transfer arrangement shall be provided to permit connecting the total dc load to either station battery without creating areas where, prior to failure of either a station battery or a charger, a single event can disable both dc supplies. **(proposed additional language consistent with D4, 5.8.3)**

5.8.4.~~3~~ The battery chargers and all dc circuits shall be protected against short circuits. ~~All protective devices should be coordinated to minimize the number of dc circuits interrupted.~~ (moved to Appendix A, Section 2.12 as guidance statement.)

~~3.3.4.4 dc~~5.8.5DC battery systems shall be continuously monitored to detect abnormal voltage levels (both high and low), dc grounds, and loss of ac to the battery chargers ~~in order to allow prompt attention by the appropriate operating authorities.~~. These conditions shall be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate actions. (proposed additional language consistent with D4, 5.8.5)

~~3.3.4.~~5 ~~**Special Protection System** dc~~.8.6 DC supply ~~circuits~~to the **SPS component** shall be continuously monitored to detect loss of voltage ~~in order to allow prompt attention by the~~ and be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate ~~operating authorities.~~actions. (proposed additional language consistent with D4, 5.8.6)

~~3.3.~~5~~.~~.9 Station Service ac Supply Criteria

~~If a **Special Protection System**~~If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, there shall be two sources of station service ac supply, each capable of carrying at least all the ~~critical loads~~battery chargers associated with the ~~**Special Protection System**~~**SPS**.

~~3.3.6~~ 5.10 Circuit Breakers Criteria

Where ~~**Special Protection System**~~**SPS** redundancy is achieved by the use of independent **protection groups** tripping the same circuit breakers without

overarming, each circuit breaker shall be equipped with two independent trip coils. (This dual trip coil requirement does not apply to Type II **SPS**.)

~~3.3.7~~

The design of a breaker with two trip coils shall be such that the breaker will operate if both trip coils are energized simultaneously. The relative polarity between the voltage applied to the two trip coils shall not affect proper breaker operation. The correct operation of this design shall be verified by tests and documented. (proposed additional language consistent with D4, 5.10)

5.11 **Teleprotection** Criteria

5.11.1 Communication facilities required for **teleprotection** shall be designed to have a level of performance consistent with that required of the ~~**Special Protection System**~~**SPS**, and shall meet the following:

~~3.3.7~~5.11.1.1 Where the design of ~~a **Special Protection System**~~an **SPS** is composed of multiple **protection groups** for redundancy and each group requires a communication channel~~, the~~:

5.11.1.1.1 The equipment ~~and channel~~ for each group shall be separated physically on non-adjacent panels and designed to minimize the risk of more than one **protection group** being disabled simultaneously by a single event or condition.

~~3.3.7~~5.11.1.1.2 The communication medium outside the substation physical perimeter for each **protection group** shall be designed to minimize the risk of both **protection groups** being disabled simultaneously by a single event or condition. In addition, physical separation of the communication media outside the substation fence shall be three feet at a minimum. (Also, see Appendix A, Section 2.9.)

5.11.1.2 **Teleprotection** equipment shall be monitored to detect loss of equipment and/or channel ~~to allow prompt attention by the~~ and be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate ~~operating authorities.~~actions.

~~3.3.7~~5.11.1.3 **Teleprotection** ~~systems shall be designed to assure adequate signal transmission during **bulk power system disturbances, and**~~equipment shall be provided with means to test for proper signal adequacy.

~~3.3.7~~5.11.1.4 **Teleprotection** equipment shall be powered by the substation batteries or other sources independent from the power system. See Section 5.8, Battery and dc Supply Criteria.

~~3.3.7~~5.11.1.5 Except as identified otherwise in these criteria, the two **teleprotection** groups shall not share the same component. ~~The use of a single communication tower for the radio communication systems used by the two SPS groups is permitted.~~

~~3.3.8 Physical Separation/~~5.11.1.5.1 The use of a single communication tower for radio communication systems used by the two **protection groups** of an **SPS** is permitted as long as diversity of the communication signals is achieved.

5.11.1.5.2 Where telecommunication route diversity cannot be achieved, overarming of the appropriate **SPS** trip outputs is an acceptable mitigation.

5.12 Environment ~~Criteria~~ (This Section does not apply to Type II **SPS**.)

~~3.3.8~~5.12.1 In addition to the physical separation as referenced in ~~sections 3.3.1.2 and 3.3.9.5~~Section 5.2.2, if ~~a **Special Protection System**~~an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, each ~~separate~~individual **protection group** and ~~**Teleprotection**~~**teleprotection** of ~~an~~the **SPS** shall be on ~~different~~ non-adjacent vertical mounting assemblies or enclosures.

~~3.3.8.2~~

5.12.2 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, wiring for each individual **protection group** and

teleprotection of the **SPS** shall not be in the same cable. (proposed additional language consistent with D4, 5.12.2)

5.12.3 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy:

- Cabling for individual **protection groups** and **teleprotection** of the **SPS** shall be physically separated. This can be accomplished via different raceways, trays, trenches, etc. (proposed additional language consistent with D4, 5.12.3)
- Cable separation shall be achieved up to the breaker control cabinet. (new clarified separation requirement)
- Cable separation shall be achieved up to the equipment control cabinet. (new clarified separation requirement)

5.12.5 In the event a common raceway is used, cabling for ~~separate~~individual **protection groups** of an **SPS** shall~~-~~ be separated by a fire barrier.

~~3.3.9~~ 5.13 Grounding Criteria

~~Station grounding is critical to the correct operation of **Special Protection Systems**. The design of the ground grid directly impacts proper **Special Protection System** operation and probability of false operation from **fault** currents or transient voltages.~~ (moved to Appendix A, Section 2.11, as a guidance statement.

~~3.3.9.1~~ Each TO, GO ~~and~~or DP shall have established as part of its substation design procedures or specifications, a mandatory method of designing the substation ground grid, which:

~~.~~5.13.1 Can be traced to a recognized calculation methodology
~~.~~5.13.2 Considers cable shielding
~~.~~5.13.3 Considers equipment grounding

~~3.3.10~~ 5.15 Provision for Breaker Failure Criteria

Type I **SPS** shall include breaker failure **protection** for each circuit breaker whose operation is critical to the adequacy of the action taken by the **SPS** with due regard to the power system conditions this **SPS** is required to detect. ~~Options~~ The following are options for breaker failure **protection**:

~~3.3.10~~5.15.1 A design which recognizes that the breaker has not achieved or will not achieve the intended function required by the ~~**Special Protection**~~

~~System~~SPS and which takes independent action to achieve that function. This provision needs not be duplicated and can be combined with conventional breaker failure schemes if appropriate.

~~3.3.10~~5.15.2 Overarming the ~~Special Protection System~~SPS such that adequate action is taken even if a single breaker fails.

5.15.3~~.3.10.3~~ The redundancy afforded by actions taken by other independent schemes or devices.

~~3.3.11~~5.16 Design to Facilitate Testing and Maintenance ~~Criteria~~

~~3.3.11.1 Each SPS shall be maintained in accordance with the Maintenance Criteria for Bulk Power System Protection (Document A-4).~~

~~3.3.11.2~~ 5.16.1 The design of an **SPS** both in terms of circuitry and physical arrangement shall facilitate periodic testing and maintenance.

~~3.3.11.3~~ 5.16.2 Test facilities or test procedures shall be designed such that they do not compromise the independence of the redundant design aspects of ~~the~~an **SPS**.

~~3.3.11.4 An SPS shall be functionally tested when initially placed in service and when modifications are made.~~ (moved to separate new section 5.18)

~~3.3.11.5~~ 5.16.3 If a segmented testing approach is used, test procedures and test facilities shall be designed to ensure that related tests properly overlap. Proper overlap is ensured if each portion of circuitry is seen to perform its intended function, such as operating a relay~~,~~ from either a real or test stimulus, while observing some common reliable downstream indicator.

~~3.3.11.6 All positive combinations of input logic shall be tested regardless of the maintenance strategy used.~~ (will be incorporated into the maintenance criteria D3)

~~3.3.11.7 Sufficient testing shall be employed~~5.17 Design to ~~ensure that timing races do not exist within hardwired or electronic logic, and that the SPS operating time is within design limits.~~ (will be incorporated into the maintenance criteria D3)

~~3.3.11.8 Each time the SPS is maintained, its hardware shall be tested in conjunction with the control facilities, related computer equipment, software and **operating procedures** to ensure compatibility and correct operation.~~ (will be incorporated into the maintenance criteria D3)

~~3.3.12~~Facilitate Analysis of **SPS** Performance

~~3.3.12~~5.17.1 ~~**Bulk power system** automatic operations shall be analyzed to determine proper **Special Protection System** performance. Corrective measures must be taken promptly if the **Special Protection System** or a **protection group**~~

~~within the SPS fails to operate or operates incorrectly.~~ (covered by NERC Standard PRC-004

~~3.3.12.2~~ Event recording capability shall be provided to permit analysis of ~~system operations and **Special Protection System**~~the **SPS**'s performance.

~~4~~5.18 Commissioning Testing

An **SPS** shall be functionally tested when initially placed in service and when modifications are made. (moved from Section 5.16 above)

6.0 Measures and Assessments

~~-~~None developed at this time.

Draft Sept 27, 2012

7.0 Compliance Requirements

R1. An entity, proposing to install a new **special protection system** or a modification to an existing **special protection system**, shall submit documentation as per Sections 1.6.2.1 or 1.6.2.2, respectively.

R2. An entity, proposing to install a new **special protection system** or a modification to an existing **special protection system**, shall obtain a letter of acceptance by TFSP of the compliance statement accompanying the submittal in R1 prior to placing the **special protection system** in service.

R3. The entity shall provide within 30 days, upon request from the Regional Entity (Criteria Compliance Enforcement Program) documented evidence of the submittal and acceptance by TFSP, of any new or modified **special protection system**.

Prepared by: Lead Task Force- Task Force on System Protection

Review and Approval: Revision to any portion of this Directory will be posted by the

lead Task Force in the NPCC Open Process for a 45 day review and comment period. Upon satisfactorily addressing all the comments in this forum, the Directory document will be sent to the remaining Task Forces for their recommendation to seek RCC approval.

Upon approval of the RCC, this Directory will be sent to the Full Member Representatives for their final approval if sections pertaining to the Requirements and Criteria portion have been revised. All voting and approvals will be conducted according to the most current "NPCC Inc. Bylaws" in effect at the time the ballots are cast.

Revisions pertaining to the Appendices or any other portion of the document such as Links, Glossary Terms, etc., will only require RCC Member approval of the document. Errata may be corrected by the Lead Task Force at any time and provide the appropriate notifications to the NPCC Inc. membership.

This Directory will be updated at least once every three years and as often as necessary to keep it current and consistent with NERC Regional Reliability Standards and other NPCC documents.

