

Rev. 1
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PJM and Transmission Owners
Event Investigation Program Document

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POLICY STATEMENT

The Transmission Owning members of PJM and PJM are committed to preserving the reliability of PJM monitored transmission facilities. Part of that commitment is to analyze system events or problems for the purpose of learning from the events, implementing corrective actions and sharing knowledge to improving operations at PJM and Transmission Owning companies.

PJM Transmission Owners and PJM are committed to implementing a process to investigate events or near-miss events that resulted in reliability problems and to providing the resources necessary for a robust process.

Features of the event investigation process should include:

1. Starting with everything on the table at the beginning of the investigation, nothing should be initially ruled out or excluded from the investigation process.
2. Performing a thorough analysis of all systems, human performance, work processes, materials, environmental conditions, physical plant and management systems both individually and collectively, that contributed to the event.
3. Learning as much about the event as possible with the goal of improving the operation of the transmission system, not punishing the involved parties.
4. Use of a structured Root Cause methodology to ensure accurate and thorough determination of root causes, contributing factors and corrective actions.
5. Investigation of “near miss” events. Learning captured from “near miss” events can be just as valuable as those of actual events.
6. The parties involved in the event should participate in the investigation. The investigation team leader should not have been directly involved in the actual event and should be approved by the leadership of participating organizations. Consideration should be given to using resources from an organization not involved in the event or an outside consultant if needed.
7. Allowance for timely delivery of initial/preliminary findings to implement interim stop gap or safeguard measures as immediate corrective actions, if necessary.
8. A challenge or critical review of findings and recommended corrective actions before finalization of the investigation.
9. Assurance that corrective actions are completed.
10. Dissemination of learning to PJM and all Transmission Owners.
11. A post implementation effectiveness review of corrective actions to ensure corrective actions actually solved the problem.

PJM and the Transmission Owners are not formally bound to participate the Event Investigation Process and by participating, are not prevented from taking any action they determine necessary in the course of event investigation activities. The Event Investigation Process should be suspended where investigation of an event by the

North American Electric Reliability Council (NERC) or other organizations would cause duplication of effort or confusion.

SIMPLIFIED EVENT INVESTIGATION PROCESS STEPS

Step	Activity	Responsibility
1	Event Identification, Classification and Fact Finding	PJM and Transmission Owner Officers (or designee)
2	Determination of Investigative Action	PJM and Transmission Owners through the PJM System Operations Subcommittee (Transmission)
3	Establishment of Investigation Ownership	PJM and Involved Transmission Owner(s)
4	Launch of RCA Team	Investigation Owner
5	Execution of RCA	RCA Investigation Leader
6	RCA Challenge Review and Solicitation of Comments	Investigation Owner
7	Publishing of RCA and ACA reports to PJM and Transmission Owners	Investigation Owner
8	Follow-up of corrective actions/notification of completion	Investigation Owner
9	Event Investigation Program Oversight	PJM System Operations Subcommittee (Transmission)

PROCEDURE

1 **PURPOSE**

- 1.1 The purpose of this document is to provide guidance, instruction and clarify roles and responsibilities for PJM and Transmission Owners to initiate and perform event investigations of operational events on PJM monitored transmission facilities, including but not limited to completion of a formal Root Cause Analysis of events by PJM and/or a combination of PJM Transmission Owners.

2 **DEFINITIONS**

- 2.1 PJM – PJM Interconnection, LLC
- 2.2 Transmission Owner(s) – Transmission owning company or companies of PJM as specified in the PJM Transmission Owners Agreement (TOA).
- 2.3 PJM or Transmission Owner Officer – A company officer or designee with responsibility for the operation of their respective transmission system with authority to execute the responsibilities of and commit resources to execution of the PJM Transmission Owners Event Investigation Process.
- 2.4 PJM and Involved Transmission Owner Officer(s) – Transmission Owner Officers with personnel or equipment directly or substantively involved in an operating event on PJM monitored transmission facilities.
- 2.5 Apparent Cause Analysis (ACA) – a systematic gathering and reporting of information in a report format that separates and clarifies the facts regarding the description of an event, the apparent causes of the event and corresponding corrective actions in order to reasonably prevent or mitigate recurrence.
- 2.6 Root Cause Analysis (RCA) – A systematic methodology for performing analysis of operational events to determine root cause(s) and contributing factors that led to an event and corrective actions to preclude recurrence of the event or similar events.
- 2.7 Investigation Owner – PJM or a Transmission Owner that takes responsibility for leadership of the execution of an ACA or RCA investigation. The Investigation Owner is responsible for establishing the

