ENERGY COMPLIANCE, INC. | *Field Reference for Compliance Programs*

SPECIAL TOPICS SERIES · EC-WP-600

Disturbance Reporting and Event Analysis

EOP-004 reporting, root cause analysis, and the institutional learning that follows.

EOP-004 is one of the few standards that looks backward. Most reliability standards ask what you will do. Disturbance reporting asks what you did, why, and whether it should have been prevented. This reference walks through what EOP-004 actually requires, where root cause analysis really comes from, and how a single event report can open the door to every other standard you own.

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Standards, thresholds and effective dates cited here were checked against the primary sources listed in Sources and Authorities as of October 2026. They change. Confirm the current version before you rely on any of them.

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Foreword

This professional reference is one of a series Energy Compliance, Inc. publishes for registered entities and the people who run their compliance programs.

I've spent more than thirty years on every side of the bulk electric system. I've operated control centers as a Reliability Coordinator, Transmission Operator, and Power System Operator. I've audited grid facilities and signed off on findings as a senior compliance auditor. I've worked enforcement matters from inside the regulator's process. For the last several years I've advised registered entities directly through the firm I founded.

The entities that do reliability well share a common habit. They take the standards seriously without confusing them with reliability itself. They know that a NERC Reliability Standard is a floor, not a ceiling. They know that compliance is something an auditor evaluates, but reliability is something a system either delivers or doesn't. They prepare for audits by building programs that survive real questions, not binders that look thick.

That's the perspective these references try to share. Each one focuses on a single topic: a standard family, an operational function, a regulatory framework, or an emerging industry challenge. Each one walks through how the topic actually works.

These references are written for the compliance manager who wants to understand the system, not just memorize requirements. For the legal counsel who has to brief a board honestly. For the senior operator who's been told that compliance and reliability are the

same thing and suspects they aren't. And for the new compliance hire who got handed a binder and told good luck.

These references aren't marketing material disguised as content. They're the result of three decades of doing this work and watching it succeed and fail. I've written them in the same voice I use in a control room or in front of a Regional Entity audit team: direct, evidence-grounded, honest about what the standards do and do not require.

Energy Compliance exists because most of the consulting offered to registered entities today is structured for billable hours rather than for outcomes. Every engagement is overseen by a senior practitioner. We don't bring five people to a meeting that needs one. We automate the work that should be automated. We apply senior judgment to the work that requires it. If that approach matches what you're looking for in a compliance partner, the back of this reference has our contact information.

If not, the reference still belongs to you. Take what's useful. Apply it well. And remember the only test that ultimately matters: when the system needs to perform, does it?

Rob Smith

Founder and Principal, Energy Compliance, Inc.

Executive Summary

Disturbance reporting runs in the opposite direction from most of the framework. A typical reliability standard tells you what to have in place before something happens. EOP-004 asks you to account for something that already happened: what you did, why, and whether it should have been prevented.

> **From the Field**
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> An EOP-004 report isn't the end of an event. It's the beginning of an investigation. Treat it accordingly.
>
> Most entities treat disturbance reporting defensively. Mature programs treat it as performance documentation. Same form, different posture, different outcome.
>
> Root cause is not a synonym for the first plausible explanation. It's the analysis that survives review by an auditor who has seen this fail before.

Start with what the standard actually requires, because the industry folklore around it is bigger than the text. EOP-004-4, the version in force today, has two requirements. R1 says you need an event reporting Operating Plan. R2 says you report the events listed in Attachment 1 to the entities named in that plan by the later of 24 hours after you recognize a threshold was met or the end of your next business day. That's it. EOP-004 does not require a root cause analysis.

The analysis comes from somewhere else: the ERO Event Analysis Process, which runs on NERC's authority under Section 800 of its Rules of Procedure, and a handful of standards that do require cause work, most notably PRC-004-6 for Protection System Misoperations and, since October 1, 2026, PRC-030-1 for unexpected changes in inverter-based resource output. A program that treats the 24-hour report as the whole job is missing most of the exposure.

The report is not sworn. Treat it as if it were. Once it's filed, it becomes the institutional record, and in my view, later statements that contradict it will be read as corrections to that record. The Regional Entity can open a Compliance Investigation in response to a system disturbance, and an event that closes cleanly under EOP-004 can still put your PRC, TOP, FAC or CIP evidence on the table.

Two changes matter now. First, EOP-004-5 adds a new reportable event type for loss of inverter-based resources following a Disturbance, with Interconnection-specific thresholds. FERC approved it on August 10, 2026, and it takes effect October 1, 2027. Second, PRC-030-1 makes applicable Generator Owners analyze unexpected IBR output changes on a clock.

1 Statutory Authority and the Evolution of Mandatory Disturbance Reporting

Major disturbances are rarely the product of one failed relay or one bad operator decision. They grow out of layers: protection performance, situational awareness, planning assumptions, operator choices, communication, and the boundaries between the organizations that share a system. Disturbance reporting exists so those layers get written down while the evidence is still fresh.

This reference treats disturbance reporting as a governance function, not a maintenance chore. That framing matters because it changes who in your organization owns the problem. The report leaves the control room, but it lands in front of regulators, standards drafters and, sometimes, your board.

1.1 From Voluntary Coordination to Section 215

Before 2005, NERC's reliability rules were voluntary. Compliance ran on peer pressure and reputation. That arrangement had no teeth, and the August 14, 2003 blackout proved what that meant in practice.

