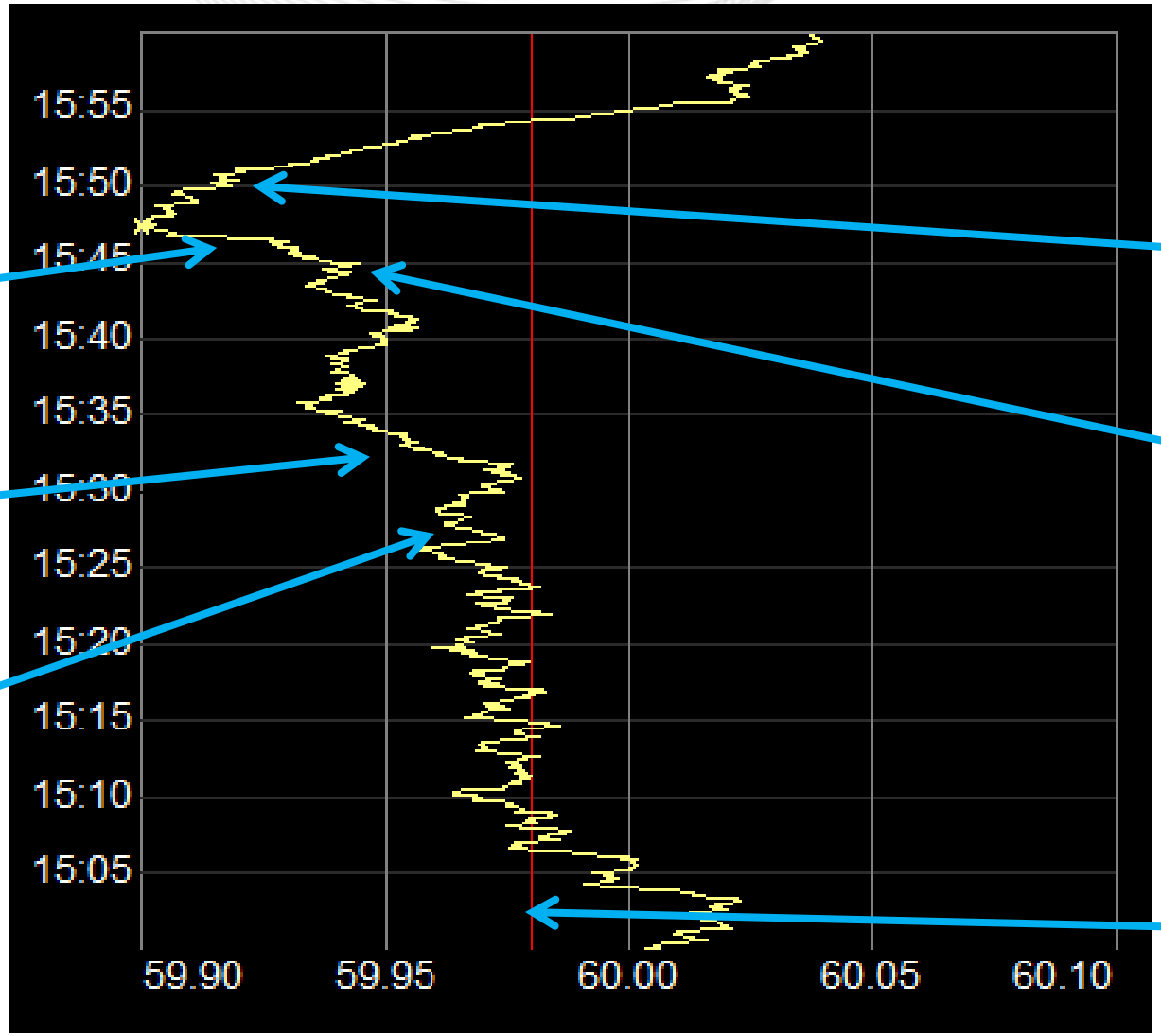
# July 10, 2018 ACE/Frequency Excursion Apparent Cause Analysis Report

Donnie Bielak
Reliability Engineering

# Executive Summary

- On July 10, 2018 PJM observed a low ACE of -2,942 MW along with a low frequency of 59.903 Hz at approximately 15:49. There were several factors which lead up to this event including multiple unit trips, non-approved cases from RTSCED, a drop in eastern interconnect frequency, and poor synchronized reserve response

# Frequency Response




.03Hz drop. Pseudo tied unit trips (800MWs)

.04Hz drop. Cause unknown. The NERC RS investigating.