investigation team, timely completion of the investigation and acceptance of the corrective actions.

- 2.8 Investigation Team Leader – Individual designated by PJM or a Transmission Owner to provide leadership and guidance to a team of personnel executing a RCA.
- 2.9 PJM System Operations Subcommittee (Transmission) – A subcommittee of the PJM Operating Committee that provides oversight of the Event Investigation Process.

3 **SCOPE**

- 3.1 Events intended to be included in the scope of the Event Investigation Process include events on the transmission system that result in significant reliability problems, violations of reliability criteria or standards, including near-miss situations or situations where operational conditions of the system are not well understood or explained by PJM or Transmission Owner system operators. Events listed below should initiate the event investigation process:
 - 3.1.1 Violations to a NERC Operational Standard that are reportable to NERC or applicable regional compliance process: Examples:
 - a. Actual overloads which result in a reportable interconnection reliability operational limit (IROL) violation.
 - b. Near-miss events that could have resulted in an IROL violation.
 - 3.1.2 Submittal of a DOE EIA-417 form or a report to NERC in accordance with the NERC disturbance-reporting standard: EOP-004-0.
 - 3.1.3 Nuclear power plant tripping or operational problem, reported to PJM and/or the NRC where PJM and/or Transmission Owner equipment did not operate as intended or within a nominal range and may have been the cause or a contributing factor.
 - 3.1.4 Events, due to their impact or severity, are attracting widespread public media coverage.
 - 3.1.5 Events involving multiple transmission facility tripping, where the cause cannot be immediately explained or that may have involved personnel error.

- 3.2 Events intended to be **excluded** from the scope of the Event Investigation Process include events:
 - 3.2.1 Occurring due to weather or other acts of nature or where equipment operated as intended or within a nominal range of what is expected.
 - 3.2.2 Occurring on sub-transmission or distribution systems, assuming no impact on the transmission system.
 - 3.2.3 Involving generator owned and operated equipment where PJM and Transmission Owner equipment operated as intended or within a nominal range of what is expected.
 - 3.2.4 Originating outside the transmission system where PJM and Transmission Owner equipment operated as intended or within a nominal range of what is expected.
 - 3.2.5 Where the event results in purely economic consequences and the reliability of the transmission system is not challenged or compromised.
 - 3.2.6 Where the event is limited to the complete failure of or mis-operation of a single transmission system component and otherwise transmission system equipment operated as intended or within a nominal range of what is expected and did not contribute to significant reliability problems or violations of reliability criteria or standards.
 - 3.2.7 Should an event occur that challenges system reliability and it is anticipated that the event is likely to end up in litigation; PJM and the Transmission Owners should contact their respective legal counsel to obtain legal advice about the investigation.

4 **RESPONSIBILITIES**

- 4.1 General Responsibilities of PJM and Transmission Owners
 - 4.1.1 Monitor transmission system operations and initiate discussions with PJM and other transmission owners to determine appropriate actions to system events.
 - 4.1.2 Serve as the Investigation Owner when necessary. Remain prepared to supply an Investigation Team Leader, team members and /or expert resource personnel trained in a formal RCA process in order to support execution of a RCA.

5 **INVESTIGATION PROCESS**

5.1 Step 1 – Event Identification, Classification and Fact Finding

5.1.1 PJM and Transmission Owners monitor system operations and identify, record and report events covered or potentially covered by the Event Investigation Process scope.

