

NUCLEAR GENERATION GROUP

STANDARD PROCEDURE

VOLUME 99

BOOK/PART 99

**CAP-NGGC-0205**

***SIGNIFICANT ADVERSE CONDITION INVESTIGATIONS AND  
ADVERSE CONDITION INVESTIGATIONS-INCREASED RIGOR***

REVISION 9



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## **1.0 PURPOSE**

- 1.1 This procedure provides guidance to effectively conduct a structured Significant Adverse Condition Investigation, identify cause(s), develop appropriate corrective action(s), and prepare a Significant Adverse Condition Investigation report.
- 1.2 This procedure also provides guidance to effectively conduct an Adverse Condition Investigation – Increased Rigor, identify cause(s), develop appropriate corrective action(s), and prepare an Adverse Condition Investigation – Increased Rigor report.
- 1.3 This procedure supplements CAP-NGGC-0200, Corrective Action Program, which describes program requirements regarding Significant Adverse Conditions and Adverse Conditions that require increased rigor.

## **2.0 REFERENCES**

### **2.1 Developmental**

- 2.1.1 Title 10, Code of Federal Regulations Part 50 (10CFR50), Appendix B, Criterion XVI
- 2.1.2 INPO 05-005, Performance Objectives and Criteria
- 2.1.3 INPO OE-907, INPO Good Practice-Root Cause Analysis
- 2.1.4 INPO Principles for Effective Self Assessment and Corrective Action Programs
- 2.1.5 BNP Updated FSAR Chapter 17, HNP FSAR Chapter 17, RNP Updated FSAR Chapter 17, CR3 FSAR Section 1.7
- 2.1.6 NGGD-1400, Self Evaluation Program
- 2.1.7 NUREG-1022, Event Reporting Guidelines 10CFR50.72 and 50.73
- 2.1.8 RNP LER 94-003
- 2.1.9 NGG and Plant Procedure Writer's Guides (PRO-NGGC-0201, HNP: AP-005, BNP: 0AP-005, RNP: AP-007, CR-3; AI-402B)

### **2.2 Implementing**

- 2.2.1 CAP-NGGC-0200, Corrective Action Program
- 2.2.2 Plant Nuclear Safety Committee Procedures [0AI-09, Plant Nuclear Safety Committee Administration (BNP), AP-013, Plant Nuclear Safety Committee (HNP), PLP-001, Plant Nuclear Safety Committee (RNP), AI-301, Plant Nuclear Safety Committee Charter (CR3)

## **2.2 Implementing**

2.2.3 NGGS-REG-0006, Corporate Self Evaluation Review Board

2.2.4 CAP-NGGC-0206, Corrective Action Program Trending and Analysis

2.2.5 RIS 2006-13, Information on the Changes Made to the Reactor Oversight Process to More Fully Address Safety Culture

2.2.6 NRC Inspection Manual Chapter 0305, Operating Reactor Assessment Program

2.2.7 ADM-NGGC-0107, Equipment Reliability

2.2.8 CAPR NCR 00243389-09, Ineffective Implementation of CAP (BNP)

2.2.9 HUM-NGGC-0001, Human Performance Program

2.2.10 OPS-NGGC-1306, Reactivity Management Program

## **3.0 DEFINITIONS**

### **3.1 Action / Occurrence**

A human behavior, or equipment performance, that leads to an outcome. In the Corrective Action Program the outcome of interest is an Event.

### **3.2 Barrier**

An administrative or physical control intended to promote consistent performance by inhibiting an inappropriate act or equipment failure. A barrier can be administrative in the form of a procedure or other control documentation, or it can be a physical restraint such as lock or chain.

### **3.3 Barrier Analysis**

Investigative technique to identify the missing or ineffective administrative or physical controls that were intended to prevent an inappropriate action.

### **3.4 Causal Factor / Cause**

Any factor that initiates an event, contributes to its outcome, or exacerbates its consequences. The more thoroughly the causal factors for an event are understood, the more probable that action can be taken to both correct and prevent recurrence of the event. Several types of causal factors are specifically defined: Apparent Cause, Common Cause, Contributing Cause, and Root Cause.