Generator runs back (400MWs)

Simultaneous Activation of Reserve (SAR) initiated.

Synchronized Reserve Event initiated

Scheduled frequency (59.98 Hz)

# Contributing Factor 1: Time Error Correction during Hot Weather Alert

| Root Cause | Recommendations |
|---|---|
| Procedures – Details Need Improvement | Add recommendations around not approving time error corrections during emergency procedures (e.g. hot/cold weather alerts) or recalling time error corrections during events such as frequency excursions. |
| Training – Continuing Training Needs Improvement | Training related to not approving time error corrections during emergency procedures (e.g. hot/cold weather alerts) or recalling time error corrections during events such as frequency excursions. |

# Causal Factor 1: No response from units called online

| Root Cause | Recommendations |
|---|---|
| Procedures – Ambiguous Instructions | Improve PJM Manual 13 language to include reference to PJM Manual 11 section 2.3.4 (Minimum Generator Operating Parameters – Parameter Limited Schedules). |
| | Discuss changes to the emergency procedures messages to more clearly notify participants that resources could be committed on their unit specific parameters from their parameter limited schedule. |
| | Provide operations update on PJM Manual 13 revisions related to parameter limited schedules. |
| Training – Continuing Training Needs Improvement | Reinforce training with PJM members to highlight how unit specific parameters and “real-time values” are utilized during emergency procedures. (Hot/Cold Weather Alerts, Maximum Generation Alerts, Maximum Generation Emergency). (PJM Manual 11 Section 2.3.4). |

# Causal Factor 2: Multiple unit trips

| Root Cause | Recommendations |
|---|---|
| Tolerable Failure – Random Equipment Failures, Difficult to Predict | Track a list of unit trips and perform analysis on tripping frequency specifically looking for any trends by unit or unit type. |

# Causal Factor 3: RTSCED cases not approved

| Root Cause | Recommendations |
|---|---|
| Procedure Enhancement | Create a procedure detailing the steps around monitoring system conditions and deciding when RTSCED case data is valid. |
| Training – Continuing Training Needs Improvement | Additional training for dispatchers and dispatch supervisors on the new procedure and tools/displays related to monitoring RTSCED case data. |
| Human Engineering – Displays/Tools Need Improvement | Improve dispatcher displays to show an operational representation of the RTSCED case data. Additional displays will help dispatch validate cases. |
| | Make improvements to dispatch applications to increase accuracy and dispatcher trust in the solved cases. RTSCED can be configured to account for a portion of committed CTs that are due online. |

# Causal Factor 4: Unexplained drop in Eastern Interconnect frequency

| Root Cause | Recommendations |
|---|---|
| Other – Insufficient Information to Identify Root Cause | Work with NERC Resources Subcommittee to investigate the source of the unexplained drop in eastern interconnect frequency on 7/10/2018 15:31 to 15:37. |

# Causal Factor 5: Poor Synchronized Reserve event response

| Root Cause | Recommendations |
|---|---|
| Management System – Procedure Not Strict Enough | Make changes to synchronized reserve market to better incentivize resources for participation in the market. This should include a combination of improved penalty and incentive structures. |

# Tier 2 resource response aggregated by resource type

| Unit Type | T2 Reponse MW | T2 Assigned MW | Response (%) |
|---|---|---|---|
| CT | 42.7 | 108.4 | 39% |
| Hydro | 89 | 107 | 83% |
| Steam | 33.9 | 59.7 | 57% |
| DR | 143.1 | 219.5 | 65% |
| **Total** | **308.7** | **494.6** | **62%** |

| | T1 Response MW | T1 Estimate MW | Response (%) |
|---|---|---|---|
| Total | 525 | 784 | 67% |