



FEAT Recommendations Completion Report

for

FRCC System Disturbance

and

Underfrequency Load Shedding Event Report -

February 26th, 2008 at 1:09 pm

FEAT 02/26/2008 Recommendations Completed:

June 01, 2010

Reported to:

FRCC Operating Committee

July 01, 2010

Recommendation 1:

Review and enhance as required, present policies and procedures related to removing protection systems from service when performing maintenance or troubleshooting.

Note: The interim measures already implemented by FPL addressed this issue. (ref. FPART 1)

Note: The above recommendation was based on analysis of 2 sub-teams:

There is not a practical method available that can provide complete monitoring of trip circuits that include test switches. There must always be processes, procedures and controls in place to prevent removal of protection on energized equipment. The FPART report has addressed this in recommendation 1. (ref. PPET-1)

Applicable Entity: FPL	Status: Complete
Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs	Status: Complete
Applicable Entity: NERC – Industry Advisory ¹	Status: Complete

Status of Recommendation 1:

- FPL has implemented Protection & Control (P&C) Assurance Procedure with enhanced Relay Maintenance Request process (final issued June 2008). FPL also completed training of all P&C Engineers on September 30, 2008.
- FRCC TOs, TOPs, GOs, and GOPs - All applicable entities have reported completion of this recommendation.
- NERC issued an Industry Advisory titled “Relay Maintenance Practices” on June 26, 2008.

¹ NERC issued an Industry Advisory “Relay Maintenance Practices” (A-2008-06-26-03, issued June 26, 2008) calling for a review of protection system maintenance practices, associated system analyses, and communications with operating personnel.

Recommendation 2:

It is recommended that FEAT notify all FRCC members of both the switch mechanism and the switch semaphore failure modes to increase situational awareness regarding the symptoms of these failures such that they can address any reliability issues that may occur in similar installations. (ref. FPART 2)

Applicable Entity: FRCC TOs and TOPs – through ORS

Status: Complete

Status of Recommendation 2:

- All TO/TOP's have acknowledged receipt of the FEAT Notification of Switch Mechanism and Switch Semaphore Failure Modes that was sent out in March 2009.
 - 40+ Interrupters reported – To be replaced
 - 128+ Interrupters reported - To be inspected
 - ✦ Some entities did not report the number of Interrupters that will be inspected and/or replaced (as they were not asked to do so).

Recommendation 3:

It is recommended that the NERC investigate and determine if an Industry Alert is warranted related to the switch failure modes. (ref. FPART 3)

Applicable Entity: NERC

Status: Complete

Status of Recommendation 3:

- NERC Event Analysis added Recommendations 3 (Industry Alert related to switch failure modes) to their pending Alerts and lessons learned.

Recommendation 4:

Review and enhance as required procedures/guidelines for on-site and/or supervision oversight and participation in the decision making process related to routine and corrective protection system maintenance activities.

Note: The interim measures already implemented by FPL addressed this issue.

(ref. FPART 4)

Applicable Entity: FPL

Status: Complete

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 4:

- FPL - Implemented P&C Assurance Procedure whereby leadership reviews the work plan before the work is performed. Completed Final training of all P&C Engineers on September 30, 2008.
- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 5:

Review/develop procedures/guidelines as required for notification and system operations documentation when protection systems are removed from service when conducting protection system and/or equipment maintenance activities.

Note: The interim measures already implemented by FPL addressed this issue. (ref. FPART 5)

Applicable Entity: FPL

Status: Complete

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 5:

- FPL – Implemented P&C Assurance Procedure with enhanced RMR process.
 - Interim P&C Assurance Procedure was issued 3/13/08 and
 - Formal procedure was issued 6/3/08.
 - Completed Initial training of all P&C Engineers 3/29/08.
 - Final training completed 9/30/08.
- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 6²:

Review and enhance procedures/guidelines as required for notification of control room supervisor by control room personnel when protection systems are removed from service in order to ensure proper system reliability assessment.

Note: The interim measures already implemented by FPL addressed this issue however the FEAT Interim Recommendation Report specified an additional enhancement which was also implemented by FPL. (ref. FPART 6)

Applicable Entity: FPL	Status: Complete
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Applicable Entity: FRCC TOs and TOPs	Status: Complete
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Applicable Entity: NERC – Industry Advisory ³	Status: Complete
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Status of Recommendation 6:

- FPL – By 3/18/2008 FPL had implemented and trained all control room personnel on P&C Assurance Procedure.
 - By 6/18/2008 FPL had trained all control room personnel on "Relay Outage Coordination Procedures".
 - FPL trained and reinforced the RMR process as part of the overall Clearance request process.
- FRCC TOs and TOPs – All applicable entities have reported completion of this recommendation.
- NERC issued an Industry Advisory “Relay Maintenance Practices” (A-2008-06-26-03, issued June 26, 2008) calling for a review of protection system maintenance practices, associated system analyses, and communications with operating personnel.