The blackout affected an area with an estimated 50 million people and 61,800 MW of load across eight states and Ontario. The U.S.-Canada Power System Outage Task Force issued its final report in April 2004. It grouped the causes under inadequate system understanding, inadequate situational awareness, inadequate tree trimming, and inadequate reliability coordinator diagnostic support. It made 46 recommendations. The first was to make reliability standards mandatory and enforceable, with penalties for noncompliance.

Congress did that in the Energy Policy Act of 2005, which added Section 215 to the Federal Power Act. Section 215 authorizes FERC to certify an Electric Reliability Organization, approve the Reliability Standards it proposes, and oversee their enforcement, including through Regional Entities that hold delegated authority. FERC certified NERC as the ERO on July 20, 2006. In Order No. 693, issued March 16, 2007, FERC approved the first set of mandatory Reliability Standards.

Two pieces of the federal rules are worth knowing by number. 18 CFR 39.2(d) requires every user, owner and operator of the Bulk-Power System to provide FERC, the ERO and the applicable Regional Entity the information necessary to implement Section 215. NERC Rules of Procedure Sections 807 and 808 then say the same thing in operational terms: if a Reliability Standard sets reporting criteria, you report what it requires on its clock, and you also provide whatever additional information NERC or the Regional Entity requests to analyze the event.

1.2 How the Reporting Standard Has Changed

The disturbance reporting standard has not stood still. EOP-004-2 merged the old CIP-001 Sabotage Reporting standard and EOP-004-1 Disturbance Reporting into a single Event Reporting standard; FERC approved it on June 20, 2013. EOP-004-3 replaced Special Protection System terminology with Remedial Action Scheme. EOP-004-4, approved by FERC on January 18, 2018, has been in effect since April 1, 2019.

EOP-004-5 is next. It keeps the two-requirement structure and adds an event type for inverter-based resource loss following a Disturbance. The NERC Board adopted it in June 2026, FERC approved it on August 10, 2026 in Docket No. RD26-8-000, and it becomes effective October 1, 2027, when EOP-004-4 retires.

Each revision followed the same pattern: the criteria missed something, and the criteria changed. Chapter 5 comes back to that.

1.3 What Mandatory Reporting Does

Mandatory reporting serves three purposes at once.

First, visibility across boundaries. RCs, BAs, TOPs and GOPs each see part of the system, and a disturbance in one footprint can matter to the next. A common reporting obligation gets the facts to the people with the wide-area view.

Second, an enforceable record. Once a standard says an event type is reportable, the report is no longer optional, and failing to file it is itself a potential violation. What used to be a utility's private effort to understand an outage becomes an obligation to put specific information in front of the ERO.

Third, a feedback loop into the standards. Analysis of past disturbances has driven changes in protection, vegetation, monitoring and, most recently, inverter-based resource performance requirements. If the experience isn't recorded systematically, it doesn't get applied systematically.

1.4 Reliability Causation Is Not Legal Fault

Disturbance analysis records causality in the reliability sense. It asks which conditions, across all the layers, combined to produce the system consequence. Enforcement asks a narrower question: was a Reliability Standard violated?

Those questions overlap, but they are not the same. An event can expose a real weakness without any violation, or a violation that had nothing to do with the outcome. A good program keeps both in view and doesn't let fear of the second corrupt the answer to the first.

End-of-Chapter Summary

The authority for mandatory disturbance reporting comes from FPA Section 215, enacted after the 2003 blackout showed what voluntary standards could not deliver. EOP-004 turns that authority into a specific reporting obligation, and the NERC Rules of Procedure add a duty to provide whatever further information the ERO needs. The point is visibility, accountability and learning, in that order of urgency.

2 EOP-004 Structure, Thresholds, and Reporting Architecture

EOP-004 does not try to list every anomaly that can happen on the Bulk Electric System. It lists event types and thresholds, assigns each one to the functional entities positioned to see it, and sets one reporting clock. Everything else in this chapter follows from those three choices.

2.1 Two Requirements

EOP-004-4 applies to Reliability Coordinators, Balancing Authorities, Transmission Owners, Transmission Operators, Generator Owners, Generator Operators and Distribution Providers, collectively the "Responsible Entity."

R1, the Operating Plan. Each Responsible Entity must have an event reporting Operating Plan, in accordance with Attachment 1, that includes the protocols for reporting to the ERO and to other organizations: the Regional Entity, company personnel, your Reliability Coordinator, law enforcement, or governmental authorities. R1 carries a Lower Violation Risk Factor. The severity of a violation scales with the number of applicable event types missing from the plan, and having no plan at all is Severe.

R2, the report. Each Responsible Entity must report Attachment 1 events to the entities in its plan by the later of 24 hours after recognizing that an event type threshold was met, or the end of its next business day. The standard defines end of business day as 4 p.m. local time. R2 carries a Medium Violation Risk Factor. Severity scales with lateness, in 24-hour steps, and with the number of required recipients you missed.

The evidence is simple: a completed Attachment 2 form or a DOE OE-417 form, plus proof of when it was submitted, such as an operator log entry, voice recording or email. Retain the current Operating Plan and every version issued since your last audit, and retain R2 evidence since your last audit.

Note the Attachment 1 caveat. Under adverse conditions such as severe weather or multiple events, you may not be able to report damage and issue a written report on time. In that case you still notify on the R2 clock and provide what you know. The standard does not excuse silence.