5.1.2 PJM and/or Transmission Owner Officers direct the preliminary gathering of facts and information as necessary to provide a succinct description of the event, its extent and consequences in preparation for a conference call briefing with PJM and Involved Transmission Owners within 24-48 hours or two (2) business days.

5.2 Step 2 - Determination of Investigative Action

5.2.1 Upon identification or notification of an event, PJM will schedule a conference call of the System Operations Subcommittee (Transmission) for the purpose of deciding if the event falls within the scope of the Event Investigation Process and to specify the level of action as outlined below:

Level	Definition	Use when:
I	No Action	<ul style="list-style-type: none"> • The consequences of a repeat of a similar type event are acceptable. • Information brought to light during the conference call adequately explains the cause of the events. • Corrective actions are either not needed or appear simple and obvious. • There appears to be little or no opportunity to learn from the event.
II	Apparent Cause Analysis (ACA)	<ul style="list-style-type: none"> • The consequences of a repeat of a similar type event are acceptable. • The cause of the event is not clear or there is disagreement on the causes. Further investigation is required. • Corrective actions are not obvious. Further investigation is required. • There appears to be opportunity for learning from the event.
III	Root Cause Investigation (RCA)	<ul style="list-style-type: none"> • The consequences of the event or a repeat of a similar type event are unacceptable. • A pattern of repeat (or similar) events has emerged. • A comprehensive, “best effort” investigation to assure identification of root causes and effective corrective actions to prevent recurrence is required.

5.2.2

he event classification results in initiation of an Apparent Cause Analysis (ACA) or a Root Cause Analysis (RCA), **then**, proceed to Step 5.3

- 5.3 Step 3 - Establishment of Investigation Owner
 - 5.3.1 PJM and Involved Transmission Owner Officers shall select either PJM or a Transmission Owner to be the Investigation Owner and serve as the primary sponsor for completion of the ACA or RCA.
- 5.4 Step 4 – Launch of Investigation Team
 - 5.4.1 The Investigation Owner for an ACA investigation shall obtain and distribute the names of PJM and Involved Transmission Owner investigation participants.
 - 5.4.2 The Investigation Owner shall complete the investigation and report results using the ACA investigation form (Attachment 6.1) to the PJM and Involved Transmission Owners via conference call within 30 business days.
 - 5.4.3 The Investigation Owner for a RCA investigation shall schedule an in-person kick-off meeting for the RCA Team that includes PJM and Involved Transmission Owner Officers, the Investigation Team Leader, team members and any external expert resources supporting the RCA. Attachment 6.2 provides a checklist as an aid for initiating the RCA.
 - 5.4.4 The RCA kick-off meeting shall cover topics required to support the work of the RCA team and clarify management expectations, including: management sponsorship, resources available to the team, time commitment of participants, access to information from PJM and Transmission Owners, expectations for the thoroughness of the investigation, timelines for completion of activities and confidentiality of information.
 - 5.4.5 The RCA investigation leader and team members shall submit a team charter to PJM and the Involved Transmission Owners. The charter will outline the problem statement and scope of the investigation and estimated schedule milestones for completion of the RCA through and including Step 6 of the Event Investigation Process - RCA Challenge Review and Solicitation of Comments. The charter should be changed/updated as needed through the course of the investigation. The Investigation Owner should approve changes.
- 5.5 Step 5 – Execution of RCA
 - 5.5.1 The RCA Investigation Leader, in concert with any internal or external RCA expert resources provided, shall conduct the RCA utilizing a RCA methodology and guidelines cited in Attachment 6.3 or equivalent process.