² Recommendation 6 was a FEAT recommendation that was previously conveyed in the *FEAT Interim Recommendations Report* as Recommendation 5 and was based on FPART’s preliminary analysis.

³ NERC issued an Industry Advisory “Relay Maintenance Practices” (A-2008-06-26-03, issued June 26, 2008) calling for a review of protection system maintenance practices, associated system analyses, and communications with operating personnel.

Recommendation 7:

All parties should review protective system maintenance procedures to ensure they include a step to “Return relay configuration to in-service operating configuration”. (ref. FPART 7)

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 7:

- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 8:

The opening of the Turkey Point – Flagami – Galloway 230kV line at 0.93 seconds when the Turkey Point terminal operated would have benefited the isolation of the fault. FPL should study implementing transfer trip for operation of line backup relaying on all terminals of this three-terminal line. (ref PPET-2)

Applicable Entity: FPL

Status: Complete

Status of Recommendation 8:

- FPL - A project, which added transfer trip for a line backup relay operation as recommended, was engineered and installed at the three substations identified in the recommendation.
 - The project was placed in service 11/16/2008.

Recommendation 9:

The relaying at Miami on the 230kV lines to Flagami should be replaced with relaying that can more effectively coordinate with backup relaying for faults at Flagami. FPL should follow through with these plans to replace the panels. (ref PPET-3)

Applicable Entity: FPL

Status: Complete

Status of Recommendation 9:

- A project was engineered to replace the line panels on both Flagami-Miami 230kV lines.
 - This project was placed in service 06/01/09.

Recommendation 10:

NERC should issue an industry advisory to make owners of large autotransformers aware that relaying for these high value assets should be reviewed and additional backup protection considered to potentially limit the impacts of extreme events. (ref PPET-4a)

Applicable Entity: NERC

Status: Complete

Status of Recommendation 10:

- NERC Event Analysis added Recommendation 10 (Industry Advisory - Large autotransformers) to their pending Alerts and lessons learned in March of 2009.

Recommendation 11:

NERC should assign the System Protection and Control Task Force to produce a technical paper describing the issue and application of backup protection of autotransformers. (ref PPET-4b)

Applicable Entity: NERC

Status: Complete

Status of Recommendation 11:

- NERC SPCS added recommendation 11 (transformer backup protection) to their work plan in March 2009.

Recommendation 12:

To prevent the digital relay directional element from dropping out during evolving faults a common timer is available as an option and should be used. Common zone timing will suspend a timer for 1 cycle if it drops out and will provide ride-through timing for evolving faults. (ref PPET-5)

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 12:

- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 13:

The owners of relay systems should record and reset relay targets in a timely manner. Electromechanical relay targets would require site visits and procedures should be in place to insure the targets are reset. Programming targets on microprocessor based relaying should consider the reset feature and be programmed according to company procedures. (ref PPET-6)

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 13:

- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 14:

Owners should consider enhanced R-X quadrant testing for electromechanical distance relays and their apparent failure modes when investigating mis-operations. (ref PPET-7)

Applicable Entity: FRCC TOs, TOPs, GOs, and GOPs

Status: Complete

Status of Recommendation 14:

- FRCC TOs, TOPs, GOs, and GOPs – All applicable entities have reported completion of this recommendation.

Recommendation 15⁴:
 FRCC Operating Committee issue an alert to all FRCC GOs/GOPs who own or operate large frame combustion turbines and request that the GOs/GOPs undertake a review of the design and settings for auxiliary and plant distribution under-voltage protection to ensure these settings appropriately coordinate with both: (1) the generator protection settings as described in the FRCC Handbook document, FRCC Generator Coordination Requirements, dated November 2001; and (2) the specific equipment’s protection requirements. (ref. GRT-1)

Applicable Entity: FRCC GOs and GOPs **Status:** Complete

Applicable Entity: NERC – Industry Advisory⁵ **Status:** Complete

Status of Recommendation 15:

- FRCC GOs and GOPs – All applicable entities have reported completion of this recommendation.
- NERC issued an Industry Advisory “Unexpected Loss of Generation due to Low Voltage on the System” (A-2008-06-26-01 issued June 26, 2008) based on Recommendations 15.