### **3.4.1 Apparent Cause**

The most probable causal factor(s) for an Event based on information obtained from a limited investigation.

### **3.4.2 Common Cause**

The shared causal factor(s) that contributed to, or caused, a Trend of similar Events.

### **3.4.3 Contributing Cause**

A causal factor that did not produce the event, but did shape the outcome or exacerbate the consequences.

### **3.4.4 Root Cause**

The fundamental causal factor(s) that if corrected, will prevent recurrence of an Event.

### **3.4.5 Selected Cause**

The causal factor that most likely describes the root cause of the event, when the root cause cannot be explicitly determined.

## **3.5 Change Analysis**

Comparison of successful performance of an activity to unsuccessful performance of the same activity to determine potential differences in work environment, processes or equipment that may have affected successful completion of a task.

## **3.6 Common Cause Analysis (CCA)**

The systematic review and analysis of events that display one or more similar attributes for the purpose of determining if the identified patterns of similarity are the result of common causal factors; and thus warrants more comprehensive corrective action.

## **3.7 Corrective Action (CORR)**

An action to correct or fix an Adverse Condition, a Significant Adverse Condition, a Contributing Cause or the Apparent Cause of a condition.

## **3.8 Corrective Action to Prevent Recurrence (CAPR)**

An action to prevent recurrence of a Significant Adverse Condition by addressing the cause.

### **3.10. Critical Steps**

Steps, that when performed, are irrecoverable or irreversible and have the potential of direct impact on plant condition or safety.

### **3.11 Degradation Influence**

An adverse condition that when present, results in equipment susceptibility to a Degradation Mechanism. Degradation Influences include loss of lubrication, moisture intrusion, contamination, aging, excessive flow, excessive force, and high resistance.

### **3.12 Degradation Mechanism**

The process or physical phenomena involved in the Equipment Failure. Degradation Mechanisms either alter material dimensions (e.g., corrosion, wear, pitting, erosion, expansion, shrinkage, melting, yielding, fracture, cracking); or inhibit component operation: (i.e., moisture, blockage, sticking, etc.).

### **3.13 Equipment Failure**

Damage to or degradation of a System, Structure, or Component (SSC) that may cause or contribute to the Event.

### **3.14 Error Driver**

A mismatch between the performer's ability and the job conditions that causes reduced chance for success or increased probability for error.

### **3.15 Error-Likely Situation**

A condition characterized by factors that increase the potential for human error. This situation typically exists when the demands of the task exceed the capabilities of the individual or when work conditions exist that aggravate limitations of human nature.

### **3.16 Event**

The condition, or consequence, that is the focus of investigation.

#### **3.16.1 Repeat Event**

An Event that is produced as a result of the same causal factors that produced a similar Event for which Corrective Actions to Prevent Recurrence were implemented within the previous two years.

### **3.17 Event and Causal Factor (EC&F) Charting**

A combination of several techniques (event timeline, change analysis, barrier analysis) used to develop a graphical representation of the entire event, depicting a complete picture of the relationship between a specific event and its causes.

### **3.18 Event Timeline**

The sequential series of events leading to the terminal event, plotted on a timeline.

### **3.19 Extent of Cause**

The set of products, components, processes or persons that possess similar susceptibility to the identified causal factor(s).

### **3.20 Extent of Condition**

The set of products, components or processes that exhibit the same deficiency as the investigated condition.

### **3.21 Failure Mechanism**

An equipment performance shortfall that results from the Degradation Influence, and leads to the event (e.g., the regulator's diaphragm tore, the breaker's control power fuse blew).

### **3.22 Failure Mode**

The specific type or manner of failure exhibited by the subject equipment (e.g., failed to open, failed to close, failed to regulate flow, failed to energize).

### **3.23 Failure Mode Analysis**

A process used to determine the cause of equipment and system failures through analysis involving identification and evaluation of possible failure modes and scenarios, and elimination of non-relevant failure modes via a validation process using objective evidence.

### **3.24 Failure Scenario**

The sequence of actions, or occurrences, that leads to an equipment failure Event.