2.2 The Attachment 1 Thresholds

The table below summarizes the EOP-004-4 Attachment 1 event types. Read the standard itself for exact wording; the thresholds are short, and the details matter.

Event type	Who reports	Threshold (summary)
Damage or destruction of a Facility	RC, BA, TOP	Damage in its area that results in actions to avoid a BES Emergency
Damage or destruction of its Facility	TO, TOP, GO, GOP, DP	Actual or suspected intentional human action; theft only if it degrades normal operation
Physical threats to its Facility	TO, TOP, GO, GOP, DP	Non-weather threat with potential to degrade normal operation, or suspicious device or activity
Physical threats to its BES control center	RC, BA, TOP	Same test, applied to the control center
Public appeal for load reduction	BA	Appeal to maintain continuity of the BES
System-wide voltage reduction	TOP	3% or more
Firm load shedding	Initiating RC, BA or TOP	100 MW or more, manual or automatic
Voltage deviation on a Facility	TOP	10% or more of nominal, sustained 15 continuous minutes or more
Uncontrolled loss of firm load	BA, TOP, DP	15 minutes or more from a single incident: 300 MW or more if prior-year peak demand is 3,000 MW or more; 200 MW or more for all others
System separation (islanding)	RC, BA, TOP	Each island of 100 MW or more
Generation loss	BA	Within one minute: 2,000 MW or more in the Eastern, Western or Quebec Interconnection; 1,400 MW or more in ERCOT
Loss of off-site power to a nuclear plant	TO, TOP	Complete LOOP per the Nuclear Plant Interface Requirements
Transmission loss	TOP	Unexpected loss, contrary to design, of three or more BES Facilities from a common disturbance, excluding successful automatic reclosing
Unplanned control center evacuation	RC, BA, TOP	30 continuous minutes or more
Loss of Interpersonal and Alternative Interpersonal Communication	RC, BA, TOP	Complete loss at a staffed BES control center, 30 continuous minutes or more
Loss of monitoring or control	RC, BA, TOP	Complete loss at a staffed BES control center, 30 continuous minutes or more

Notice what the thresholds measure. They are physical system effects: megawatts, minutes, percent of nominal, number of Facilities. None of them is commercial. And they are deliberately set to catch events with real reliability significance without burying the ERO in noise. Set them

too low and the important reports drown. Set them too high and the industry loses events it needed to learn from. That second failure is exactly what drove EOP-004-5.

2.3 Who Reports Is a Registration Question

Reporting responsibility follows functional registration. The Balancing Authority reports generation loss. The Transmission Operator reports system-wide voltage reduction and transmission loss. The entity that initiated firm load shedding reports it. An entity registered for several functions files one report for an event, not one per registration.

That makes event reporting inseparable from knowing exactly what you're registered for and what each registration obligates you to see. If your Operating Plan doesn't match your registrations, you have a compliance gap before anything trips. If your operating authority and your reporting authority sit in different groups that don't talk, you have one the moment something does.

2.4 EOP-004-5 and the IBR Loss Criterion

EOP-004-4's generation loss thresholds were built around large synchronous units. The EOP-004-5 implementation plan says it directly: those thresholds were not aligned with the large IBR disturbances the ERO had analyzed, which caused widespread grid disturbances but were not required to be reported because they didn't meet the EOP-004 thresholds.

EOP-004-5 adds an event type for Inverter-Based Resource loss following a Disturbance. The Balancing Authority reports an unexpected loss of IBR output within its area, in 30 seconds or less following a Disturbance, calculated with a new Attachment 2 equation that compares aggregated pre-Disturbance output to the minimum output in the 30 seconds after. The thresholds are 900 MW in the Eastern Interconnection, 500 MW in the Western Interconnection, 800 MW in ERCOT and 500 MW in Quebec. Losses due to weather, lack of wind, changes in irradiance, fuel unavailability, curtailment, ramping, planned outages or testing, SCADA or telemetry failure, or loss of a radial line that disconnects the IBR are excluded. The old Attachment 2 form becomes Attachment 3, and the form is now called DOE-417.

The implementation plan gives entities twelve months after regulatory approval because Balancing Authorities may need new SCADA tags, data from asset owners, model changes, calculations and alarms to detect the threshold in time. With FERC approval on August 10, 2026, the effective date is October 1, 2027. If you are a BA, that work should already be on a schedule. If you own IBRs in a BA's area, expect data requests.

2.5 The Reporting Stack

EOP-004 is rarely the only report an event triggers. The table shows the common companions. Your Operating Plan should map an event to every one of them, so the operator on shift doesn't have to work it out at 2 a.m.

Obligation	Source	Clock
EOP-004 event report	EOP-004-4 R2	Later of 24 hours after recognition or end of next business day (4 p.m. local)

Obligation	Source	Clock
DOE-417 Emergency Alert	DOE-417 instructions	Within 1 hour for criteria 1 through 9
DOE-417 Normal Report	DOE-417 instructions	Within 6 hours for criteria 10 through 13
DOE-417 System Report	DOE-417 instructions	Same 24-hour or next-business-day clock as EOP-004
DOE-417 Final Report	DOE-417 instructions	Within 72 hours
Reportable Cyber Security Incident (high and medium impact systems)	CIP-008-6 R4	E-ISAC and NCCIC, or their successors, within 1 hour of determination
ERO Event Analysis Process brief report	EAP v5.0, Appendix A	Target time frames set in the EAP appendix

DOE-417 is mandatory under Section 13(b) of the Federal Energy Administration Act of 1974, and the ERO accepts it in lieu of the EOP-004 form when you are required to file it. One well-built DOE-417 can satisfy two obligations. A sloppy one creates two problems.