References:

NPCC RRS PRC-XXX-X (Future NPCC Regional Standard)

~~Basic Criteria for~~ Design and Operation of ~~Interconnected~~the Bulk Power ~~Systems (Document A-2~~System (Directory #1)

Emergency Operation ~~Criteria (Document A-3)~~(Directory #2)

Maintenance Criteria for Bulk Power System Protection (~~Document A-4~~Directory #3)

NPCC Glossary of Terms (Document A-7)

Draft Sept 27, 2012

~~Attachment 1~~
~~Definition of Terms~~

~~**Bulk power system** – The interconnected electrical systems within northeastern North America comprising **generation** and transmission facilities on which **faults** or **disturbances** can have a **significant adverse impact** outside of the local area. In this context, local areas are determined by the Council members.~~

~~**Contingency** – An event, usually involving the loss of one or more **elements,** which affects the **power** system at least momentarily.~~

~~**Fault** – An electrical short circuit.~~

~~Permanent Fault — A fault which prevents the affected **element** from being returned to service until physical actions are taken to effect repairs or to remove the cause of the fault.~~

~~Transient Fault — A fault which occurs for a short or limited time, or which disappears when the faulted **element** is separated from all electrical sources and which does not require repairs to be made before the **element** can be returned to service either manually or automatically.~~

~~**Operating Procedures** – A set of policies, practices, or system adjustments that may be automatically or manually implemented by the system operator within a specified time frame to maintain the operational integrity of the interconnected electric systems.~~

~~Automatic Operating Systems — **Special protection systems**, remedial action schemes, or other operating systems installed on the electric systems that require *no intervention* on the part of **system operators**.~~

~~Normal (Precontingency) Operating Procedures — Operating procedures that are normally invoked by the **system operator** to alleviate potential facility overloads or other potential system problems in anticipation of a **contingency**.~~

~~Postcontingency Operating Procedures — Operating procedures that may be invoked by the **system operator** to mitigate or alleviate system problems after a **contingency** has occurred.~~

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~~**Protection** - The provisions for detecting power system **faults** or abnormal conditions and taking appropriate automatic corrective action.~~

~~**Protection group** — A fully integrated assembly of **protective relays** and associated equipment that is designed to perform the specified protective functions for a power system **element**, independent of other groups.~~

~~Notes:~~

~~(a) Variously identified as Main **Protection**, Primary **Protection**, Breaker Failure **Protection**, Back-Up **Protection**, Alternate **Protection**, Secondary **Protection**, A **Protection**, B **Protection**, Group A, Group B, System 1 or System 2.~~

~~(b) Pilot **protection** is considered to be one **protection group.**~~

~~**Protection** system~~

~~Element Basis~~

~~One or more **protection** groups; including all equipment such as instrument transformers, station wiring, circuit breakers and associated trip/close modules, and communication facilities; installed at all terminals of a power system **element** to provide the complete **protection** of that **element**.~~

~~Terminal Basis~~

~~One or more **protection** groups, as above, installed at one terminal of a power system **element**, typically a transmission line.~~

~~Pilot **Protection** — A form of line **protection** that uses a communication channel as a means to compare electrical conditions at the terminals of a line.~~

~~**Significant adverse impact** — With due regard for the maximum operating capability of the affected systems, one or more of the following conditions arising from **faults** or **disturbances**, shall be deemed as having **significant adverse impact**:~~

~~a. instability;~~

~~. any instability that cannot be demonstrably contained to a well defined local area.~~

. any loss of synchronism of generators that cannot be demonstrably contained to a well-defined local area

b. unacceptable system dynamic response;

. an oscillatory response to a **contingency** that is not demonstrated to be clearly positively damped within 30 seconds of the initiating event.

c. unacceptable equipment tripping

. tripping of an un-faulted **bulk power system** element (element that has already been classified as **bulk power system**) under planned system configuration due to operation of a **protection** system in response to a stable power swing

. operation of a Type I or Type II **Special Protection System** in response to a condition for which its operation is not required

d. voltage levels in violation of applicable **emergency** limits;

e. loadings on transmission facilities in violation of applicable **emergency** limits;

Special protection system (SPS) – A **protection system** designed to detect abnormal system conditions, and take corrective action other than the isolation of faulted **elements**. Such action may include changes in **load**, **generation**, or system configuration to maintain system **stability**, acceptable voltages or power flows. Automatic underfrequency **load shedding** as defined in the *Emergency Operation Criteria* A-3, is not considered a **Special Protection System**. Conventionally switched, locally controlled shunt devices are not **Special Protection Systems**.

Teleprotection – A form of **protection** that uses a communication channel

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Appendix A
Guidance for Consideration in SPS Design

1.0 ~~Introduction~~

1.0 Introduction

This Appendix provides the guidance for consideration in the implementation of the **Special Protection System (SPS)** design criteria stipulated in Section ~~3.3~~5 of this Directory.

2.0 Design Considerations

2.1 General Considerations

The general objective for any **SPS** is to perform its intended function (generator rejection, load rejection, etc.) in a dependable and secure manner. In this context, dependability relates to the degree of certainty that the **SPS** will operate correctly when required to operate. Security relates to the degree of certainty that the **SPS** will not operate when not required to operate.

The relative effects on the **bulk power system** of a failure to operate when desired versus an unintended operation should be weighed carefully in selecting design parameters. For example, the choice of duplication as a means of providing redundancy improves the dependability of the **SPS** but can also jeopardize security in that it may increase the probability of an unintended operation. This general objective can be met only if the **SPS** can dependably respond to the specific conditions for which it is intended to operate and differentiate these from other conditions for which action must not take place.

Close coordination should be maintained among system planning, design, operating, maintenance, and **protection** functions, since both initially and throughout their life cycle, **SPSs** are a multi-discipline concern.

2.~~0 Considerations~~2 Issues Affecting Dependability

~~—~~2.2.1 Redundancy is normally provided by duplication. Some aspects of duplication may be achieved by overarming, which is defined as providing for more corrective action than would be necessary if no failures are considered. The redundancy requirements for an **SPS** apply only with

respect to its response to the conditions it is required to detect.

~~2~~.2.2 For ~~a **Special Protection System**~~an **SPS** that is composed of multiple **protection groups**, the risk of simultaneous failure of more than one **protection group** because of design deficiencies or equipment failure should be considered, particularly if identical equipment is used in each **protection group**. The extent and nature of these failures should be recognized in the design and operation of the ~~**Special Protection System**~~**SPS**.

2.2.3 ~~Area~~In addition to the separation requirements in the criteria, area of common exposure should be kept to a minimum to reduce the possibility of all groups being disabled by a single event such as fire, evacuation, water leakage, and other such incidents.

2.3~~.0 Considerations~~ Issues Affecting Security

~~2~~.3.1 An **SPS** should be designed to operate only for conditions which require its specific ~~–~~protective ~~–~~or control actions.

2.4 ~~**Special Protection Systems**~~Issues Affecting Dependability and Security

2.4.1 **SPSs** should be no more complex than required for any given application.

2.4.2 The components and software used in ~~**Special Protection Systems**~~**SPSs** should be of proven quality,~~—~~ as demonstrated either by actual experience or by stringent tests under simulated operating conditions.

~~**Special Protection Systems**~~2.4.3 **SPSs** should be designed to minimize the possibility of component failure or malfunction due to electrical transients and interference or external effects such as vibration, shock and temperature.

~~3.5 **Special Protection Systems**~~2.4.4 **SPSs**, including intelligent electronic devices (IEDs) and communication systems used for **protection**, should comply with applicable industry standards for utility grade **protection** service. Utility Grade **Protection** System Equipment are equipment that are suitable for protecting transmission power system **elements**, that are required to operate reliably, under harsh environments normally found at

substations. Utility grade equipment should meet the applicable sections of all or some of the following types of industry standards, to ensure their suitability for such applications:

- IEEE C37.90.1~~-2002~~ (oscillatory surge and fast transient)
- IEEE C37.90.1~~-2002~~ (service conditions)
- IEC 60255-22-1~~, 2005~~ (1 MHz burst, i.e. oscillatory)
- IEC 61000-4-12~~, 2001~~ (oscillatory surge)
- IEC 61000-4-4~~, 2004~~ (EFT)
- IEC 60255-22-4~~, 2002~~ (EFT)
- IEEE C37.90.2~~-2004~~ (narrow-band radiation)
- IEC 60255-22-3~~, 2000~~ (narrow-band radiation)
- IEC 61000-4-3~~, 2002~~ (narrow-band radiation)
- IEEE 1613 (communications networking devices in Electric power Substations)

~~3.6 Special Protection System~~2.4.4 **SPS** circuitry and physical arrangements should be carefully ~~–~~designed so as to minimize the possibility of incorrect operations due to personnel error.

2.4.5 ~~**Special Protection System**~~**SPS** automatic self-checking facilities should be designed so as to not ~~-~~degrade the performance of the ~~**Special Protection System.**~~**SPS.**

2.4.6 Consideration should be given to the consequences of loss of instrument transformer voltage inputs to ~~**Special Protection Systems**~~**SPSs**.

2.4.7 Consideration should be given to the effect of the means of arming on overall security and dependability of ~~the **Special Protection System.**~~an **SPS.** Arming should have a level of security and dependability commensurate with the requirements of ~~the~~an **SPS**.

~~Considerations~~2.5 Issues Affecting Performance

~~4~~2.5.1 Control Cable, Wiring and Ancillary Control Device

Control cables and wiring and ancillary control devices should be highly dependable and secure. Due consideration should be given to published codes and standards, fire hazards, current-carrying capacity, voltage drop, insulation level, mechanical strength, routing, shielding, grounding, and

environment.

~~4.~~2.5.1 Environment

2.5.1.1 Means should be employed to maintain environmental conditions that are favorable to the correct performance of ~~**Special Protection Systems**~~an **SPS**.

~~5.0~~

2.5.1.2. Fire barrier used to separate the cabling of the two **protection groups** of an **SPS** in common raceway should be sufficiently rated to allow enough time to isolate the affected facility while maintaining operation of one **protection group**.

2.6 Operating Time of an **SPS**

Adequate time margin should be provided taking into account study inaccuracies, differences in equipment, and **protection** operating times.

~~6.0~~ 2.7 Arming of an **SPS**

Arming is the selection, which may be external to the ~~**Special Protection System**~~**SPS**, of desired output action based on power system conditions and recognized contingencies. Arming requirements of ~~a Special Protection System~~an **SPS** are normally based upon the results of system studies, which take into account recognized contingencies, operating policies/procedures, and current power system load/generation conditions. For a simple ~~**Special Protection System**~~**SPS**, arming may be an on/off function. ~~**A Special Protection System**~~An **SPS** can be armed either automatically or manually.

~~6~~2.7.1 Automatic arming is implemented without human intervention.

~~6.2 Arming manually if the recognition, decision or implementation~~2.7.2 Manual arming requires human intervention. Sufficient time, with adequate margin for recognition, analysis, and the taking of corrective action, should be allowed.

~~7.0 Maintenance Considerations~~(will be incorporated into the maintenance criteria D3)

~~7.1 Additional periodic maintenance is recommended on the following **protection** equipment:~~

- ~~On continuously monitored analog **teleprotection** channels, verify signal adequacy every twelve months.~~
- ~~On non-monitored analog **teleprotection** channels, verify signal adequacy every month.~~
- ~~On digital **teleprotection** systems, which are inherently monitored, verify local function every two years.~~
- ~~On batteries and chargers, verify proper operation and general condition every month.~~
- ~~On circuit breakers, verify ability to trip via each trip coil every two years, with due regard to critical trip paths between sensing relays and the breaker trip coils.~~

~~7.2 It is the responsibility of each TO, GO and DP to evaluate its own particular circumstances and determine if any additional maintenance should be performed on its system. More extensive maintenance may be required but not limited to:~~

- ~~during the initial break-in period,~~
- ~~where **protection** systems are exposed to abnormal conditions such as temperature extremes, vibration, corrosive atmosphere, etc.,~~
- ~~when the operating condition of **protection** system control wiring is suspect..~~

~~7.3 The design of a **Special Protection System** both in terms of circuitry and physical arrangement should facilitate periodic testing and maintenance in a manner that mitigates the risk of inadvertent operation. As a **Special Protection System**~~2.8 Voltage Transformer and Potential Device

Voltage transformer installations should be designed with due regard to ferroresonance. (added language consistent with D4, Appendix A, 2.7)

2.9 Communication Medium for **Teleprotection**

In cases where constraints do not allow three feet separation, this distance may be reduced if a proposed alternative design can achieve comparable physical protection of the communication medium. If an alternative design cannot be met, then an alternative communication path or protection scheme should be proposed. (additional guidance associated with new requirement in 5.11.1.1.2)

2.10 Maintenance Considerations

2.10.1 As an **SPS** may be complex and may interface with other **protection systems** or control systems, special attention should be placed on ensuring that test devices and test interfaces properly support a clearly defined maintenance strategy.