### **3.25 Human Performance**

The system of intentional and unintentional human behaviors and the influences leading to these behaviors that eventually manifests as "results" in the workplace.

### **3.26 Immediate Action**

Action implemented immediately upon discovering an event for the purpose of mitigating or terminating the consequences.

### **3.27 Inappropriate Act**

A human action (behavior), whether observable or not, that is inappropriate for a given situation and transforms normal performance into an undesirable result or Event.

### **3.28 Interim Action**

Action implemented to prevent the effects of a condition or reduce the risk of recurrence while awaiting implementation of Corrective Actions to Prevent Recurrence. Interim Corrective Action may include briefing personnel regarding the problem, or other temporary measures.

### **3.29 Latent Organizational or Programmatic Weakness**

An uncorrected deficiency in the organizational processes or values that has the effect of provoking human error or degrading the integrity of barriers.

### **3.30 Management Control System**

The collective set of standards, policies, strategies, values, expectations and controls used to direct every employee's behavior in a predictable fashion to accomplish the organization's mission.

### **3.31 Management Sponsor**

The Unit/Section Manager (or designee) assigned to provide management oversight of a Significant Adverse Condition Investigation.

### **R2.2.8 3.32 Quality Review Board (QRB)**

A management panel convened to provide review and approval of Significant Adverse Condition Investigations, Effectiveness Reviews and selected Adverse Condition Investigations.

### **R2.2.8 3.33 Root Cause Review Team (RCRT)**

A team facilitated by Self Evaluation Unit personnel that performs an informal review of a Significant Adverse Condition Investigation. This review is intended to ensure that CAP-NGGC-0205 procedure and investigative process requirements are met and to improve the quality to the highest degree possible prior to QRB review.

### **3.34 Safety Culture**

That assembly of characteristics and attributes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.

### **3.35 Safety Significance**

The relative importance of a problem determined by considering actual and potential impact on plant and personnel safety.

### **3.36 Significant Adverse Condition Investigator (Investigator)**

Each Priority 1 Significant Adverse Condition Investigation must have at least one individual on the team who has completed the applicable qualification process and is currently qualified (qual group GN32). The CR3 team leader must be qualified [NOCS 62610].

### **3.37 Significant Condition Adverse to Quality**

Failure, malfunction, deficiency, deviation, defective material and equipment, or non-conformance that adversely affects the safety related function(s) of a SSC or part deemed significant based on actual or potential consequences that adversely affect the safe operation of the facility, the health and safety of personnel or the public, or the environment. Therefore, these conditions are subject to the requirement of 10CFR50 Appendix B Criterion XVI to determine cause and take Corrective Action(s) to Prevent Recurrence.

### **3.38 Situational Awareness**

A general mindset towards work that is characterized by enhanced attention to detail and ongoing vigilance to anticipate possible error-likely situations and flawed defenses. Behaviors include:

- Monitoring personnel and conditions to identify undesirable situations
- Interpreting and anticipating error-likely situations and flawed defenses and deciding on changes to the work situation and/or contingency actions
- Intervening to execute necessary changes in the work situation to prevent existence of error-likely situations and flawed defenses.

### **3.39 Support / Refute Methodology**

A process for identifying the true equipment Failure Mode by organizing and analyzing facts to systematically eliminate possible failure modes until one or more failure modes cannot be refuted and are substantiated by the evidence.

### **3.40 Task Walkthrough**

Simulating task performance without actually performing the actions, or observing the task being performed.