> **From the Field**
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> EOP-004 doesn't list every anomaly that has to be reported. It lists the categories. Knowing which category a real event falls into, at 2 a.m., with incomplete information, is the operational judgment the standard demands. Write the Operating Plan for that operator, not for the auditor.

End-of-Chapter Summary

EOP-004 is a short standard: an Operating Plan and a report on a fixed clock, triggered by physical thresholds and assigned by functional registration. The complexity lives in the companion obligations, DOE-417, CIP-008 and the Event Analysis Process, and in the new EOP-004-5 IBR criterion coming October 1, 2027.

3 Root Cause Analysis Expectations and Methodological Discipline

EOP-004 does not require root cause analysis. It's worth being precise about where the cause work actually comes from, because each source carries different obligations and different exposure.

3.1 Where Cause Analysis Is Actually Required

The ERO Event Analysis Process. The EAP, now at Version 5.0 (accepted by the NERC Reliability and Security Technical Committee September 20, 2023, effective January 1, 2024), is a guideline built on NERC's Rules of Procedure Section 800 authority. It sorts qualifying events into Categories 1 through 3 by reliability impact, with Category 0 for events of interest that don't meet the criteria. The registered entity proposes a category, coordinates with its Regional Entity, and submits a Brief Report. Category 3 events require an Event Analysis Report, and one can be requested for any category. The EAR addresses the sequence of events, the causal factors and the corrective actions. The EAP states plainly that it does not exempt anyone from mandatory reporting under a standard.

PRC-004-6, Protection System Misoperations. The TO, GO or DP that owns a BES interrupting device that operated must, within 120 calendar days, identify whether its Protection System components caused a Misoperation. Once a cause is identified, the owner has 60 calendar days to develop a Corrective Action Plan and evaluate whether it applies to its other Protection Systems and locations, or to explain in a declaration why corrective actions are beyond its control or would not improve BES reliability. Then it must implement each CAP until it is complete. This is mandatory cause analysis with a deadline.

PRC-030-1, unexpected IBR output changes. Effective October 1, 2026, PRC-030-1 requires applicable Generator Owners to run a documented process that identifies a complete loss of facility output, or a change in Real Power output of at least 20 MW and at least 10% of gross nameplate within 4 seconds, excluding changes from resource variability, dispatch, planned work, configured disconnection, or Misoperations already handled under PRC-004. Within 90 calendar days of such an event, or of a request from the RC, BA or TOP, the GO must analyze the facility's performance, determine the root cause, document ride-through performance including reactive response, assess whether corrective action is needed, and decide whether the root cause applies to its other IBR facilities. If corrective action is needed, a CAP or a technical justification goes to the RC, BA and TOP within 60 calendar days of completing the R2 analysis.

Put those three side by side and the practical lesson is clear. The 24-hour report is the trailhead. The cause analysis that follows may be guideline-driven, mandatory, or both, and the same event can start all three clocks.

3.2 Direct Cause and Underlying Cause

None of these sources mandates a method. Fault trees, cause mapping, barrier analysis: the choice is yours, and it should fit the event. What reviewers look for is depth.

A sound analysis separates the direct cause from the underlying cause. The direct cause may be a relay operation or a failed component. The underlying cause is usually something like settings that were never coordinated, testing that wasn't done, a modeling assumption that was wrong, or an operating constraint nobody had written down. Components rarely fail in isolation. Design, maintenance, settings, procedures and ambient conditions interact.

A fix that replaces the failed part and stops there treats the symptom. If the analysis doesn't ask why the barrier that should have stopped the failure wasn't there, the next event will ask for you.

3.3 Preserve the Evidence First

Analysis is only as good as the data behind it. Event logs, sequence-of-events records, relay files, digital fault recorder and PMU data, SCADA historian records, operator logs and voice recordings all need to be preserved before anyone starts forming conclusions.

The rules back this up. The EAP planning meeting is supposed to identify the need for a data retention hold, and Regional Entities will formally send a Data Retention Hold notice for Category 3 events when they or NERC deem it necessary. NERC's disturbance monitoring requirements now include PRC-002-5 and, for inverter-based resources, PRC-028-1, Disturbance Monitoring and Reporting Requirements for Inverter-Based Resources.

> **From the Field**
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> The San Fernando disturbance on July 7, 2020 is a useful public example. Two faults on the 230 kV system reduced solar PV output in Southern California, and the second, a three-phase fault on re-energization, cut roughly 1,000 MW. CAISO filed a brief report as a Category 1i event, and NERC and WECC concluded more information was needed to find the root cause, so they sent data requests to the affected Generator Owners. One of the report's findings was headed, simply, "Poor Data Resolution from Solar PV Facilities." If your plant can't produce high-resolution data after an event, someone else's analysis will describe your plant for you.

3.4 Human Performance

Most analyses start with the technical failure. They should not end there. Decisions made under pressure, alarm presentation, operator workload and the quality of communication between groups all shape how an event unfolds. A purely technical analysis misses the human-system interaction, and that's often where the most useful corrective action sits.