2.10.2 Proper overlap is ensured if each portion of circuitry is seen to perform its intended function, such as operating a relay, from either a real or test stimulus, while observing some common reliable downstream indicator.

2.11 ~~Whenever practicable, some of~~ Grounding

~~7.5~~ Station grounding is critical to the ~~maintenance testing requirements may be met by analyzing~~

~~and documenting the detailed performance~~correct operation of an **SPS**. The design of the ~~**Special Protection System** during actual events to demonstrate that the specific testing requirements have been fulfilled. Such an approach can reduce the~~ ground grid directly impacts proper **SPS** operation and probability of false operation ~~during maintenance while effectively reducing the extent of planned maintenance~~from **fault** currents or transient voltages.(moved from Section 5.13)

2.12 Battery and Direct Current (dc) Supply

Protective devices protecting battery chargers and dc circuits should be coordinated to minimize the number of dc circuits interrupted. (moved from Section 5, 5.8.4)

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Appendix B
Procedure for the Review of a Special Protection ~~Systems~~System

1.0 ~~1.0~~ Introduction

1.1. This Appendix ~~provide~~provides the procedure to ~~follow to~~ obtain concurrence from NPCC if an entity ~~concludes that~~ proposes a new, modification to or retirement of a **Special Protection System** ~~or a modification of an existing **Special Protection System** will be required which affects the **bulk power system**.~~ **(SPS)**.

1.2. The ~~procedure is also~~proposing entity should allow sufficient lead time in order to accomplish all the steps in the process outlined here in. These processes are shown ~~on~~in the attached flow ~~chart.~~charts.

~~2.0 NPCC Review and Concurrence~~

~~2.1 Allowing for sufficient lead time to ensure an orderly review, the entity will notify the chairman of the Task Force on Coordination of Planning (TFCP) of its proposal to install a new **Special Protection System** or modify an existing **Special Protection System**. The entity will send copies of the complete notification to TFCO and TFSP. This notification will include statements that describe possible failure modes and whether misoperation, unintended operation or failure of the **Special Protection System** would have local, inter-company, inter-**Area** or inter-Regional consequences, when the **Special Protection System** is planned for service, how long it is expected to remain in service, the specific **contingency**(s) for which it is designed to operate and whether the **Special Protection System** will be designed according to the NPCC *Bulk Power System Protection Criteria* (Document A-5) and the *Special Protection System Criteria* and Standards requirements listed in this docment.~~

1.3. ~~2.2 If the **Special Protection System** is expected to have only local consequences, TFCP will request that the~~ The following are involved in the review and approval process of the **SPS**:

- Task Force on Coordination of Planning - TFCP
- Task Force on System Protection - TFSP
- Task Force on System Studies ~~(- TFSS) and the Task Force on System Protection (TFSP) review the proposal.~~

~~2.2.1 TFSP will be notified of the proposed **Special Protection System**. TFSP~~

~~will advise TFCP of any concerns.~~

~~2.2.2 TFSS will review the analyses that the proposing entity has performed. A presentation may be required from the proposing entity. The purpose of the review will be to confirm that there are no adverse inter-**Area** or inter-Regional consequences of either a failure of the **Special Protection System** to operate when and how it is required or an inadvertent or unintended operation of the **Special Protection System**. If necessary, TFSS will request that the proposing entity conduct additional analyses.~~

~~2.2.3 If the TFSS review confirms the **Special Protection System** has only local consequences, TFSS will send the information to TFCP. If TFCP concurs, they will then notify the proposing entity of NPCC's conclusions that the **Special Protection System** has only local consequences. TFCP will also notify the Reliability Coordinating Committee (RCC), all the Task Forces, the Compliance Committee (CC), the proposing entity and other Members that concurrence has been given to the proposing entity to modify an existing **Special Protection System** or install a new **Special Protection System**, at which time, the **Special Protection System** may be deployed.~~

~~2.2.4 If the TFSS review concludes that the **Special Protection System** could have inter-**Area** or inter-Regional consequences, they will inform the TFCP. Upon receipt of the TFSS conclusion or if TFCP separately determines the **Special Protection System** could have inter-**Area** or inter-Regional consequences, TFCP will arrange for an overall NPCC review as detailed in Step 3.~~

~~2.2.5 TFSS will update the NPCC **Special Protection System** list/database.~~

~~2.3 If the proposing entity expects the **Special Protection System** to have inter-**Area** or inter-Regional consequences, or if the TFSS or TFCP review concludes this to be the case, TFCP will request the Task Force on Coordination of Operation (TFCO), the Task Force on System Protection (TFSP) and TFSS to review it. Each of the Task Forces may require a presentation from the proposing entity.~~

~~2.3.1 TFSP will confirm the failure modes of the **Special Protection System**, including actions of back-up **protection**, and whether or not the **Special Protection System** complies with NPCC system **protection** standards.~~

~~TFSP will review whether the new or modified **Special Protection System** is in conformance with the NPCC *Bulk Power System Protection Criteria* (Document A-5) and the *Special Protection System Criteria* and Standards requirements listed in this document and forward a summary of their findings to TFCO, TFCP and TFSS. This summary will include a statement as to whether the **Special Protection System** is in conformance with the *Bulk Power System Protection Criteria* (Document A-5) and the *Special Protection System Criteria* and Standards requirments listed in this document and whether the Task Force has any objections to its modification or installation.~~

- ~~2.3.2 TFSS will review the analysis that the proposing entity has performed. The purpose of the review will be to assess the **Special Protection System** is in conformance with the NPCC *Design and Operation of the Bulk Power System* (Directory #1) and~~ Task Force on Coordination of Operations – TFCO
- Reliability Coordinating Committee – RCC

2.0 NPCC Review and Concurrence of a Proposed New or Modification to an Existing **SPS**

2.1. The proposing entity shall notify the TFCP Chairman and Secretary of its intention to install a new **SPS** or modify an existing **SPS**.

The notification shall include statements and analysis which describes:

- the proposed **SPS** Type (I, II, III) and rationale for classification,
- the need and location for the **SPS**,
- when the **SPS** is planned for service,
- how long the **SPS** is expected to be in service,
- the specific contingency(s) for which the SPS is designed to operate,
- the possible failure modes and the consequences of misoperation, unintended operation or failure of the **SPS,**
- for modification of an existing **SPS**, a descriptive statement of the modification, the current **SPS** type and the reason for the change, and
- a statement that the **SPS** is designed according to the Criteria and Standards requirements listed in this document.

2.2. TFCP shall forward the documentation from the proposing entity to TFSS to determine the ~~inter-**Area** or inter-Regional~~**SPS** Type.

TFSS shall review the analysis that the proposing entity has performed to determine the consequences of either a failure of the ~~**Special Protection System**~~**SPS** to operate when

and how it is required, or an inadvertent or unintended operation of the ~~**Special Protection System.**~~**SPS**. If necessary, TFSS ~~will~~shall request that the proposing entity conduct additional studies. ~~When their review is completed,~~

TFSS ~~will~~shall forward a summary of their findings to the TFCP Chairman and Secretary.

2.3. The review shall proceed as follows:

Type I or II **SPS** as described in 2.4
Type III **SPS** as described in 2.5

2.4. Approval of a New or Modification Type I or II **SPS**

2.4.1. TFCP shall forward the documentation from the proposing entity and the TFSS findings to ~~TFCO, TFCP~~TFSP and ~~TFSP. This summary will include a statement as to~~ TFCO.

2.4.2. TFSP shall confirm the failure modes of the **SPS** including actions of back-up protection, and whether ~~the **Special Protection System**~~or not the **SPS** complies with NPCC system **protection** standards. TFSP shall review whether the new or modified **SPS** is in conformance with the ~~criteria stipulated in the *Design and Operation of the*~~ NPCC Regional Reliability Reference Directory #4 *"Bulk Power System* ~~(~~*Protection Criteria"*; and the NPCC Regional Reliability Reference Directory #~~1) and whether the Task Force has any objections to~~ 7 *"Special Protection System Criteria"*.

TFSP shall forward a summary of its ~~modification or installation~~findings to TFCP.

~~2.3.3 TFCO will review the operability of the **Special Protection System** and forward a summary of their findings to TFCP, TFSS and TFSP. This summary will include a statement as to whether the Task Force has any objections to its modification or installation.~~

~~2.3.4 TFCP will prepare an overall summary for the RCC. This summary will include the findings of the other Task Forces and whether there are any objections to the modification of the existing **Special Protection System** or the installation of the new **Special Protection System** and as a minimum, include the following information:~~

~~Function, i.e. GR **generation rejection** etc.~~

~~Identification~~
~~Initiating condition~~
~~Action(s) resulting~~
~~Name of the **Special Protection System**, and owner, identification number Arming, i.e. percentage of time, system conditions for which it's needed, manual vs. automatic, etc.~~
~~Reason for the installation~~
~~Comments, explanations, such as "temporary until such time…"~~
~~Company, owner~~
~~SPS Number, drawn by NPCC staff~~
~~Current Status, i.e. New, Changed or Removed~~
~~Type Determination~~
~~Determinations of the Task Forces' analyses~~
~~Consequences of operation, misoperation and failure to operate~~
~~Approximate of **load** or **generation** rejected by **Special Protection System** operation~~
~~Proposed date of deployment~~
~~Proposed date of retirement/deactivation~~

2.4.3. ~~2.3.5 The~~ TFCO shall review the operability of the **SPS** and shall assess its impact to operations if the **SPS** were to operate incorrectly or fail to operate, and any potential for unintended interaction with other special protection systems. TFCO shall provide a summary of its conclusions together with a statement accepting or rejecting the proposed installation of the new **SPS** or the modification of the existing **SPS**. TFCO shall include a statement that the new **SPS** or the modification of an existing **SPS** conforms to NPCC Regional Reliability Reference Directory #1 "Design and Operation of the Bulk Power System".

TFCO shall forward a summary of its findings to TFCP.

2.4.4. TFCP shall review the **SPS** for conformance with NPCC Regional Reliability Reference Directory #1 *"Design and Operation of the Bulk Power System"*. TFCP may return the application to the proposing entity for further clarification. (Add some more description of what TFCP is reviewing.)

2.4.5. TFCP shall prepare a combined summary report including the proposing entity notification and the task force recommendations for evaluation by RCC.

2.4.6. RCC ~~will~~shall review the summary report and act on the proposal ~~to modify an existing **Special Protection System** or install a new **Special Protection System**. The~~. RCC may ~~also~~ approve or reject the proposal, or remand the review of the

~~Special Protection System~~**SPS** back to ~~the TFCP if further analyses are determined to be needed.~~ TFCP.

2.4.7. ~~2.3.6 The~~ TFCP ~~will~~shall notify ~~the RCC,~~ all the ~~Task Forces, the CC,~~ task forces and the proposing entity ~~and other Members~~ of the outcome of the review.

2.4.8. Upon RCC approval the **SPS** may be deployed.

2.4.9. TFSS shall update the NPCC **Special Protection System** list/database.

2.5. Approval of a New or Modification Type III **SPS**

2.5.1. After review of the **SPS** for conformance with NPCC Regional Reliability Reference Directory #1 *"Design and Operation of the Bulk Power System"*, TFCP shall approve or reject the proposal.

2.5.2. TFCP shall prepare a summary report including the proposing entity notification informing RCC of their conclusion.

2.5.3. TFCP shall notify all the task forces and the proposing entity of the outcome of the review.

2.5.4. Upon ~~NPCC~~TFCP approval ~~of~~ the ~~type and compliance with Criteria, the Special Protection System~~**SPS** may be deployed.

2.5.5. ~~2.3.7 The~~ TFSS ~~will then~~shall update the NPCC **Special Protection System** list/database.