⁴ Recommendation 15 was a FEAT recommendation that was previously conveyed in the *FEAT Interim Recommendations Report* as Recommendation 3 and was based on GRT’s preliminary analysis.

⁵ NERC issued an Industry Advisory “Unexpected Loss of Generation due to Low Voltage on the System” (A-2008-06-26-01 issued June 26, 2008) based on Recommendations 15.

Recommendation 16⁶:

FRCC Operating Committee issue an alert to all FRCC GOs/GOPs who own or operate large frame combustion turbines to be aware of potential turbine combustor lean blowout under certain frequency excursions. It is recommended that individual GOs/GOPs consult with appropriate combustion turbine manufacturers to understand their vulnerabilities with regard to lean blowout resulting from a system frequency disturbance. In the absence of a frequency rate of change response criteria in the FRCC Generator Coordination Requirements document (dated November 2001 - FRCC Handbook), the GRT also recommends that the FRCC OC investigate the need for establishing a criteria. (ref. GRT-2)

Applicable Entity: FRCC GOs and GOPs	Status: Complete
Applicable Entity: FRCC OC (establishing a criteria)	Status: Complete
Applicable Entity: NERC – Industry Advisory ⁷	Status: Complete

Status of Recommendation 16:

- FRCC GOs and GOPs – All applicable entities have reported completion of this recommendation.
- FRCC OC – The FRCC OC discussed the need for the establishment of a criterion. It was agreed that the NERC issued Industry Advisory on “Turbine Combustor Lean Blowout” (A-2008-06-26-02 issued June 26, 2008) was sufficient at this time. The FRCC Standards department will take the recommendation into consideration during the revision of any related regional criteria or in the potential development of a regional reliability standard.
- NERC issued an Industry Advisory “Turbine Combustor Lean Blowout” (A-2008-06-26-02 issued June 26, 2008) based on Recommendations 16.

⁶ Recommendation 16 was a FEAT recommendation that was previously conveyed in the *FEAT Interim Recommendations Report* as Recommendation 4 and was based on GRT’s preliminary analysis.

⁷ NERC issued an Industry Advisory “Turbine Combustor Lean Blowout” (A-2008-06-26-02 issued June 26, 2008) based on Recommendations 16.

Recommendation 17:

FRCC RC and operating entities under its Reliability Authority to develop a glossary that provides definitions of EMS alarms either received via SCADA or ICCP. This glossary should include definitions for unusual or infrequently received EMS alarms if the definitions of these alarms are not readily apparent from the alarm description field (as received in the EMS alarm log). This alarm glossary should be readily available to system operators and should be reviewed at least annually through formal or informal training activities. (ref. RRT-1)

Applicable Entity: FRCC RC, BAs, and TOPs
(other entities EMS as appropriate) **Status:** Complete

Status of Recommendation 17:

- FRCC RC – Completed the first draft of a glossary of "Unusual or Infrequent Reliability Coordinator Alarms" which was reviewed by the FRCC ORS during the February 2009 ORS meeting.
 - The glossary was finalized based on comments received during the March 2009 ORS meeting and is available for use by the RC.
- FRCC BAs and TOPs – All applicable entities have reported completion of this recommendation.

Recommendation 18⁸:

FRCC companies should re-affirm the **Regional Voice Communications Procedure** contained in the FRCC Handbook document with all FRCC control room personnel involved in the day-to-day operation of the FRCC transmission system. (ref. RRT-2)

Applicable Entity: FRCC RC, BAs, and TOPs **Status:** Complete

Status of Recommendation 18:

- Recommendation 18 was previously discussed and conveyed under the FEAT Interim Recommendations Report, as part of Recommendation 1.

⁸ Recommendation 18 was previously discussed and conveyed under the *FEAT Interim Recommendations Report*, as part of Recommendation 1.

Recommendation 19⁹:

FRCC to review the communication protocol detailed in the FRCC Regional Voice Communication Procedure to be followed when communicating via the FRCC voice communication channels. It is recommended that the FRCC OC direct that the FRCC SOS develop an independent learning activity on the *Regional Voice Communications Procedure* and administer the resultant learning activity to all FRCC Control Room operators within two months of development.

(ref. RRT-3)

Applicable Entity: FRCC RC, BAs, and TOPs

Status: Complete

Status of Recommendation 19:

- Recommendation 19 was previously discussed and conveyed under the *FEAT Interim Recommendations Report* as Recommendation 2.