3.5 Corrective Actions That Match the Cause

Corrective actions can be equipment changes, procedure changes, training, settings reviews or model updates. Whatever they are, each one should trace back to a cause the analysis actually identified. Reviewers test that line. A corrective action list that reads like a generic improvement plan tells them the analysis didn't find the cause.

Honesty matters here more than anywhere. Shading the analysis to reduce enforcement exposure may buy a quiet quarter. Over time it degrades the reliability program, and if the shading is discovered, it costs far more than the original issue would have.

End-of-Chapter Summary

EOP-004 requires a report, not an analysis. Cause analysis comes from the ERO Event Analysis Process and from standards such as PRC-004-6 and PRC-030-1, which carry their own deadlines. Whatever the source, the work should separate direct from underlying causes, preserve the evidence first, account for human performance, and tie every corrective action to a cause.

4 Institutional Accountability and Oversight Review

An EOP-004 report starts as an operational record. Once it's filed, it enters a regulatory process with its own logic. Understanding that process is how you keep the report from becoming the first exhibit in a case you didn't know you were part of.

4.1 Layered Accountability

Accountability runs in layers. The registered entity is accountable for the accuracy and completeness of what it reports, including information it gathered from others. The Regional Entity reviews submissions and coordinates analysis in its footprint; there are six of them: MRO, NPCC, ReliabilityFirst, SERC, Texas RE and WECC. NERC decides whether a major event warrants analysis at the NERC level, and a Regional Entity can ask NERC to elevate one, under Rules of Procedure Section 807 and the Blackout and Disturbance Response Procedures in Appendix 8. FERC oversees the ERO under Section 215, and under CMEP Section 4.4 FERC can open its own investigation at any time in response to a system disturbance.

4.2 When a Disturbance Opens a Compliance Investigation

This is the part most programs underestimate. Under Section 4.4 of the CMEP, Appendix 4C to the Rules of Procedure, the Compliance Enforcement Authority may initiate a Compliance Investigation at any time in response to a system disturbance, a Complaint, or any potential noncompliance identified by other means. Compliance Investigations are generally led by Regional Entity staff, NERC can take the lead, and they are confidential unless FERC directs otherwise.

That review rarely stays confined to whether the report was on time. A tree contact points to vegetation management. A relay operation points to PRC-004 and PRC-005. A loss of monitoring points to your control center and TOP obligations. An inverter trip points to ride-through, modeling and, now, PRC-030-1. Expect requests for relay settings, sequence-of-events data, maintenance records and operator logs. Those requests are routine, and they underline the point: conclusions without hard evidence don't survive review.

4.3 Coordination Gaps

Some events can't be pinned on one entity. A voltage problem can involve the Generator Operator, the Transmission Operator and the Balancing Authority at once. Review in those cases focuses on the seams: communication protocols, data sharing, whether the parties were working from the same models. Layered accountability doesn't dilute your own. It means you need to know where your piece starts and stops before the event, not after.

4.4 The Board Is Watching Too

A significant disturbance is enterprise risk, with economic, reputational and regulatory consequences, and boards should treat it that way. That's healthy, as long as it leads to better analysis rather than more careful wording. In my view the best signal of program maturity is a report that is timely, candid about what is still unknown, and specific about what will be fixed.

End-of-Chapter Summary

A filed report is reviewed in layers, by the Regional Entity, NERC and sometimes FERC. The CMEP allows a Compliance Investigation in response to a system disturbance, and review routinely extends past EOP-004 to the other standards the event touches. Know your piece of the accountability chain before the event, and support every conclusion with evidence.

5 Disturbance Analysis as a Driver of Standards Evolution

Several of today's Reliability Standards trace directly to major events. That isn't an accident. It's built into the Rules of Procedure.

5.1 The Feedback Loop Is Written Down

Rules of Procedure Section 806 describes the reliability performance program as analysis of large-scale outages, disturbances and near misses to determine root causes and lessons learned, with results fed to the standards development and compliance monitoring programs. Section 810 gives NERC three levels of formal notice: Level 1 Advisories, Level 2 Recommendations and Level 3 Essential Actions, with Essential Actions requiring Board approval. The EAP says the same from the bottom up: analyzed events feed the ERO Cause Code Assignment Process, trends emerge, and mitigation can include NERC Alerts or recommended changes to standards and to disturbance reporting itself.

The path from an event to a standard usually runs like this. The affected entities report and analyze. The ERO correlates the event with others like it. A technical group decides whether the risk is isolated or systemic. If it's systemic, the answer may be an Alert, a guideline, a revised standard or a new one.

5.2 Three Examples

Mandatory standards themselves. The 2003 blackout report's first recommendation was mandatory, enforceable standards. That is the origin of the Section 215 regime this whole reference sits inside.

Vegetation and data recorders. The same report listed inadequate tree trimming among the causes. Transmission vegetation management is now governed by FAC-003. Its Recommendation 28 called for time-synchronized data recorders; disturbance monitoring requirements now sit in PRC-002-5, and for IBRs in PRC-028-1.

Inverter-based resources. The EOP-004-5 implementation plan traces the new IBR loss criterion to a series of widespread solar PV loss events, the November 2020 San Fernando disturbance report, and a follow-up recommendation to fix the generation loss criteria. The IBR standards family, including PRC-028-1, PRC-029-2 and PRC-030-1, now addresses ride-through, monitoring and post-event analysis directly.