3.0 NPCC Review and Concurrence for the Retirement of an Existing **SPS**

3.1. The proposing entity shall notify the TFCP Chairman and Secretary of its intention to retire an existing **SPS.**

The notification shall include statements that describe:

- the identification and type of **SPS** being retired,
- the specific changes which have eliminated the need for the **SPS,** and
- for a Type I or II **SPS**, the proposing entity will provide evidence that the **SPS** retirement does not have a **significant adverse impact** on the reliability of the **bulk power system**.

3.2. The review shall proceed as follows:

Type I or II SPS as described in 3.3
Type III SPS as described in 3.4

3.3. Approval to Retire a Type I or II **SPS**

3.3.1. TFCP shall forward the documentation from the proposing entity to TFSS.

TFSS shall review the analysis that the proposing entity has performed to determine the consequences of the removal of the **SPS** shall

TFSS shall forward a summary of their findings or concerns to the TFCP Chairman and Secretary.

TFCP may return the application to the proposing entity for further clarification.

3.3.2. TFCP shall prepare a combined summary report including the proposing entity notification and TFSS recommendation for evaluation by RCC.

3.3.3. RCC shall review the summary report and act on the proposal. RCC may approve or reject the proposal, or remand the review of the **SPS** back to TFCP.

3.3.4. TFCP shall notify all the task forces and the proposing entity of the outcome of the review.

3.3.5. Upon RCC approval the **SPS** may be retired.

3.3.6. The TFSS shall update the NPCC **Special Protection System** list/database.

3.4. Retiring a Type III **SPS**

3.4.1. A formal approval to retire a Type III SPS is not required. TFCP shall notify all the task forces and the proposing entity of the retirement.

3.4.2. The **SPS** may be retired.

3.4.3. TFSS shall update the NPCC **Special Protection System** list/database.

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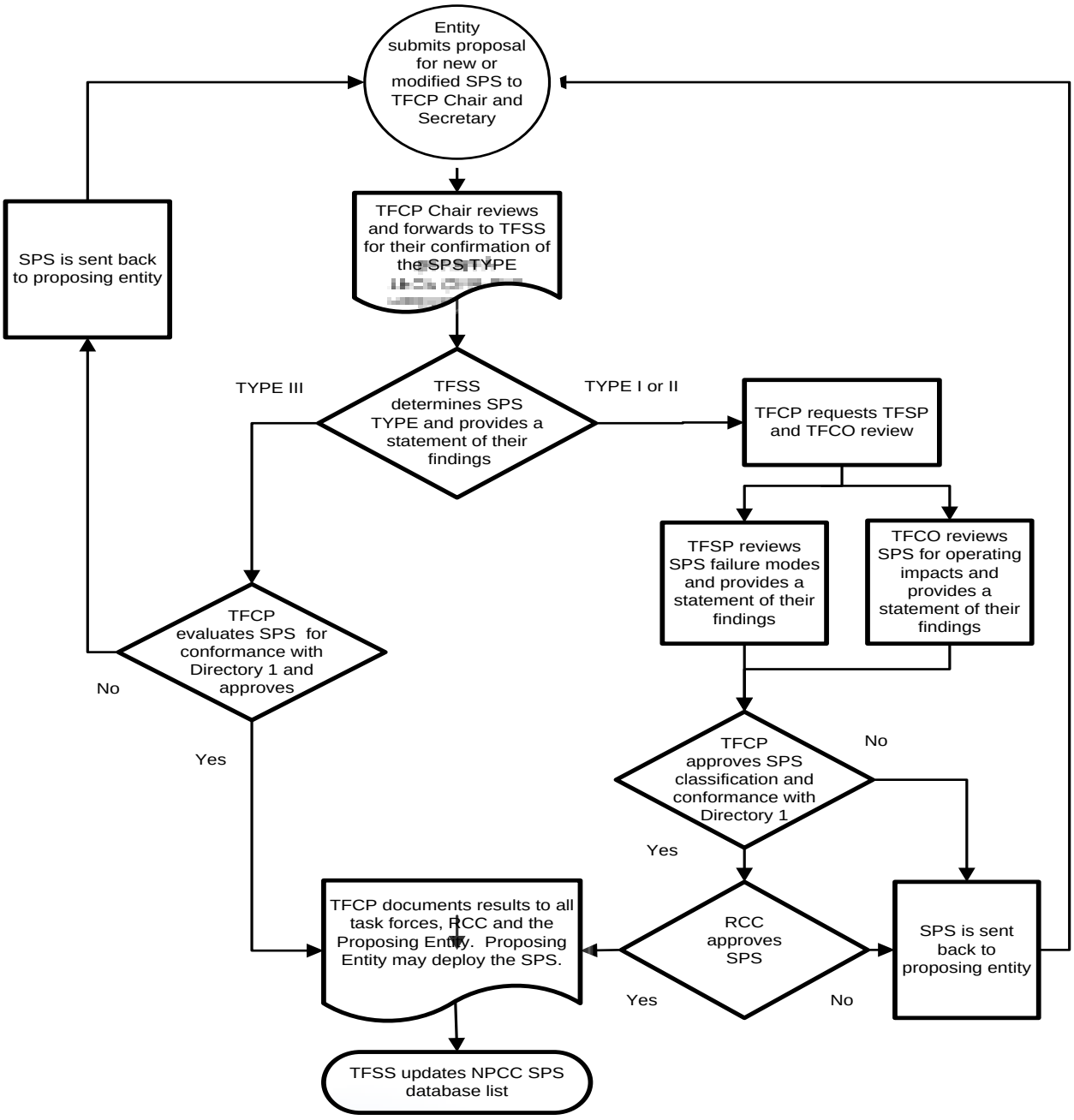
FLOW CHART FOR REVIEW OF NEW OR MODIFIED SPECIAL PROTECTION SYSTEMS (SPS)



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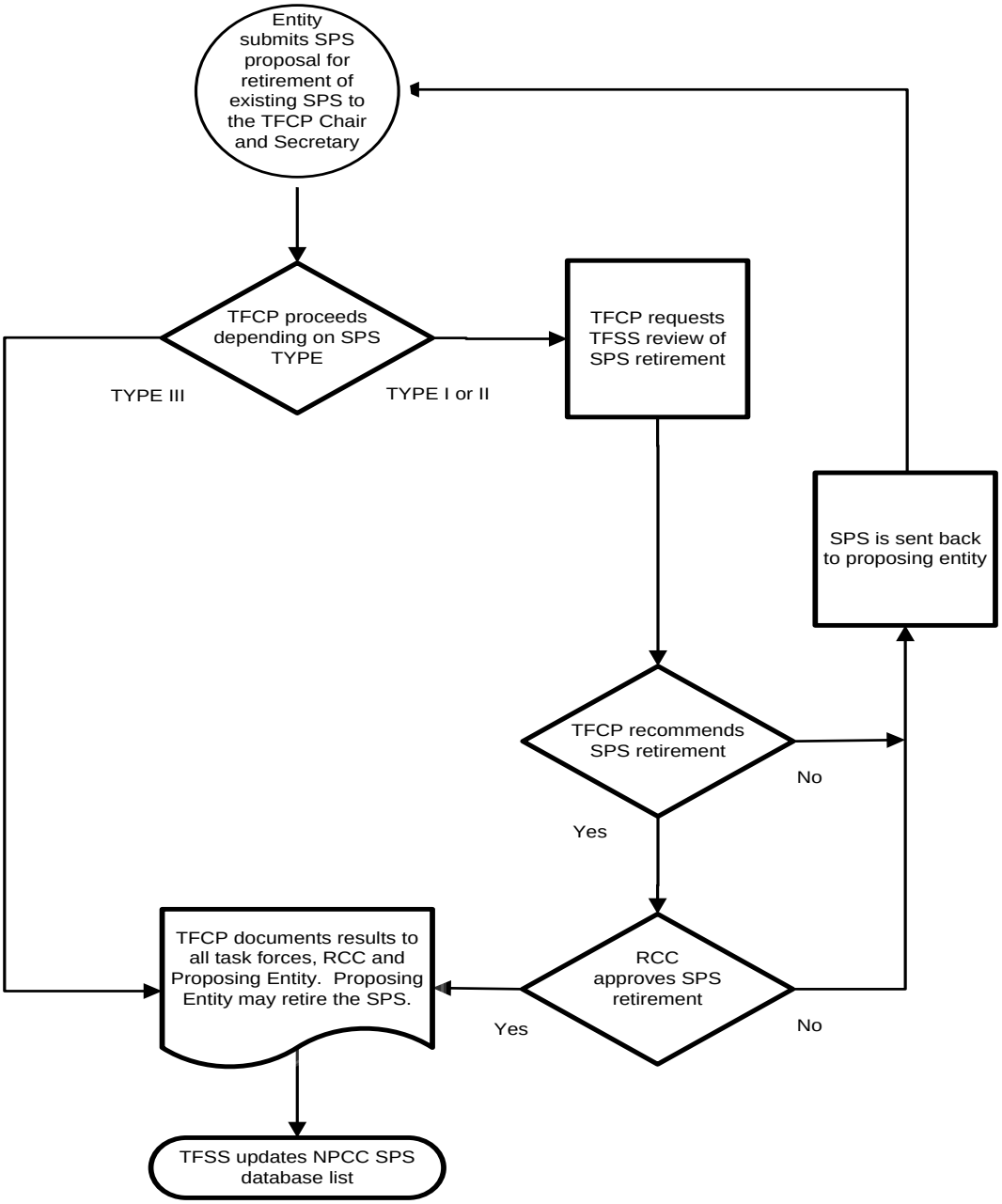
FLOW CHART FOR RETIREMENT OF SPECIAL PROTECTION SYSTEMS (SPS)



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Appendix C

Procedure for Reporting to TFSP New and Modified Special Protection Systems

1.0 Introduction

~~3~~In accordance with the applicable facilities described in Section 1.6.2 of this Directory (D7), Responsible Entity should provide the Task Force on System Protection (TFSP) with advance notification of any of its new **SPS** facilities, or significant changes in its existing **SPS** facilities. Notification should be made to the TFSP early in the engineering design stage.

2.0 Presentation and Review of ~~Special Protection Systems~~SPSs

Each new or modified Type I or Type II ~~**Special Protection System**~~**SPS** shall be reported to the Task Force on System Protection in accordance with the following presentation and review procedure.

~~3~~2.1 A presentation will be made to the TFSP on new facilities or a modification to an existing facility when requested by an NPCC Member or the TFSP.

~~3~~2.2 A presentation will be made to the TFSP when the design of the ~~**protection**~~SPS facility deviates from the ~~*Bulk Power System Protection Criteria* (Document A-5~~D7 Requirement(s).

~~3~~2.3 A presentation will be made to the TFSP when an NPCC Member is in doubt as to whether a design meets the ~~*Protection Criteria*~~D7 Requirements.

3.~~4~~0 Data Required for Presentation and Review ~~of Proposed **Special Protection System:**~~:

3.~~4.~~1 The ~~TO, GO or DP~~Responsible Entity will advise the TFSP of the basic design of the proposed system. The data will be supplied on the ~~attached forms~~Protection System Review Form, accompanied by a geographical map, a one-line diagram of all affected areas, and the associated **protection** and control function diagrams. A physical layout of the **protection** panels and batteries for the purpose of illustrating physical separation will also be included.

3.~~4~~.2 The proposed **protection** system will be explained with due emphasis on any special conditions or design restrictions existing on the particular power system:

3.5~~4~~.0 Procedure for Presentation:

3.5~~4~~.1 The ~~TO, GO or DP~~Responsible Entity will arrange to have a technical presentation made to the TFSP.

3.5~~4~~.2 To facilitate scheduling, the chairman of the TFSP will be notified approximately four months prior to the desired date of presentation.