## **4.0 RESPONSIBILITIES**

### **4.1 Management Sponsor**

- 4.1.1 Identify and assign a qualified Significant Adverse Condition Investigator.
- 4.1.2 Determine if a Significant Adverse Condition Investigation Team will be used.
- 4.1.3 When a Team is used, work with the (Lead) Significant Adverse Condition Investigator to identify and assign appropriate personnel to the Team.
- 4.1.4 As needed, communicate resource needs and obtain commitments from appropriate managers. Team members should be relieved of other duties as necessary to ensure appropriate focus on the Significant Adverse Condition Investigation and team participation.
- 4.1.5 Establish expectations with the (Lead) Significant Adverse Condition Investigator for investigation scope, milestones, and periodic briefings and approve the problem description statement.
- 4.1.6 Act as liaison between the investigation and other site management by briefing other management representatives as appropriate.
- 4.1.7 As necessary, communicate the need for additional immediate compensatory or corrective actions to appropriate personnel and ensure follow-through.
- 4.1.8 As necessary, communicate nuclear safety, personnel safety, operability, and regulatory issues to appropriate personnel.
- 4.1.9 Prior to approving the investigation assignment in Action Tracking, confirm adequacy and quality of the investigation and investigation report.
- 4.1.10 Present Significant Adverse Condition Investigation to the Quality Review Board (QRB).

### **4.2 Significant Adverse Condition Investigator**

- 4.2.1 When a Team is used, provide input to the Management Sponsor regarding needed organizational resources.
- 4.2.2 When a Team is used, establish (with Management Sponsor input if needed) work schedule expectations.
- 4.2.3 Conduct periodic briefings with Management Sponsor and other management representatives, as applicable.
- 4.2.4 Conduct investigation in accordance with this procedure.

## **4.2 Significant Adverse Condition Investigator**

- 4.2.5 Communicate recommendations for immediate and interim corrective actions to the Management Sponsor.
- 4.2.6 Communicate newly identified regulatory, operability, or plant/personnel safety issues to the Management Sponsor.
- 4.2.7 If a Team is used, provide direction and leadership, including conducting the Team kick-off meeting and requesting additional resources if needed.
- 4.2.8 Be directly accountable to the Management Sponsor during the period of the investigation.
- 4.2.9 Prepare the Significant Adverse Condition Investigation Report.

## **4.3 Significant Adverse Condition Investigation Team Members**

- 4.3.1 Provide technical expertise to aid the team in determining the scope of the problem, the cause of the problem, and potential solutions.
- 4.3.2 Ensure availability to the Team according to the established Team schedule and the discretion of the (Lead) Investigator.
- 4.3.3 Report directly to the (Lead) Investigator during the period of the investigation.

## **5.0 PREREQUISITES**

N/A

## **6.0 PRECAUTIONS AND LIMITATIONS**

The use of forms equivalent to those included as attachments to this procedure is acceptable if all required information is contained.

## **7.0 SPECIAL TOOLS AND EQUIPMENT**

N/A

## **8.0 ACCEPTANCE CRITERIA**

N/A

## 9.0 INSTRUCTIONS

**NOTE:** It is neither a procedural requirement nor a management expectation for every step to be performed for every Investigation, or for the steps to be performed in the sequence provided. The investigative process is iterative rather than sequential and the investigative tasks and level of effort must be tailored to the specific Event being investigated.

### 9.1 Performing a Priority 1 Significant Adverse Condition Investigation

#### Management Sponsor (or Plant General Manager)

##### 9.1.1 Assign Personnel to Perform the Investigation

- 9.1.1.1 Consider and document immediate corrective actions or compensatory measures taken to place the plant in a safe condition or to restore compliance.
- 9.1.1.2 Confirm qualification prior to assigning a Significant Adverse Condition Investigator.
- 9.1.1.3 Designate an Investigator.

#### Management Sponsor / Investigator

- 9.1.1.4 Concur regarding the investigative techniques, rigor, and depth needed to determine Cause and Corrective Action(s) to Prevent Recurrence.
  - If it is decided that the structured investigative techniques described in this procedure are not necessary to determine the Cause and Corrective Action(s) to Prevent Recurrence then proceed to step 9.1.6.4. The reasoning for this decision must be documented on Attachment 16, Significant Adverse Condition Investigation Report.

## 9.1.1 Assign Personnel to Perform the Investigation

**NOTE:** Training expertise should be used to analyze contributing causes of personnel performance problems to help identify and differentiate between training and non-training solutions. Training expertise may be part of the team or may be used to review data during key briefings.

**NOTE:** Consider whether the event involves equipment performance, training issues, human performance, or a trend, and apply appropriately trained and knowledgeable resources. Consideration should be given to the complexity of the event when selecting team members. More complex events may require members with more investigative experience.