5.3 Not Every Event Changes a Standard

The tempo is set by people, not by the event. Regulators first ask whether a vulnerability is isolated or a trend. A local failure on one line is usually fixed by the owner, and the framework

stays as it is. A pattern that shows up across entities and Regions is what moves a standard. That's why the quality of each individual report matters: the trend is built from them.

Disturbance analysis also feeds risk-based compliance monitoring. What the Regional Entity learns from events in its footprint shapes where it looks next, which audits it prioritizes and what it asks for.

End-of-Chapter Summary

The Rules of Procedure build a loop from event analysis to Alerts and standards. The 2003 blackout, vegetation management, disturbance monitoring and the new IBR requirements all show the loop at work. Not every event changes a standard, but every standard change starts with events someone reported and analyzed well.

6 Disturbance Reporting, Enforcement Exposure, and Risk Posture

A disturbance report adds a layer of transparency to your compliance posture. What started as an account of an event becomes an official record the regulator can read, compare, and act on.

6.1 What an EOP-004 Violation Looks Like

The EOP-004 violation itself is usually about process: no Operating Plan, an event type missing from the plan, a report filed late, or a required recipient left off. The Violation Severity Levels make the scale explicit. For R2, up to 24 hours late is Lower, more than 24 and up to 48 hours is Moderate, more than 48 and up to 72 hours is High, and more than 72 hours or no report at all is Severe.

That's the small exposure. The larger exposure is what the report reveals.

6.2 The Cross-Standard Exposure

An event that unfolded exactly as designed, with every control in place, may produce little more than questions. An event analysis that documents weak work practices, outdated procedures or bad models can reveal violations of standards well beyond EOP-004. Communication failures, modeling errors and missing data are all candidates. In practice, the report becomes a cross-reference to every standard family the event touched.

This creates a real tension. An honest analysis may surface compliance issues. A defensive one may avoid them for a while. The reliability regime depends on the honest one.

6.3 How Conduct Is Weighed

When a violation is found, the NERC Sanction Guidelines (Appendix 4B) require NERC or the Regional Entity to consider, at a minimum, these adjustment factors: repetitive violations and compliance history; failure to comply with a Remedial Action Directive; intentional violations; any attempt to conceal the violation or resist, impede or fail to cooperate; management involvement in an intentional violation or concealment; the presence and quality of the entity's compliance program; the degree and quality of cooperation; and self-reporting and voluntary mitigation.

Read that list against your event reporting program. Concealment and lack of cooperation are aggravating. Cooperation, an effective internal compliance program and self-reporting are mitigating. A timely, candid, well-analyzed report with corrective actions already moving is the posture those factors reward. Repeated events of the same type, on the other hand, build exactly the compliance history the guidelines tell enforcement staff to weigh.

6.4 Operations, Compliance, Engineering and Leadership

Major events need operations, compliance, engineering and executive oversight working from the same facts. When those groups don't communicate, the reliability risk and the enforcement risk both go up. As systems grow more complex, with more inverter-based resources, more controls and more automation, events increasingly cut across generation, transmission and control systems, and so does the exposure.

Reliability isn't perfection. It's good governance, sound engineering analysis and corrective actions that match the cause. Disturbance reporting is where an auditor gets to see whether you have all three.

End-of-Chapter Summary

The EOP-004 violation is usually a process failure with severity scaled by lateness. The bigger exposure is what the analysis reveals about other standards. The Sanction Guidelines reward cooperation, effective compliance programs and self-reporting, and they penalize concealment and repetition. Candor is the cheapest risk control you have.

7 Interconnection-Wide Learning and Public Disturbance Analysis

EOP-004 holds an individual entity accountable for reporting. The larger value of the system is what the ERO and the Regions learn by putting many reports side by side. A condition that caused trouble at one facility probably exists at similar facilities somewhere else.

7.1 Reconstruction and Publication

Major event reviews pull together data from many sources, including relay records, SCADA, PMUs and operator logs, to reconstruct a sequence of events across organizational boundaries. They examine protection performance, voltage and frequency behavior and control interactions. Public disturbance reports then put the findings on the record. Publication does several jobs: it preserves institutional memory past staff turnover, feeds the standards discussion, and shows the public that significant events are not hidden.

The EAP's lessons learned step is the routine version of the same thing. Registered entities draft proposed lessons learned, Regional Entities and technical groups review them, and NERC posts them. Lessons learned are meant to be detailed enough to help others without disclosing confidential data.

7.2 Confidentiality

Participating in the process does not mean publishing your secrets. Under the EAP, information an entity designates as confidential is treated as confidential, and Critical Energy Infrastructure Information is handled as CEII. U.S. entities should understand one condition, though: by participating, they acknowledge that brief reports and EARs may be disseminated to an Applicable Governmental Authority on request under Section 1500 of the Rules of Procedure. Write accordingly.

7.3 Comparable Data

Interconnection-wide learning only works if reports can be compared: common criteria for when to report, common documentation, and analysis disciplined enough that the cause codes mean something. The Reliability Coordinator's wide-area view matters here, as does close coordination with Transmission Operators, Balancing Authorities and Generator Operators to reconstruct events accurately.

High-resolution data has changed what analysis can see. PMU and digital fault recorder data now support detailed study of oscillations, frequency excursions and voltage behavior, and they can confirm or break the assumptions in planning and operating studies. IBR events make the point sharply: ride-through and control interaction analysis needs both physical data and knowledge of the control behavior.