3.5~~4~~.3 Copies of materials to be presented will be distributed to TFSP members 30 days prior to the date of the presentation.

3.6~~5~~.0 Review by TFSP

The TFSP will review the material presented and develop a position statement concerning the proposed ~~**protection** system.~~**SPS**. This statement will indicate one of the following:

3.6~~5~~.1 The need for additional information to enable the TFSP to reach a decision.

~~3.6~~5.2 Acceptance of the ~~TO, GO or DP~~Responsible Entity's statement of conformance to the ~~*Protection Criteria*~~D7 Requirements.

3.6~~5~~.3 Acceptance of the submitted proposal.

3.6~~5~~.4 *Conditional acceptance of the submitted proposal.

3.6~~5~~.5 *Rejection of the submitted proposal

* Position Statements to include an indication of areas of departure from the intent of the ~~*protection criteria*~~D7 Requirements and suggestions for modifications to bring the ~~**protection** system~~**SPS** into conformance with the NPCC criteria.

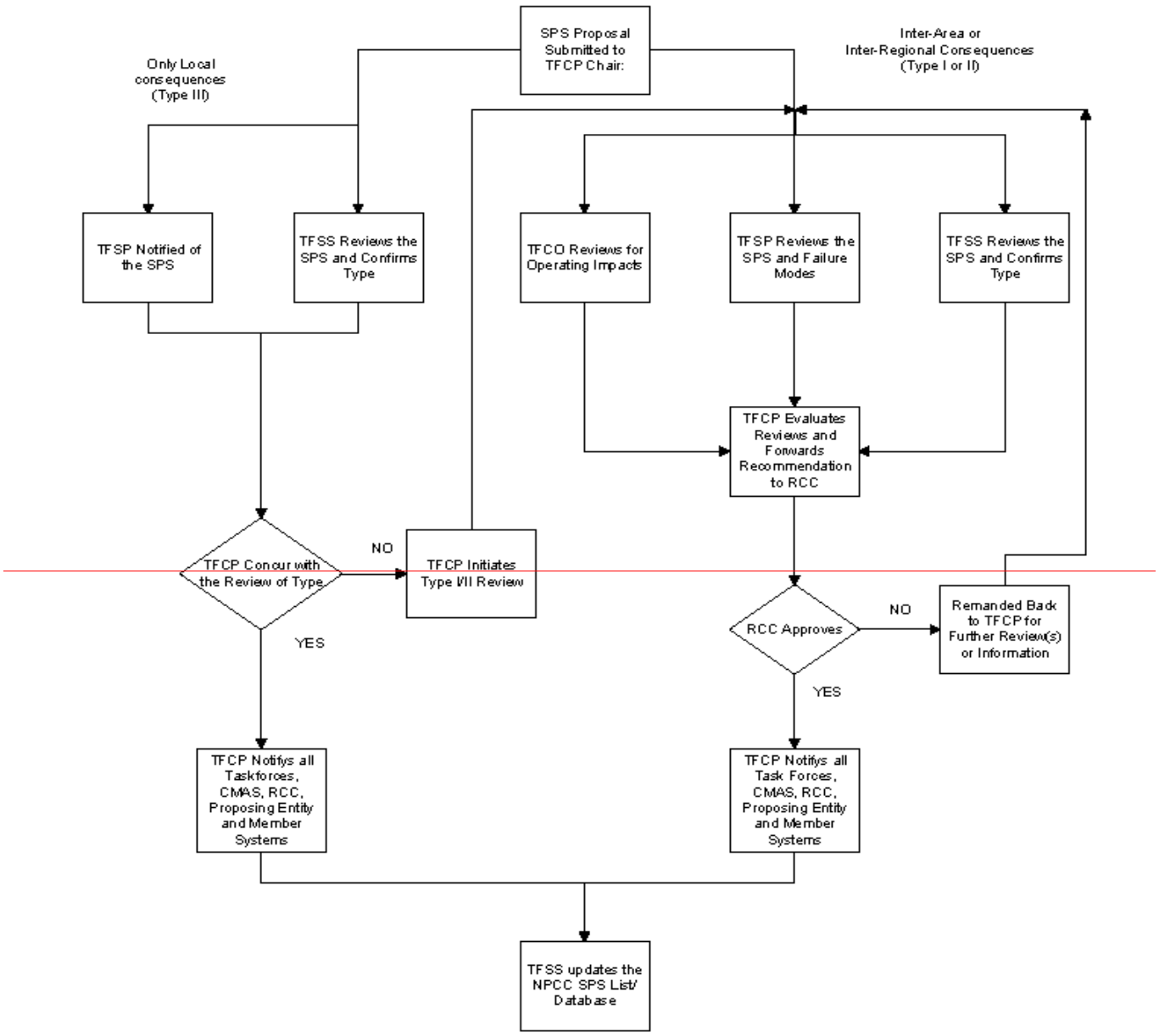
~~3.6~~5.6 The results of the TFSP review will be documented in the following manner.~~-~~

- ~~.~~A position statement will be included in the minutes of the meeting at ~~which~~ the proposed ~~**protection** system~~**SPS** was reviewed. ~~.~~The Chair of TFCP will be notified of the position statement.
- If necessary, a letter outlining areas of ~~nonconformance~~non-conformance with the NPCC ~~*Protection Criteria*~~D7 Requirements and recommendations for correction will be submitted to the ~~TO, GO or DP. .~~Responsible Entity.

The Task Force will maintain a record of all the reviews it has conducted.

Draft Sept 27, 2012

~~PROCEDURE FOR NPCC REVIEW OF NEW OR MODIFIED BULK POWER SYSTEM SPECIAL PROTECTION SYSTEMS (SPS)~~



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NPCC
Regional Reliability Reference Directory # 7
Special Protection Systems

Task Force on System Protection Revision Review Record
December 27, 2007
Draft Sept 27, 2012
For Open Process Review

Adopted by the Members of the Northeast Power Coordinating Council Inc., this December 27, 2007, based on recommendation by the Reliability Coordinating Committee, in accordance with Section VIII of the NPCC Amended and Restated Bylaws dated July 24, 2007 and as amended to date.

Revision History

Version	Date	Action	Change Tracking (New, Errata or Revisions)
0	12/27/07		New

Table of Contents

1.0 Introduction

1.1 Title Special Protection Systems

1.2 Directory Number 7

1.3 Objective

This directory provides the basic criteria for **Special Protection Systems (SPSs)** such that the **Bulk Power System** in NPCC Inc. member **Areas** is operated reliably. It is not a design specification. (consistent with language in D4, 1.3)

1.4 Effective Date Immediately upon Approval by the NPCC Full Members

Compliance Guidance Statement- Protection system designs submitted to the TFSP prior to the date of this revision are not subject to the TFSP documentation requirements described in Section 7, Compliance Requirements R1, R2, and R3.

1.5 Background

This directory establishes the basic **protection** criteria for **SPSs**.

Guidance for consideration in the implementation of these criteria is provided in Appendix A, and the procedure for reviewing new and revised **SPSs** is provided in Appendix B and Appendix C.

1.6 Applicability

1.6.1 Functional Entities

Transmission Owners

Generator Owners

Distribution Providers

1.6.2 Facilities

1.6.2.1 New Facilities

The standard requirements and criteria stipulated in this Directory apply to all new Type I and Type II **SPSs** as defined below. In the application of Type II **SPSs**, security is the prime concern (see Section 3.3.1 of this document). As such, Sections 5.2.1, 5.6.3, 5.7.2, 5.10 and 5.12 in this document do not apply to Type II. Each new Type I or Type II **Special Protection System** shall be reported to the Task Force on System Protection. It is recommended that this reporting be in accordance with the procedure stipulated in Appendix C of this Directory using the appropriate portion of the "Protection System Review Form" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

1.6.2.2 Existing Facilities

It is the responsibility of individual companies to assess their existing **SPSs** and to make modifications which are required to meet the intent of these criteria as follows:

1.6.2.2.1 Planned Renewal or Upgrade to Existing Facilities

It is recognized that there may be **SPSs,** which existed prior to each TO's, GO's, and DP's adoption of the *Special Protection System Criteria*, that do not meet these criteria. If any **SPSs** or sub-systems of these facilities are replaced as part of a planned renewal or upgrade to the facility and do not meet all of these criteria, then an assessment shall be conducted for those criteria that are not met. The result of this assessment shall be reported. It is recommended that this reporting be in accordance with the procedure stipulated in Section 4.0 of Appendix C of this Directory using the appropriate portion of the "Protection System Review Form" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

1.6.2.2.2 SPS Re-classified to Type I or Type II

These requirements apply to all existing **SPS**s

which are reclassified as Type I or Type II due to system changes. A mitigation plan shall be required to bring such an **SPS** into compliance with these criteria.

For Type I **SPS**, where the owner of the SPS has determined that the cost and risks involved to implement physical separation, as per Section 5.12, cannot be justified, the reason for this determination and an assessment shall be reported to the TFSP. It is recommended this reporting be in accordance with the procedure stipulated in Appendix C of this Directory using the appropriate portion of the "Protection System Review forms" (formerly C-22 forms), for review and disposition by the TFSP, or in a form consistent with the intent of the procedure. (proposed additional language consistent with D4, 1.6.2.2.2)

1.6.2.2.4 In-kind Replacement of SPS Equipment

If a component of an SPS is replaced "in-kind" as a result of an un-planned event, then it is not required to upgrade the associated **protection system** to comply with these criteria.

1.6.3 Responsibility

Whenever changes are anticipated in generating sources, transmission facilities, or operating conditions, Generator Owners and Transmission Owners shall review those **SPS** applications (i.e., settings, ac, and dc supplies) which can reasonably be expected to be impacted by those changes. (proposed additional language consistent with D4, 1.6.3)

1.6.4 Classification of **Special Protection Systems**

SPSs are sub-divided into three types. Reference can be made to the NPCC *Design and Operation of the Bulk Power System* (Directory #1) and NERC TPL Standards, where design criteria contingencies, operating criteria contingencies, and extreme contingencies are described.

Type I An **SPS** which recognizes or anticipates abnormal system conditions resulting from design and operating criteria **contingencies**, and whose misoperation or

failure to operate would have a **significant adverse impact** outside of the **local area**. The corrective actions taken by an **SPS** along with the actions taken by other **protection systems** are intended to return power system parameters to a stable and recoverable state.

Type II — An **SPS** which recognizes or anticipates abnormal system conditions resulting from extreme **contingencies** or other extreme causes, and whose misoperation or failure to operate would have a **significant adverse impact** outside of the **local area**.

Type III — An **SPS** whose misoperation or failure to operate results in no **significant adverse impact** outside the **local area**. The practices contained in this document for a Type I **SPS** should be considered but are not required for a Type III **SPS**. It should be recognized that a Type III **SPS** may, due to system changes, become Type I or Type II.

2.0 Terms Defined in this Directory

The definitions of terms found in this Directory appearing in bold typeface, can be found in NPCC *Glossary of Terms*.

3.0 NERC ERO Reliability Standard Requirements

The NERC ERO Reliability Standards containing Requirements that are associated with this Directory include, but may not be limited to:

3.1 PRC-012-0 — Special Protection System Review Procedure

3.2 PRC-013-0 Special Protection System Database

3.3 PRC-014-0 — Special Protection System Assessment

3.4 PRC-015-0 — Special Protection System Data and Documentation

3.5 PRC-016-0 — Special Protection System Misoperations

3.6 PRC-017-0 - Special Protection System Maintenance and Testing

4.0 NPCC Regional Reliability Standard Requirements

None at this time. To be developed.

5.0 NPCC "Full Member", More Stringent Criteria

These Criteria are in addition to, more stringent than, or more specific than NERC or any Regional Reliability standard requirements. (proposed additional language consistent with D4, 5.0)

5.1 General Criteria

An **SPS** shall be designed to recognize the specific power system conditions associated with its intended function.