- 5.5.2 Information gathered from individual interviews and documents relating to the personal performance of specific individuals involved in the event investigation shall remain confidential. Access to this information is to be limited to the investigation team and PJM and Involved Transmission Owner Officers unless required by other legal or regulatory proceedings

- 5.6 Step 6 – RCA Challenge Review and Solicitation of Comments
 - 5.6.1 Upon completion of the RCA, the RCA Investigation Owner and RCA Investigation Leader shall sponsor a RCA Challenge Review Meeting. The purpose of the Challenge Review Meeting is to provide a critical review of root cause determinations, contributing factors and proposed corrective actions. Participants in the Challenge Review Meeting shall include PJM and Involved Transmission Owners, the RCA Investigation Leader and Team members and other organizational entities that may be affected by the implementation of corrective actions. At the discretion of the Investigation Owner, other uninvolved Transmission Owners may be invited in order to provide an impartial and objective perspective to the challenge review. The Challenge Board chairperson may be the Investigation Owner or another agreed upon executive. Review and acceptance of proposed corrective actions by all affected parties should be obtained prior to the challenge meeting. Challenge board approval of conclusions and corrective actions should constitute final approval of the report unless otherwise directed by the chairperson.

- 5.7 Step 7 - Publishing of Investigations to PJM and Transmission Owners
 - 5.7.1 For RCA Investigations - Upon completion of actions resulting from the Challenge Review Meeting the RCA Investigation Leader shall distribute the final report to the Transmission Owners. . The report shall be marked confidential and PJM and all Transmission Owners shall treat the report as confidential information.
 - 5.7.2 For ACA Investigations – Upon review and approval of the investigation results by PJM and Involved Transmission Owners, the investigation shall be marked as confidential and distributed to PJM and all Transmission Owners. PJM and Transmission Owners shall treat the report as confidential information.

- 5.8 Step 8 - Corrective Action Follow-up and Notification of Completion
 - 5.8.1 The Investigation Owner shall monitor completion of corrective actions and notify PJM and the Transmission Owners when completion of all corrective actions has occurred.

- 5.8.2 PJM and Involved Transmission Owners shall retain copies of investigation reports.
- 5.8.3 An effectiveness review of corrective actions shall be performed within 18 months of RCA completion.
- 5.9 Step 9 Event Investigation Program Oversight
 - 5.9.1 PJM shall maintain a record of events, conference calls for evaluating events for investigative action, decisions made and the status of current and ongoing RCA or ACA investigations. The record shall be included in the standard agenda of the PJM System Operations Subcommittee (Transmission) in order to provide guidance on the type of events that should be investigated and the type of investigations that are appropriate as well as for general review, evaluation and oversight of the program by the Committee.

6 **ATTACHMENTS**

- 6.1 ACA Investigation Form
- 6.2 RCA Investigation Owner Implementation Checklist
- 6.3 Guidelines for Selecting and Using Root Cause Analysis Methodologies

Attachment 6.1

ACA INVESTIGATION FORM

Apparent Cause Analysis (ACA) Investigation Report

.
DATE OF INCIDENT xx/xx/xxxx

.
TITLE: The title should identify the equipment, behavior or process affected and what the incident or problem was. Also include the location of the incident.

.
REPORT BY:

Name of the Investigation Team Leader

.
APPROVED BY:

Investigation Owner

.
DATE APPROVED: xx/xx/xxxx

INVESTIGATION PARTICIPANTS:

List additional names of team members or persons that had input into the investigation (e.g. subject matter experts, supervisors, etc).

EXECUTIVE SUMMARY:

Summarize with a single length paragraph containing a brief synopsis of the event. Including significant consequences (injuries, damaged equipment, outages). Also, summarize the notable causes and corrective actions.

.
EVENT DESCRIPTION:

Identify what happened and how it was discovered. Identify procedures, activities or processes involved. If this was a repeat event identify it as such and how it differed from previous events. Parties involved should also be identified (Do not use names - use titles or positions...customers, others). Include actual and/or potential consequences.

ANALYSIS METHODOLOGY:

Identify what approach, analysis, and/or resources were used to reach the cause conclusions (e.g., change analysis, barrier analysis, interviews, etc.). If there was an equipment failure, include the failure mode (i.e. how it happened).