7.4 Learning, Not Blame

Public disturbance analyses focus on system behavior and the conditions that allowed it, not on individual culpability. That approach supports open discussion and is the premise of the whole learning culture. It doesn't erase enforcement. It does mean the best thing you can contribute to an event review is accurate, complete data and an honest account of what happened.

End-of-Chapter Summary

The ERO's analysis turns individual reports into interconnection-wide knowledge: reconstructed events, published findings, lessons learned and cause-code trends. Confidential information is protected, but it can reach governmental authorities on request. The quality of the shared record depends on the quality of each entity's data and candor.

Glossary

Term	Meaning in this paper
Balancing Authority (BA)	The responsible entity that integrates resource plans ahead of time, maintains Demand and resource balance within a Balancing Authority Area, and supports Interconnection frequency in real time. (NERC Glossary)
BES Emergency	Any abnormal system condition that requires automatic or immediate manual action to prevent or limit the failure of transmission facilities or generation supply that could adversely affect the reliability of the Bulk Electric System. (NERC Glossary, "Emergency or BES Emergency")
Brief Report	The report a registered entity submits to its Regional Entity for a qualifying event under the ERO Event Analysis Process.
Bulk Electric System (BES)	Unless modified by the Glossary's inclusions and exclusions, all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. It does not include facilities used in the local distribution of electric energy. (NERC Glossary)
Cascading	The uncontrolled successive loss of System Elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies. (NERC Glossary)
Compliance Investigation	A CMEP compliance monitoring process that the Compliance Enforcement Authority may initiate at any time, including in response to a system disturbance. (ROP Appendix 4C, Section 4.4)
Compliance Monitoring and Enforcement Program (CMEP)	The program, set out in Appendix 4C to the NERC Rules of Procedure, that NERC and the Regional Entities use to monitor, assess and enforce compliance with Reliability Standards.
Corrective Action Plan (CAP)	A list of actions and an associated timetable for implementation to remedy a specific problem. (NERC Glossary)
DOE-417	The U.S. Department of Energy's Electric Emergency Incident and Disturbance Report, mandatory for specified respondents under Section 13(b) of the Federal Energy Administration Act of 1974, and accepted by the ERO in lieu of the EOP-004 form when required.
Electric Reliability Organization (ERO)	The organization FERC certifies under FPA Section 215 to establish and enforce Reliability Standards for the Bulk-Power System. FERC certified NERC as the ERO on July 20, 2006.
ERO Event Analysis Process (EAP)	NERC's guideline process, grounded in Rules of Procedure Section 800, for categorizing, analyzing and sharing lessons from Bulk Electric System events. Version 5.0 took effect January 1, 2024.

Term	Meaning in this paper
Event Analysis Report (EAR)	The detailed EAP report covering the sequence of events, causal factors and corrective actions. Required for Category 3 events and available on request for others.
Firm Demand	That portion of the Demand that a power supplier is obligated to provide except when system reliability is threatened or during emergency conditions. (NERC Glossary)
Generator Operator (GOP)	The entity that operates generating Facilities and supplies energy and Interconnected Operations Services (Category 1 GOP), or operates qualifying non-BES Inverter-Based Resources of 20 MVA or more aggregate nameplate connected at 60 kV or higher (Category 2 GOP). (NERC Glossary, summarized)
Interconnection	When capitalized, any one of the four major electric system networks in North America: Eastern, Western, ERCOT and Quebec. (NERC Glossary)
Inverter-Based Resource (IBR)	A plant or facility of devices that export Real Power through a power electronic interface, such as an inverter or converter, operated together as a single resource at a common point of interconnection. Examples include solar PV, Type 3 and Type 4 wind, battery storage and fuel cells. (NERC Glossary, summarized)
Misoperation	The failure of a Composite Protection System to operate as intended for protection purposes. The Glossary lists the specific types, including failure to trip, slow trip and unnecessary trip. (NERC Glossary, summarized)
Operating Plan	A document that identifies a group of activities that may be used to achieve some goal. An Operating Plan may contain Operating Procedures and Operating Processes. (NERC Glossary)
Protection System	Protective relays that respond to electrical quantities; communications systems necessary for correct operation of protective functions; voltage and current sensing devices providing inputs to protective relays; station dc supply associated with protective functions; and control circuitry associated with protective functions through the trip coils of the circuit breakers or other interrupting devices. (NERC Glossary)
Regional Entity	An entity with authority delegated by the ERO under FPA Section 215(e)(4) to propose and enforce Reliability Standards in its region. There are six: MRO, NPCC, ReliabilityFirst, SERC, Texas RE and WECC.
Reliability Coordinator (RC)	The entity that is the highest level of authority responsible for the Reliable Operation of the Bulk Electric System, with the Wide Area view and the operating tools, processes and procedures to prevent or mitigate emergency operating situations. (NERC Glossary, summarized)
Reliability Standard	A requirement, approved by FERC under Section 215 of the Federal Power Act, or approved or recognized by an applicable governmental authority in other jurisdictions, to provide for Reliable Operation of the Bulk-Power System. (NERC Glossary)

Term	Meaning in this paper
Root cause	In this paper, the most basic condition or set of conditions which, if corrected, would prevent recurrence of the event or a similar one. Not a NERC Glossary term.
Section 215	The section of the Federal Power Act, added by the Energy Policy Act of 2005, that establishes mandatory and enforceable Reliability Standards for the Bulk-Power System.
System separation (islanding)	In EOP-004, each separation resulting in an island of 100 MW or more, reportable by the RC, BA or TOP.
Transmission Operator (TOP)	The entity responsible for the reliability of its local transmission system, and that operates or directs the operations of the transmission Facilities. (NERC Glossary)

How Energy Compliance Can Help

Most event reporting problems are visible before the event: an Operating Plan that doesn't match the registrations, a DOE-417 workflow nobody has rehearsed, a PRC-030-1 detection process that exists on paper only, or a plant that can't produce high-resolution data when the Regional Entity asks. That's where we work.