Due consideration shall be given to dependability and security. The relative effect on the **bulk power system** due to a failure of an **SPS** to operate when desired versus an unintended operation shall be weighed carefully in selecting design parameters as follows in Sections 5.2, 5.3, and 5.4:

5.2 Criteria for Dependability (added section label consistent with D4, 5.2)

5.2.1 To enhance dependability, an **SPS** shall be designed with redundancy such that the **SPS** is capable of performing its intended function while itself experiencing a single failure. (This requirement does not apply to Type II **SPSs**.)

5.2.2 Multiple **protection groups** that are used to obtain redundancy within an **SPS** shall not share any of the same components.

5.3 Criteria for Security (added section label consistent with D4, 5.3)

5.3.1 A Type II **SPS** shall be designed to avoid false operation while itself experiencing a single component failure.

5.4 Criteria for Dependability and Security (added section label consistent with D4, 5.4)

5.4.1 The thermal capability of all **SPS** components shall be adequate to withstand the rated maximum short time and continuous loading of the associated **protected elements**.

5.4.2 Communication link availability, critical control switch, test switch positions, and trip circuit integrity shall be annunciated to a 24-hour Operations center so that operating personnel can be notified and can initiate appropriate actions.

5.5 Criteria for Operating Time and Arming(added section label consistent with D4, 5.5)

5.5.1 An **SPS** shall be designed to take corrective action(s) within times determined by studies with due regard to security, dependability, and selectivity.

5.5.2 Status of **SPS** arming shall be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate actions.

5.5.3 An **SPS** shall be equipped with means to enable its arming and to independently verify its arming.

5.6 Current Transformer Criteria

Current transformers (CTs) associated with **an SPS** shall have adequate steady-state and transient characteristics for their intended function as follows:

5.6.1 The output of each current transformer secondary winding shall be designed to remain within acceptable limits for the connected burdens under all anticipated currents, including **fault** currents, to ensure correct operation of the **SPS**.

5.6.2 The thermal and mechanical capabilities of the CT at the operating tap shall be adequate to prevent damage under maximum **fault** conditions and normal or **emergency** system loading conditions.

5.6.3 For **protection groups** to be independent, they shall be supplied from separate current transformer secondary windings. (This requirement does not apply to Type II **SPSs**.)

5.6.4 Interconnected current transformer secondary wiring shall be grounded at only one point.

5.7 Voltage Transformer and Potential Device Criteria

Voltage transformers and potential devices associated with **an SPS** shall have adequate steady-state and transient characteristics for their intended function as follows:

5.7.1 Voltage transformers and potential devices shall have adequate volt-ampere capacity to supply the connected burden while maintaining their **relay** accuracy over their specified primary voltage range.

5.7.2 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, each of the **protection groups** shall be supplied from separate voltage sources.

The **protection groups** may be supplied from separate secondary windings on one transformer or potential device, provided all of the following requirements are met: (This Section does not apply to Type II **SPS**.)

5.7.2.1 Complete loss of that voltage transformer or potential device does not prevent **both protection groups** from performing the intended function;
5.7.2.2 Each secondary winding has sufficient capacity to permit fuse **protection** of the circuit;
5.7.2.3 Each secondary winding circuit is adequately fuse protected.

5.7.3 The wiring from each voltage transformer secondary winding shall not be grounded at more than one point.

5.8 Battery and Direct Current (dc) Supply Criteria

DC supplies associated with an **SPS** shall be designed to have a high degree of dependability as follows:

5.8.1 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, no single battery or dc power supply failure shall prevent the independent **protection groups** from performing the intended function. Each battery shall be provided with its own charger. Physical separation shall be maintained between the two station batteries or dc power supplies used to supply the independent **protection groups**. (This section does not apply to Type II **SPS**.) (proposed additional language consistent with D4, 5.8.1)

5.8.2 Each battery shall have sufficient capacity to permit operation of an **SPS**, in the event of a loss of its battery charger or the ac supply source, for the

period of time necessary to transfer the load to the other battery or re-establish the supply source. Each station battery and its associated charger shall have sufficient capacity to supply the total dc load of the station. (proposed additional language consistent with D4, 5.8.2)

5.8.3 A transfer arrangement shall be provided to permit connecting the total dc load to either station battery without creating areas where, prior to failure of either a station battery or a charger, a single event can disable both dc supplies. **(proposed additional language consistent with D4, 5.8.3)**

5.8.4 The battery chargers and all dc circuits shall be protected against short circuits.

5.8.5 DC battery systems shall be continuously monitored to detect abnormal voltage levels (both high and low), dc grounds, and loss of ac to the battery chargers. These conditions shall be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate actions. (proposed additional language consistent with D4, 5.8.5)

5.8.6 DC supply to the **SPS component** shall be continuously monitored to detect loss of voltage and be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate actions. (proposed additional language consistent with D4, 5.8.6)

5.9 Station Service ac Supply Criteria

If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, there shall be two sources of station service ac supply, each capable of carrying at least all the battery chargers associated with the **SPS**.

5.10 Circuit Breakers Criteria

Where **SPS** redundancy is achieved by the use of independent **protection groups** tripping the same circuit breakers without overarming, each circuit breaker shall be equipped with two independent trip coils. (This dual trip coil requirement does not apply to Type II **SPS**.)

The design of a breaker with two trip coils shall be such that the breaker will operate if both trip coils are energized simultaneously. The relative polarity between the voltage applied to the two trip coils shall not affect proper breaker operation. The correct operation of this design shall be verified by tests and documented. (proposed additional language consistent with D4, 5.10)

5.11 **Teleprotection** Criteria

5.11.1 Communication facilities required for **teleprotection** shall be designed to have a level of performance consistent with that required of the **SPS**, and shall meet the following:

5.11.1.1 Where the design of an **SPS** is composed of multiple **protection groups** for redundancy and each group requires a communication channel:

5.11.1.1.1 The equipment for each group shall be separated physically on non-adjacent panels and designed to minimize the risk of more than one **protection group** being disabled simultaneously by a single event or condition.

5.11.1.1.2 The communication medium outside the substation physical perimeter for each **protection group** shall be designed to minimize the risk of both **protection groups** being disabled simultaneously by a single event or condition. In addition, physical separation of the communication media outside the substation fence shall be three feet at a minimum. (Also, see Appendix A, Section 2.9.)

5.11.1.2 **Teleprotection** equipment shall be monitored to detect loss of equipment and/or channel and be annunciated to a 24-hour Operations center so that operating personnel can respond and can initiate appropriate actions.

5.11.1.3 **Teleprotection** equipment shall be provided with means to test for proper signal adequacy.

5.11.1.4 **Teleprotection** equipment shall be powered by the substation batteries or other sources independent from the power system. See Section 5.8, Battery and dc Supply Criteria.

5.11.1.5 Except as identified otherwise in these criteria, the two

teleprotection groups shall not share the same component.

5.11.1.5.1 The use of a single communication tower for radio communication systems used by the two **protection groups** of an **SPS** is permitted as long as diversity of the communication signals is achieved.

5.11.1.5.2 Where telecommunication route diversity cannot be achieved, overarming of the appropriate **SPS** trip outputs is an acceptable mitigation.

5.12 Environment (This Section does not apply to Type II **SPS**.)

5.12.1 In addition to the physical separation as referenced in Section 5.2.2, if an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, each individual **protection group** and **teleprotection** of the **SPS** shall be on non-adjacent vertical mounting assemblies or enclosures.

5.12.2 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy, wiring for each individual **protection group** and **teleprotection** of the **SPS** shall not be in the same cable. (proposed additional language consistent with D4, 5.12.2)

5.12.3 If an **SPS** is designed to have multiple **protection groups** at a single location for redundancy:

- Cabling for individual **protection groups** and **teleprotection** of the **SPS** shall be physically separated. This can be accomplished via different raceways, trays, trenches, etc. (proposed additional language consistent with D4, 5.12.3)
- Cable separation shall be achieved up to the breaker control cabinet. (new clarified separation requirement)
- Cable separation shall be achieved up to the equipment control cabinet. (new clarified separation requirement)_

5.12.5 In the event a common raceway is used, cabling for individual **protection groups** of an **SPS** shall be separated by a fire barrier.

5.13 Grounding Criteria

Each TO, GO or DP shall have established as part of its substation design procedures or specifications, a mandatory method of designing the substation ground grid, which:

5.13.1 Can be traced to a recognized calculation methodology
5.13.2 Considers cable shielding
5.13.3 Considers equipment grounding

5.15 Provision for Breaker Failure Criteria

Type I **SPS** shall include breaker failure **protection** for each circuit breaker whose operation is critical to the adequacy of the action taken by the **SPS** with due regard to the power system conditions this **SPS** is required to detect. The following are options for breaker failure **protection**:

5.15.1 A design which recognizes that the breaker has not achieved or will not achieve the intended function required by the **SPS** and which takes independent action to achieve that function. This provision needs not be duplicated and can be combined with conventional breaker failure schemes if appropriate.

5.15.2 Overarming the **SPS** such that adequate action is taken even if a single breaker fails.

5.15.3 The redundancy afforded by actions taken by other independent schemes or devices.

5.16 Design to Facilitate Testing and Maintenance

5.16.1 The design of an **SPS** both in terms of circuitry and physical arrangement shall facilitate periodic testing and maintenance.

5.16.2 Test facilities or test procedures shall be designed such that they do not compromise the independence of the redundant design aspects of an **SPS**.

5.16.3 If a segmented testing approach is used, test procedures and test facilities shall be designed to ensure that related tests properly overlap. Proper overlap is ensured if each portion of circuitry is seen to perform its intended function, such as operating a relay from either a real or test stimulus, while observing some common reliable downstream indicator.

5.17 Design to Facilitate Analysis of **SPS** Performance

5.17.1 Event recording capability shall be provided to permit analysis of the **SPS**'s performance.

5.18 Commissioning Testing

An **SPS** shall be functionally tested when initially placed in service and when modifications are made.

6.0 Measures and Assessments

None developed at this time.

7.0 Compliance Requirements

R1. An entity, proposing to install a new **special protection system** or a modification to an existing **special protection system**, shall submit documentation as per Sections 1.6.2.1 or 1.6.2.2, respectively.

R2. An entity, proposing to install a new **special protection system** or a modification to an existing **special protection system**, shall obtain a letter of acceptance by TFSP of the compliance statement accompanying the submittal in R1 prior to placing the **special protection system** in service.

R3. The entity shall provide within 30 days, upon request from the Regional Entity (Criteria Compliance Enforcement Program) documented evidence of the submittal and acceptance by TFSP, of any new or modified **special protection system**.

Prepared by:	Lead Task Force- Task Force on System Protection
Review and Approval:	Revision to any portion of this Directory will be posted by the lead Task Force in the NPCC Open Process for a 45 day review and comment period. Upon satisfactorily addressing all the comments in this forum, the Directory document will be sent to the remaining Task Forces for their recommendation to seek RCC approval. Upon approval of the RCC, this Directory will be sent to the Full Member Representatives for their final approval if sections pertaining to the Requirements and Criteria portion have been

revised. All voting and approvals will be conducted according to the most current "NPCC Inc. Bylaws" in effect at the time the ballots are cast.

Revisions pertaining to the Appendices or any other portion of the document such as Links, Glossary Terms, etc., will only require RCC Member approval of the document. Errata may be corrected by the Lead Task Force at any time and provide the appropriate notifications to the NPCC Inc. membership.

This Directory will be updated at least once every three years and as often as necessary to keep it current and consistent with NERC Regional Reliability Standards and other NPCC documents.