### 9.1.1.5 For a Team investigation:

- Determine the personnel resources required for the Team. If sufficient expertise is not available on site, consider bringing in team members from other PGN plants, corporate, or from outside the company.
- Determine expectations for the Team's work schedule. Team members should be relieved of other duties as necessary to ensure appropriate focus on the Significant Adverse Condition Investigation and team participation
- Obtain the Team Members by contacting the appropriate unit / section managers.
- Conduct an Investigation kick-off meeting to address topics such as:
  - Team organizational structure and reporting relationships
  - Work schedule
  - Investigation scope, milestones and deliverables
  - Expected briefings to the Management Sponsor
  - Immediately communicating previously unidentified interim corrective actions
  - Immediately communicating previously unidentified concerns
  - Using and following established investigation methodologies
  - Initiating NCRs if additional adverse conditions are identified.

## Investigator / Investigation Team

### 9.1.2 Clarify the Event Description

- 9.1.2.1 Develop a brief description of the event using information provided in the NCR Description. Include other relevant information to ensure the event is completely and accurately understood.

## **9.1.2 Clarify the Event Description**

9.1.2.2 Develop a Problem Description that clearly identifies the problem to be investigated. Consider elements such as the following:

- What Should Be: the requirement, standard, norm or expectation
- What Is: the existing, as-found condition
- What Is Wrong: the gap or deviation between 'what is' and 'what should be'
- The Consequences: the adverse plant / regulatory / personnel affect
- The Extent of Condition that has been determined thus far

9.1.2.3 Review the Problem Description with the Management Sponsor to confirm the problem is understood and the scope of the investigation is appropriately bounded.

## **9.1.3 Preserve Physical Conditions and Important Information**

9.1.3.1 Preserve physical evidence and important information that is essential to identifying cause(s).

9.1.3.2 Plan investigation activities to not alter, destroy, or lose physical evidence and other important information.

9.1.3.3 Confer with the Operations Shift Supervisor for consideration of implementing a quarantine of affected areas, equipment, and records as soon as reasonably practical, however evidence preservation should not interfere with or delay placing the plant, area, or situation in a safe condition.

9.1.3.4 Obtain time-dependent or degradable information, including initial statements from involved individuals, archived plant computer data, etc.

## **9.1.4 Collect Data**

9.1.4.1 Assemble data that may be relevant to the investigation. Use Attachment 1, Potential Data Sources, as applicable.

## 9.1.4 Collect Data

- 9.1.4.2 Identify the individuals directly and indirectly involved in the event. These may include:
- The person(s) who took the initiating action
  - Other job/task team members, including supervisors
  - Operations Shift Superintendent and other operating staff personnel
  - Unit or Section Managers
  - Support personnel such as, Technical Support and Plant Support group staff.
- 9.1.4.3 Obtain written statements from involved individuals, as appropriate. Use Attachment 2, Post-Event Personnel Statement, or similar for this purpose.
- 9.1.4.4 Interview involved individuals, as appropriate.
- a. Plan each interview before the interview starts. Establish objectives and a set of questions for each interview. Use Attachment 3, Interviewing Techniques, and Attachment 4, Topics Suggested for Discussion During Interviews, as applicable.
  - b. Schedule the interviews with consideration of constraints such as shift work, weekends, vacation, or holidays.
  - c. Conduct initial interviews as soon as possible and, if practical, before personnel leave site for the shift.
  - d. Review the interview results with the interviewee to ensure accuracy and allow opportunity to clarify or correct information.
- 9.1.4.5 Perform field observations to determine environmental conditions and potential error precursors.
- a. Photograph and / or videotape the job-site or impacted equipment.
  - b. Walk through the task to identify environmental conditions that may have contributed to the event. Use Attachment 5, Task Walkthrough, as applicable.
  - c. Develop sketches to depict key information, relative position, size of objects, etc.
- 9.1.4.6 Review the recent work history of individuals directly involved in the event to determine if worker fatigue should be further evaluated during the event investigation

#### 9.1.4 Collect Data

- 9.1.4.7 Perform a review of appropriate databases for similar site, NGG and industry events (Operating Experience).