Event reporting program review. We review your EOP-004 Operating Plan against your registrations, Attachment 1 and the EOP-004-5 changes coming October 1, 2027, map each event type to DOE-417, CIP-008 and EAP obligations, and test the workflow with your operators. This is compliance program design and improvement applied to one of the most time-sensitive standards you own.

Post-event data request strategy. When a disturbance produces Regional Entity or NERC data requests, or an EAP Brief Report or EAR, we help you scope the response, preserve the evidence, and make sure the cause analysis and corrective actions hold together.

Audit and enforcement support. If an event has opened a Compliance Investigation, or a late or missing report has become a potential violation, we bring regulator-side experience to mitigation planning, Self-Report development and settlement posture.

WattOps Compliance. WattOps is EC's NERC compliance evidence platform, at wattopscompliance.com. Event reporting lives or dies on dated evidence: the plan version in force, the time of recognition, the time of submittal. We will run one standard at one facility through WattOps at no cost, CIP standards excluded. EOP-004 or PRC-004 is a good place to start.

RenewOps. RenewOps is EC's renewable operations monitoring and analytics platform, with a Data Center module. For solar, wind and storage owners facing PRC-030-1 and the EOP-004-5 IBR criterion, the first question after a disturbance is what the plant actually did. Ask us how RenewOps fits your fleet.

If any of this sounds like your program, call before the next event, not after it.

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About the Author

Rob Smith is the Founder and Principal of Energy Compliance, Inc., with more than thirty years in the industry on every side of the system. He began in control-room operations as a Reliability Coordinator, Transmission Operator, and Power System Operator across RTO/ISO and utility control centers. On the regulator side, he was a senior compliance auditor and subject matter expert for NERC Reliability Standards. He audited grid facilities, evaluated mitigation adequacy, participated in risk-based oversight of utility mitigation activities, and supported the development of violation notifications and settlements in FERC-directed enforcement actions. He conducted a regulatory audit in the Sultanate of Oman against the Sultanate's Sector Law and Grid Code.

He founded Energy Compliance, Inc. to deliver senior regulator-side compliance authority without the layered staffing and billable-hour overhead of larger firms.

Education:

- MBA, Energy Management, University of Mary
- MSL, Compliance Law, Fordham Law University
- BAS, Energy Management, Bismarck State College
- BAS, Mechanical Engineering, Metallurgy minor, University of Florida
- BAS, Criminology, St. Petersburg College (State Law Enforcement Certification)
- AAS, Power Plant Technology, Bismarck State College
- AAS, Electrical Transmission System Technology, Bismarck State College

Certifications: NERC Lead Auditor training; previously NERC-certified at the Reliability Coordinator level; 1st Class A Boiler Engineer License, Minnesota.

About Energy Compliance, Inc.

Energy Compliance, Inc. is an independent consulting and advisory firm based in Bloomington, Minnesota, focused exclusively on electric reliability, cybersecurity reliability, and regulatory compliance for organizations connected to the North American Bulk Electric System.

Our work supports registered entities, including Generator Owners and Operators, Transmission Owners and Operators, Reliability Coordinators, Balancing Authorities, and Distribution Providers. We work across NERC Reliability Standards, FERC orders, RTO/ISO market participation rules, Regional Entity oversight, and state regulatory frameworks.

We do this work differently than larger consulting firms. Engagements are overseen by a senior practitioner with regulator-side experience. We don't staff for billable hours. We staff for outcomes. Our deliverables are written to be operationally executable and audit-defensible, not to manufacture activity. Where automation can replace manual work, we build the automation. Where senior judgment is required, the senior is in the room.

Services Provided

Our services are written to be clearly defensible: operationally executable in real time, and audit-defensible at compliance review. Every deliverable is structured for the auditor's question, not the consultant's binder.

Energy Compliance services include, but are not limited to:

- NERC reliability and compliance advisory support

- Reliability governance and program assessments
- Registration and applicability analysis
- Operational and engineering reliability alignment
- Compliance program design and improvement
- Audit and enforcement support (non-advocacy)
- Mitigation planning and Self-Report development
- Training and executive briefings on reliability frameworks
- Regulator-perspective program reviews

We also offer:

- **NERC Compliance.** Program support, interpretation, and audit preparation.
- **Senior Advisory.** Direct engagement on complex reliability questions.
- **Industry Engagement.** Standards development and working-group participation.
- **Audit Defense.** Notice of Penalty response and settlement posture.

Each engagement is scoped to the entity's role, function, and bulk system impact.

Energy Compliance is not affiliated with, sponsored by, or endorsed by the North American Electric Reliability Corporation, the Federal Energy Regulatory Commission, or any Regional Entity.

Learn more at energycomplianceinc.com.

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