References:

NPCC RRS PRC-XXX-X (Future NPCC Regional Standard)

Design and Operation of the Bulk Power System (Directory #1)

Emergency Operation (Directory #2)

Maintenance Criteria for Bulk Power System Protection (Directory #3)

NPCC Glossary of Terms (Document A-7)

Appendix A
Guidance for Consideration in SPS Design

1.0 Introduction

This Appendix provides the guidance for consideration in the implementation of the **Special Protection System (SPS)** design criteria stipulated in Section 5 of this Directory.

2.0 Design Considerations

2.1 General Considerations

The general objective for any **SPS** is to perform its intended function (generator rejection, load rejection, etc.) in a dependable and secure manner. In this context, dependability relates to the degree of certainty that the **SPS** will operate correctly when required to operate. Security relates to the degree of certainty that the **SPS** will not operate when not required to operate.

The relative effects on the **bulk power system** of a failure to operate when desired versus an unintended operation should be weighed carefully in selecting design parameters. For example, the choice of duplication as a means of providing redundancy improves the dependability of the **SPS** but can also jeopardize security in that it may increase the probability of an unintended operation. This general objective can be met only if the **SPS** can dependably respond to the specific conditions for which it is intended to operate and differentiate these from other conditions for which action must not take place.

Close coordination should be maintained among system planning, design, operating, maintenance, and **protection** functions, since both initially and throughout their life cycle, **SPSs** are a multi-discipline concern.

2.2 Issues Affecting Dependability

2.2.1 Redundancy is normally provided by duplication. Some aspects of duplication may be achieved by overarming, which is defined as providing for more corrective action than would be necessary if no failures are considered. The redundancy requirements for an **SPS** apply only with respect to its response to the conditions it is required to detect.

2.2.2 For an **SPS** that is composed of multiple **protection groups**, the risk of simultaneous failure of more than one **protection group** because of design

deficiencies or equipment failure should be considered, particularly if identical equipment is used in each **protection group**. The extent and nature of these failures should be recognized in the design and operation of the **SPS**.

2.2.3 In addition to the separation requirements in the criteria, area of common exposure should be kept to a minimum to reduce the possibility of all groups being disabled by a single event such as fire, evacuation, water leakage, and other such incidents.

2.3 Issues Affecting Security

2.3.1 An **SPS** should be designed to operate only for conditions which require its specific protective or control actions.

2.4 Issues Affecting Dependability and Security

2.4.1 **SPSs** should be no more complex than required for any given application.

2.4.2 The components and software used in **SPSs** should be of proven quality, as demonstrated either by actual experience or by stringent tests under simulated operating conditions.

2.4.3 **SPSs** should be designed to minimize the possibility of component failure or malfunction due to electrical transients and interference or external effects such as vibration, shock and temperature.

2.4.4 **SPSs**, including intelligent electronic devices (IEDs) and communication systems used for **protection**, should comply with applicable industry standards for utility grade **protection** service. Utility Grade **Protection** System Equipment are equipment that are suitable for protecting transmission power system **elements**, that are required to operate reliably, under harsh environments normally found at substations. Utility grade equipment should meet the applicable sections of all or some of the following types of industry standards, to ensure their suitability for such applications:

- IEEE C37.90.1 (oscillatory surge and fast transient)
- IEEE C37.90.1 (service conditions)
- IEC 60255-22-1 (1 MHz burst, i.e. oscillatory)
- IEC 61000-4-12 (oscillatory surge)
- IEC 61000-4-4 (EFT)
- IEC 60255-22-4 (EFT)
- IEEE C37.90.2 (narrow-band radiation)

- IEC 60255-22-3 (narrow-band radiation)
- IEC 61000-4-3 (narrow-band radiation)
- IEEE 1613 (communications networking devices in Electric power Substations)

2.4.4 **SPS** circuitry and physical arrangements should be carefully designed so as to minimize the possibility of incorrect operations due to personnel error.

2.4.5 **SPS** automatic self-checking facilities should be designed so as to not degrade the performance of the **SPS**.

2.4.6 Consideration should be given to the consequences of loss of instrument transformer voltage inputs to **SPSs**.

2.4.7 Consideration should be given to the effect of the means of arming on overall security and dependability of an **SPS**. Arming should have a level of security and dependability commensurate with the requirements of an **SPS**.

2.5 Issues Affecting Performance

2.5.1 Control Cable, Wiring and Ancillary Control Device

Control cables and wiring and ancillary control devices should be highly dependable and secure. Due consideration should be given to published codes and standards, fire hazards, current-carrying capacity, voltage drop, insulation level, mechanical strength, routing, shielding, grounding, and environment.

2.5.1 Environment

2.5.1.1 Means should be employed to maintain environmental conditions that are favorable to the correct performance of an **SPS.**

2.5.1.2. Fire barrier used to separate the cabling of the two **protection groups** of an **SPS** in common raceway should be sufficiently rated to allow enough time to isolate the affected facility while maintaining operation of one **protection group**.

2.6 Operating Time of an **SPS**

Adequate time margin should be provided taking into account study inaccuracies, differences in equipment, and **protection** operating times.

2.7 Arming of an **SPS**

Arming is the selection, which may be external to the **SPS**, of desired output action based on power system conditions and recognized contingencies. Arming requirements of an **SPS** are normally based upon the results of system studies, which take into account recognized contingencies, operating policies/procedures, and current power system load/generation conditions. For a simple **SPS**, arming may be an on/off function. An **SPS** can be armed either automatically or manually.

2.7.1 Automatic arming is implemented without human intervention.

2.7.2 Manual arming requires human intervention. Sufficient time, with adequate margin for recognition, analysis, and the taking of corrective action, should be allowed.

2.8 Voltage Transformer and Potential Device

Voltage transformer installations should be designed with due regard to ferroresonance. (added language consistent with D4, Appendix A, 2.7)

2.9 Communication Medium for **Teleprotection**

In cases where constraints do not allow three feet separation, this distance may be reduced if a proposed alternative design can achieve comparable physical protection of the communication medium. If an alternative design cannot be met, then an alternative communication path or protection scheme should be proposed. (additional guidance associated with new requirement in 5.11.1.1.2)

2.10 Maintenance Considerations

2.10.1 As an **SPS** may be complex and may interface with other **protection systems** or control systems, special attention should be placed on ensuring that test devices and test interfaces properly support a clearly defined maintenance strategy.

2.10.2 Proper overlap is ensured if each portion of circuitry is seen to perform its intended function, such as operating a relay, from either a real or test stimulus, while observing some common reliable downstream indicator.

2.11 Grounding

Station grounding is critical to the correct operation of an **SPS**. The design of the

ground grid directly impacts proper **SPS** operation and probability of false operation from **fault** currents or transient voltages,

2.12 Battery and Direct Current (dc) Supply

Protective devices protecting battery chargers and dc circuits should be coordinated to minimize the number of dc circuits interrupted.

Appendix B
Procedure for the Review of a Special Protection System

1.0 Introduction

1.1. This Appendix provides the procedure to obtain concurrence from NPCC if an entity proposes a new, modification to or retirement of a **Special Protection System (SPS)**.

1.2. The proposing entity should allow sufficient lead time in order to accomplish all the steps in the process outlined here in. These processes are shown in the attached flow charts.

1.3. The following are involved in the review and approval process of the **SPS**:

- Task Force on Coordination of Planning - TFCP
- Task Force on System Protection - TFSP
- Task Force on System Studies - TFSS
- Task Force on Coordination of Operations – TFCO
- Reliability Coordinating Committee – RCC

2.0 NPCC Review and Concurrence of a Proposed New or Modification to an Existing **SPS**

2.1. The proposing entity shall notify the TFCP Chairman and Secretary of its intention to install a new **SPS** or modify an existing **SPS**.

The notification shall include statements and analysis which describes:

- the proposed **SPS** Type (I, II, III) and rationale for classification,
- the need and location for the **SPS**,
- when the **SPS** is planned for service,
- how long the **SPS** is expected to be in service,
- the specific contingency(s) for which the SPS is designed to operate,
- the possible failure modes and the consequences of misoperation, unintended operation or failure of the **SPS,**
- for modification of an existing **SPS**, a descriptive statement of the modification, the current **SPS** type and the reason for the change, and
- a statement that the **SPS** is designed according to the Criteria and Standards requirements listed in this document.

2.2. TFCP shall forward the documentation from the proposing entity to TFSS to determine the **SPS** Type.

TFSS shall review the analysis that the proposing entity has performed to determine the consequences of either a failure of the **SPS** to operate when and how it is required, or an inadvertent or unintended operation of the **SPS**. If necessary, TFSS shall request that the proposing entity conduct additional studies.

TFSS shall forward a summary of their findings to the TFCP Chairman and Secretary.

2.3. The review shall proceed as follows:

Type I or II **SPS**	as described in 2.4
Type III **SPS**	as described in 2.5

2.4. Approval of a <u>New or Modification</u> Type I or II **SPS**

2.4.1. TFCP shall forward the documentation from the proposing entity and the TFSS findings to TFSP and TFCO.

2.4.2. TFSP shall confirm the failure modes of the **SPS** including actions of back-up protection, and whether or not the **SPS** complies with NPCC system **protection** standards. TFSP shall review whether the new or modified **SPS** is in conformance with the NPCC Regional Reliability Reference Directory #4 "*Bulk Power System Protection Criteria"*; and the NPCC Regional Reliability Reference Directory #7 "*Special Protection System Criteria"*.

TFSP shall forward a summary of its findings to TFCP.

2.4.3. TFCO shall review the operability of the **SPS** and shall assess its impact to operations if the **SPS** were to operate incorrectly or fail to operate, and any potential for unintended interaction with other special protection systems. TFCO shall provide a summary of its conclusions together with a statement accepting or rejecting the proposed installation of the new **SPS** or the modification of the existing **SPS**. TFCO shall include a statement that the new **SPS** or the modification of an existing **SPS** conforms to NPCC Regional Reliability Reference Directory #1 "Design and Operation of the Bulk Power System".

TFCO shall forward a summary of its findings to TFCP.

2.4.4. TFCP shall review the **SPS** for conformance with NPCC Regional Reliability Reference Directory #1 *"Design and Operation of the Bulk Power System"*. TFCP may return the application to the proposing entity for further clarification. (Add some more description of what TFCP is reviewing.)

2.4.5. TFCP shall prepare a combined summary report including the proposing entity notification and the task force recommendations for evaluation by RCC.

2.4.6. RCC shall review the summary report and act on the proposal. RCC may approve or reject the proposal, or remand the review of the **SPS** back to TFCP.

2.4.7. TFCP shall notify all the task forces and the proposing entity of the outcome of the review.

2.4.8. Upon RCC approval the **SPS** may be deployed.

2.4.9. TFSS shall update the NPCC **Special Protection System** list/database.

2.5. Approval of a New or Modification Type III **SPS**

2.5.1. After review of the **SPS** for conformance with NPCC Regional Reliability Reference Directory #1 *"Design and Operation of the Bulk Power System"*, TFCP shall approve or reject the proposal.

2.5.2. TFCP shall prepare a summary report including the proposing entity notification informing RCC of their conclusion.

2.5.3. TFCP shall notify all the task forces and the proposing entity of the outcome of the review.

2.5.4. Upon TFCP approval the **SPS** may be deployed.

2.5.5. TFSS shall update the NPCC **Special Protection System** list/database.

3.0 NPCC Review and Concurrence for the Retirement of an Existing **SPS**

3.1. The proposing entity shall notify the TFCP Chairman and Secretary of its intention to retire an existing **SPS.**

The notification shall include statements that describe:

- the identification and type of **SPS** being retired,
- the specific changes which have eliminated the need for the **SPS,** and
- for a Type I or II **SPS**, the proposing entity will provide evidence that the **SPS** retirement does not have a **significant adverse impact** on the reliability of the **bulk power system**.