CAUSES:

In a brief synopsis: Identify the end result of the investigation. Record any actions, conditions or events that caused the incident. List any equipment, behavioral or procedural problems identified in the investigation. The causes should be identified by asking “why” to the point where the cause, if prevented would have prevented or mitigated the consequences of this or a similar incident.

CORRECTIVE ACTIONS (WITH NAME AND DUE OR COMPLETED DATE):

List any corrective actions completed or planned. List an owner by name and due date for each corrective action. List the date completed for those already taken. Corrective actions must have owner acceptance before capturing them in this report.

- A. XXXXXXXXXXXXXXXXXXXXXXXX
Owner (name): nnnnnnnn Due Date: dd/dd/yyyy
- .
- B. XXXXXXXXXXXXXXXXXXXXXXXX
Owner (name): nnnnnnnn Due Date: dd/dd/yyyy

Confidential Information to PJM and PJM Transmission Owners

Attachment 6.2

RCA EVENT OWNER IMPLEMENTATION CHECKLIST

- ❑ Confirm agreement and sponsorship of PJM and other Involved Transmission Owner Officers.
- ❑ Select an Investigation Leader for the RCA and brief the leader.
- ❑ Request RCA team members from PJM and any other Involved Transmission Owners.
- ❑ If the team leader does not have experience or expertise in performing a RCA, provide the team leader a qualified internal or external expert resource.
- ❑ Schedule the in-person kick-off meeting – include, sponsors, team leader & members, expert resources.
- ❑ Review and approve/amend the team charter document with PJM and Involved Transmission Owner Officers.
- ❑ Schedule the Challenge Review Meeting.
- ❑ Distribute investigation report.
- ❑ Notify PJM and Involved Transmission Owner Officers of completion of all corrective actions.

Attachment 6.3

**GUIDELINES FOR SELECTING AND USING ROOT CAUSE ANALYSIS
METHODOLOGIES**

Overall Guideline: A good Root Cause Analysis should be thorough, fair and efficient.

1. A thorough root cause analysis will generally identify more than one root cause.
2. There are a wide variety of analytical methods and expert systems available to assist in performing a RCA. Thoroughly describe the methods and systems used by the team for examination by readers and reviewers.
3. To improve the RCA team's efficiency, use risk assessment to scale analysis efforts.
4. If possible, use a skilled, independent facilitator.
5. Use subject matter experts to provide the needed information, but use an independent facilitator and objective team members to prevent bias from controlling the direction of the investigation.
6. Document in detail the procedures used to do the RCA. The documentation should include details on how information was gathered, requirements for training, team membership, analytical tools, issues investigated, report format, due date, and review responsibilities.
7. Value and practice independence throughout the process.
8. Do not automatically assume that each RCA is unique. Thoroughly search historical records (inside and outside of the event or problem area) for precursors or related data, especially for establishing the context or that would establish a pattern of similar failures across the industry. Be open to generic issues.
9. In some cases, it may be necessary to use multiple RCA methods.
10. Use Root Cause Analysis methods that have a systematic repeatable methodology.
11. Before identifying individual faults and assigning individual responsibility, look for systemic root causes. For example: weaknesses in policies, procedures, monitoring or supervision would be systemic. For repeat occurrences, determine why the previous corrective actions did not work or consider the possible deficiencies in the corrective action program as contributors to the repeat occurrence. For repeat occurrences, determine why the previous corrective actions did not work or consider the possible deficiencies in the corrective action program as contributors to the repeat occurrence.
12. Discourage the "you found it, you fix it" philosophy when it comes to the corrective action program.
13. Thoroughly detail and support all causes and contributors.
14. Maximize learning from the RCA process.

Commonly Used RCA Analytical Methods:

- 1.) Event and Causal Factor Analysis
- 2.) Change Analysis
- 3.) Barrier Analysis
- 4.) Task Analysis
- 5.) Five Why's; Seven Why's
- 6.) Problem Solving/Decision Making
- 7.) Management Oversight and Risk Tree (MORT)

Commercially Available RCA Processes:

- 1.) Tap Root
- 2.) REASONS
- 3.) Sigma XL

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