#### 9.1.5 Develop an Initial Investigation Plan

- 9.1.5.1 Use Attachment 14, Significant Adverse Condition Investigation Strategy/Plan, to document the Initial Investigation Plan.

**NOTE:** Formal documentation of Event & Causal Factor Charting is recommended but not required.

- 9.1.5.2 Develop an initial Event & Causal Factors Chart. Use Attachment 6, Event & Causal Factors Charting as applicable.

**NOTE:** Equipment performance, human performance, and organizational factors are frequently interrelated. Therefore, it is often necessary to use more than one analysis technique/approach to address all facets of the event.

- 9.1.5.3 Determine the most appropriate analysis technique/approach for the investigation. Techniques/approaches that may be used to identify and analyze causal factors are included on the following table and are further described in Attachments 7 – 13.

TECHNIQUE / APPROACH	PURPOSE	ATTACH NO.
Barrier Analysis	To identify physical and administrative barriers and determine their effectiveness.	7
Cause & Effect Analysis (Why Staircase)	Analyzes the relationship between cause and effect by asking the question "Why?"	8
Change Analysis	Provides a starting point when causes of inappropriate action are obscure, and / or when you don't know where to start.	9
Common Cause Analysis	Analyzes a Trend, or multiple similar events to determine if there are common failure modes	10
Equipment Performance Analysis	Analyzes damage to, or degradation of a System, Structure, or Component	11
Human Performance Analysis	Analyzes human performance that deviates from the expected	12
Support / Refute Methodology	Systematically eliminates possible failure modes until one or more failure mode cannot be refuted and is substantiated by the evidence.	13

## 9.1.6 Perform the Priority 1 Significant Adverse Condition Investigation

**NOTE:** Additional guidance for equipment-related investigations may be found in ADM-NGGC-0107.

- 9.1.6.1 Use the previously selected analysis techniques/approaches to determine the Inappropriate Acts / Equipment Failure Modes, and Causal Factor(s) for the event.
- 9.1.6.2 Continue using the analysis techniques/approaches to determine the relevance of each Causal Factor.
- 9.1.6.3 Iterations of asking and answering “why” should not normally be stopped before one or more root causes can be determined.

**NOTE:** In each human performance event investigation, it is the investigator’s responsibility to look past the human error that initiated the event and determine if organizational weaknesses are the root of the problem. Investigations focused only on the individual are likely to result in corrective actions that only address symptoms, rather than human errors, and are therefore incapable of preventing event recurrence.

**NOTE:** The NRC has identified important aspects of a strong safety culture and documented them in References 2.2.5 and 2.2.6. These aspects have been incorporated into Attachment 18, Worksheet for Evaluation of NRC Safety Culture Aspects, and should be considered, as appropriate, during investigations for relevant safety culture insights. Such consideration should not substitute for the investigative techniques described above but may provide additional insights in the identification and analysis of causal factors.

- 9.1.6.4 Identify the root cause(s) of the event / condition. This is the causal factor, that if eliminated would have prevented the event / condition from occurring.
- 9.1.6.5 Identify additional contributing causal factors that alone would not have caused the event, but are important enough to correct. *Carefully evaluate the difference between a causal factor that helped contribute to the event that requires correction, and an enhancement that would simply improve the process, but does not necessarily need correction.*
- 9.1.6.6 If the root cause of the event / condition can not be conclusively determined by investigation, identify the most probable causal factor (Selected Cause), that if corrected will provide a high degree of assurance that the condition will not recur. A CAPR assignment for this causal factor is required. Document this determination on Attachment 16, Significant Adverse Condition Investigation Report or Attachment 17, Significant Adverse Trend/Common Cause Analysis (CCA) Investigation Report. Document the cause as Selected Cause in this event.