3.2. The review shall proceed as follows:

Type I or II SPS	as described in 3.3
Type III SPS	as described in 3.4

3.3. Approval to Retire a Type I or II **SPS**

3.3.1. TFCP shall forward the documentation from the proposing entity to TFSS.

TFSS shall review the analysis that the proposing entity has performed to determine the consequences of the removal of the **SPS** shall

TFSS shall forward a summary of their findings or concerns to the TFCP Chairman and Secretary.

TFCP may return the application to the proposing entity for further clarification.

3.3.2. TFCP shall prepare a combined summary report including the proposing entity notification and TFSS recommendation for evaluation by RCC.

3.3.3. RCC shall review the summary report and act on the proposal. RCC may approve or reject the proposal, or remand the review of the **SPS** back to TFCP.

3.3.4. TFCP shall notify all the task forces and the proposing entity of the outcome of the review.

3.3.5. Upon RCC approval the **SPS** may be retired.

3.3.6. The TFSS shall update the NPCC **Special Protection System** list/database.

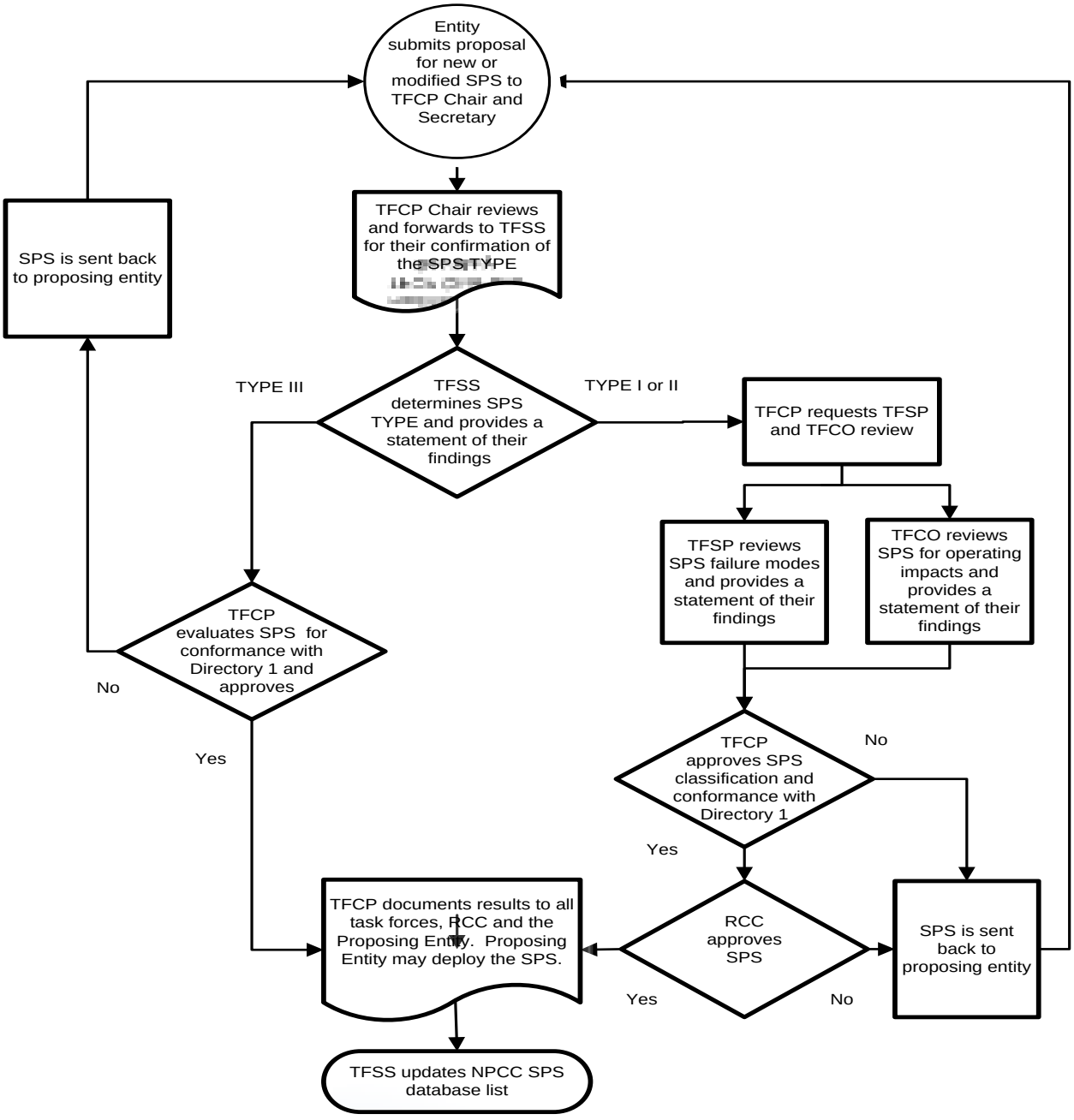
3.4. Retiring a Type III **SPS**

3.4.1. A formal approval to retire a Type III SPS is not required. TFCP shall notify all the task forces and the proposing entity of the retirement.

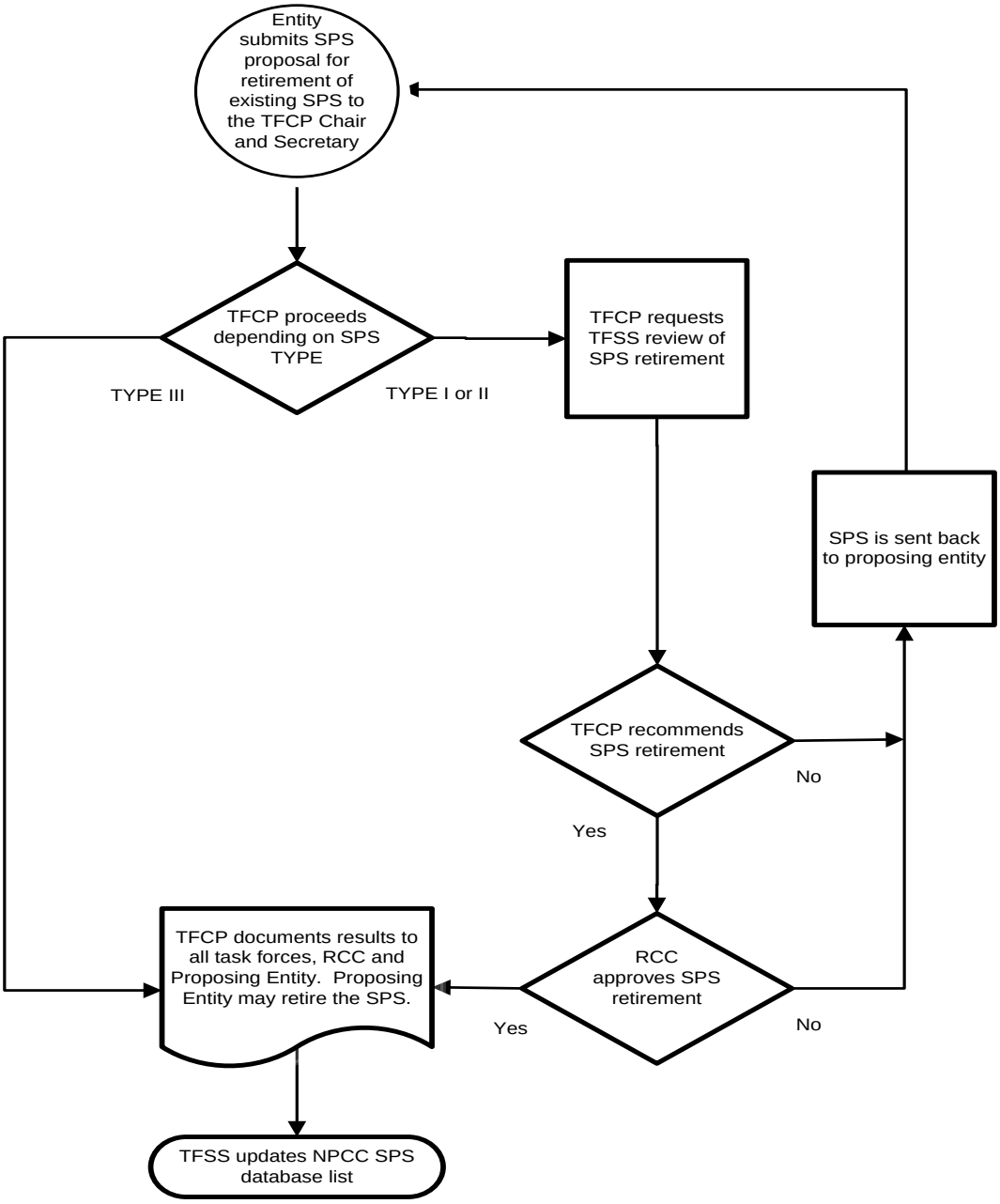
3.4.2. The **SPS** may be retired.

3.4.3. TFSS shall update the NPCC **Special Protection System** list/database.

FLOW CHART FOR REVIEW OF NEW OR MODIFIED SPECIAL PROTECTION SYSTEMS (SPS)



FLOW CHART FOR RETIREMENT OF SPECIAL PROTECTION SYSTEMS (SPS)



Appendix C

Procedure for Reporting to TFSP New and Modified Special Protection Systems

1.0 Introduction

In accordance with the applicable facilities described in Section 1.6.2 of this Directory (D7), Responsible Entity should provide the Task Force on System Protection (TFSP) with advance notification of any of its new **SPS** facilities, or significant changes in its existing **SPS** facilities. Notification should be made to the TFSP early in the engineering design stage.

2.0 Presentation and Review of SPSs

Each new or modified Type I or Type II **SPS** shall be reported to the Task Force on System Protection in accordance with the following presentation and review procedure.

2.1 A presentation will be made to the TFSP on new facilities or a modification to an existing facility when requested by an NPCC Member or the TFSP.

2.2 A presentation will be made to the TFSP when the design of the SPS facility deviates from the D7 Requirement(s).

2.3 A presentation will be made to the TFSP when an NPCC Member is in doubt as to whether a design meets the D7 Requirements.

3.0 Data Required for Presentation and Review:

3.1 The Responsible Entity will advise the TFSP of the basic design of the proposed system. The data will be supplied on the Protection System Review Form, accompanied by a geographical map, a one-line diagram of all affected areas, and the associated **protection** and control function diagrams. A physical layout of the **protection** panels and batteries for the purpose of illustrating physical separation will also be included.

3.2 The proposed **protection** system will be explained with due emphasis on any special conditions or design restrictions existing on the particular power system:

4.0 Procedure for Presentation:

4.1 The Responsible Entity will arrange to have a technical presentation made to the TFSP.

4.2 To facilitate scheduling, the chairman of the TFSP will be notified approximately four months prior to the desired date of presentation.

4.3 Copies of materials to be presented will be distributed to TFSP members 30 days prior to the date of the presentation.

5.0 Review by TFSP

The TFSP will review the material presented and develop a position statement concerning the proposed **SPS**. This statement will indicate one of the following:

5.1 The need for additional information to enable the TFSP to reach a decision.

5.2 Acceptance of the Responsible Entity's statement of conformance to the D7 Requirements.

5.3 Acceptance of the submitted proposal.

5.4 *Conditional acceptance of the submitted proposal.

5.5 *Rejection of the submitted proposal

* Position Statements to include an indication of areas of departure from the intent of the D7 Requirements and suggestions for modifications to bring the **SPS** into conformance with the NPCC criteria.

5.6 The results of the TFSP review will be documented in the following manner.

- A position statement will be included in the minutes of the meeting at which the proposed **SPS** was reviewed. The Chair of TFCP will be notified of the position statement.
- If necessary, a letter outlining areas of non-conformance with the NPCC D7 Requirements and recommendations for correction will be submitted to the Responsible Entity.
- The Task Force will maintain a record of all the reviews it has conducted.