Recommendation 20:

Review and update FRCC Handbook documents related to load restoration. Clearly describe roles and responsibilities as well as the actions and communications expectations when initiating restoration activities (by both the RC and any impacted operating entities).

(ref. RRT-4)

Applicable Entity: FRCC OC / ORS

Status: Complete

Status of Recommendation 20:

- ORS updated the FRCC handbook document “FRCC - PROC - RC - EOP-006 - FRCC Reliability Coordinator Area – Restoration Plan” and the OC approved the document on September 02, 2009.

⁹ Recommendation 19 was previously discussed and conveyed under the *FEAT Interim Recommendations Report* as Recommendation 2.

Recommendation 21¹⁰:

FRCC to expedite a review and update of the following FRCC handbook documents:

- 1) *FRCC Restoration Plan (Blackout and Blackstart)*
- 2) *Underfrequency Actions Due to Whole or Partial Islanding of the Florida Transmission System*
- 3) *Generation Deficiency with Separation*
- 4) *Restoration* (ref. RRT-5)

Applicable Entity: FRCC OC / ORS

Status: Complete

Status of Recommendation 21:

- ORS reviewed the documents referenced in Recommendation 21. Documents 1, 2, and 3 were combined as the updated “FRCC Restoration Plan” which was renamed “FRCC - PROC - RC - EOP-006 - FRCC Reliability Coordinator Area – Restoration Plan”. The OC approved the document on September 02, 2009. The fourth document titled “Restoration” was eliminated from the FRCC Handbook since the FRCC UFLS program did not allow for automatic load restoration.

Recommendation 22:

FRCC to require annual training on the revised restoration procedures. Training should detail expectations, roles, responsibilities and priorities following an FRCC Regional UFLS event including both uniform and non-uniform actuation of UFLS, type events. (ref. RRT-6)

Applicable Entity: FRCC OC / SOS

Status: Complete

Status of Recommendation 22:

- The SOS conducted training on the restoration procedures in accordance with Recommendation 22 during the 2009 and 2010 SOS training seminars.

¹⁰ Recommendation 21 was previously discussed and conveyed under the *FEAT Interim Recommendations Report*, as Recommendation 6.

Recommendation 23:

FRCC to develop and implement an alternative UFLS indication tool that combines all of the FRCC Balancing Authorities (BAs) and Transmission Operators (TOPs) underfrequency load shed status and presents that information on a high-level summary to the FRCC RC.

(ref. RRT-7)

Applicable Entity: FRCC OC / ORS

Status: Complete

Status of Recommendation 23:

- ORS – The UFLS indication tool was developed by ORS and the Data Exchange Working Group (DEWG) in March 2010. All Load Serving Entities (LSE) within the FRCC established a status point to communicate UFLS actuation within their area. The FRCC RC agent developed a geographical display to communicate UFLS actuation status points in real time across the FRCC LSEs. This display was put in service for use by the RC operators as of June 2010.

Recommendation 24:

It appears that at least 32 relays set to trip for set point A and A' did not trip in accordance with the prevailing system conditions. The URT recommends that the FRCC Operating Committee (OC) direct the FRCC System Protection and Control Subcommittee (SPCS) to perform a detailed evaluation of all relays that may have mis-operated coincident with the Event. The SPCS should work with the affected owner/operator and report their findings to the OC.

(ref. URT-1)

Applicable Entity: FRCC OC / SPCS

Status: Complete

Status of Recommendation 24:

- SPCS – A task force of the FRCC SPCS completed the recommended evaluation and presented a report to the FRCC OC at the April 2, 2009 meeting.
- No further actions are required as a result of this evaluation.

Legend

BA	Balancing Authority
EMS	Energy Management System
FPART	Field Personnel Actions Review Team
FPL	Florida Power & Light
FRCC	Florida Reliability Coordinating Council
FSRT	FRCC System Response Team
GO	Generator Owner
GOP	Generator Operator
GRT	Generator Response Team
ICCP	Inter-Control Center Communications Protocol
NERC	North American Electric Reliability Corporation
OC	Operating Committee
ORS	Operating Reliability Subcommittee
PDSC	Pre-Disturbance System Configuration
PPET	Protection Performance Evaluation Team
RC	Reliability Coordinator
ref	Reference
RRT	Restoration Response Team
SCADA	Supervisory Control and Data Acquisition
SOS	System Operator Subcommittee
SPCS	System Protection and Control Subcommittee
TO	Transmission Owner
TOP	Transmission Operator
UFLS	Underfrequency Load Shedding
URT	UFLS Response Team