## **9.1.7 Operating Experience (OE) Review**

- 9.1.7.1 Perform a review of appropriate databases for similar site, NGG, and industry events.
- 9.1.7.2 Assure that OE is reviewed from two perspectives.
  - a. Determine if OE exists that would have prevented the event. If so, then address why it was not effective in preventing the event.
  - b. Determine if this event involves program or procedure elements that implement INPO SOER, SER, or SEN actions. If so, then address why it was not effective in preventing the event.
  - c. Assure that OE is considered during the development of corrective actions (CAPR 127429-04).
- 9.1.7.3 Evaluate the previous events to determine if the current investigation is appropriately considering previously recognized causal factors.
- 9.1.7.4 Evaluate the previous events for insights regarding effective corrective actions for the current Event.
- 9.1.7.5 If the current event is a Repeat Event, determine why the previous CAPR was ineffective.
- 9.1.7.6 Contact the station OE Coordinator if you recommend this event be disseminated to the industry as Operating Experience.
- 9.1.7.7 Provide a conclusion as to the relevance of the OE reviewed and document on Attachment 16 or 17.

## **9.1.8 Extent of Cause**

Determine the set of products, components, processes or persons that possess similar susceptibility to the identified causal factor(s). The extent of cause focuses on the root cause and all identified causal factor(s) and determines the degree to which these causes have resulted or could result in additional problems.

## **9.1.9 Extent of Condition**

Determine the set of products, components, or processes that exhibit the same deficiency as the investigated condition. The extent of condition focuses on the identified problem and where else it could exist.

### **9.1.10 Safety Significance**

- 9.1.10.1 Determine actual and potential safety consequences and implications of the event, including criteria used to classify the event as a Significant Adverse Condition.
- 9.1.10.2 Determine if the event would have been more severe under reasonable and credible alternative conditions, such as power level or operating mode.

### **9.1.11 Corrective Action Plan**

- 9.1.11.1 Refer to Attachment 15 for assistance in developing effective corrective action plans.
- 9.1.11.2 Identify at least one CAPR to address the cause(s) unless preventing the Event is clearly beyond managements' control. In that case document the reasoning for this decision on Attachment 16, Significant Adverse Condition Investigation Report or on Attachment 17, Significant Adverse Trend/Common Cause Analysis (CCA) Investigation Report.
- 9.1.11.3 For CAPR assignments that result in a procedure revision, ensure that the revised procedure guidance is properly annotated as a "CAPR" per the guidance contained in the applicable NGG/Plant Writer's Guide Procedure.
- 9.1.11.4 Identify CORR assignments to address the identified condition and all other causal factors.
- 9.1.11.5 Link each CAPR and CORR to the associated causal factor. Specify which assignments, if any, are Committed Assignments.
- 9.1.11.6 CAPR(s) identified during the investigation should be created and processed to be due within 90 days from the investigation end date. Any exception to this should be processed in accordance with CAP-NGGC-0200. (CAPR 201199-04)
- 9.1.11.7 Identify Enhancement (ENHN) assignments as appropriate.

## 9.1.11 Corrective Action Plan

- 9.1.11.8 Consider the need for interim monitoring methods prior to the Priority 1 Effectiveness Review to ensure that the Corrective Action Plan is on track to prevent recurrence of the event. Examples of performance measures that may be used include:
- Observing the conduct of work or the performance of an evaluation
  - Conducting facility inspection, self assessment or other monitoring activity
  - Using trends, performance measures and indicators, or lessons learned to ensure the issue has been adequately addressed
  - Reviewing appropriate databases for similar problems
  - Running a test to challenge the process
  - Running a mock item through the process
  - Performing a walkthrough of the work , process or evolution
  - Interviewing managers and workers on their understanding of, and involvement with, the implemented corrective actions to prevent recurrence
  - Surveying the organization to evaluate knowledge and understanding of the actions implemented
- 9.1.11.9 Identify an Effectiveness Review assignment or provide the basis for waiver. For example, an Effectiveness Review could be waived if the condition is a Historical Event or is a one-time isolated Event.
- 9.1.11.10 Using Attachment 15, Effective Corrective Action Plans, validate the proposed corrective action plan.
- 9.1.11.11 Obtain concurrence from the Responsible Supervisor for each planned corrective action and Due Date.
- 9.1.11.12 For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability, for example; Work Order "ABC" was approved and completed on mm/dd/yy, Engineering Change "XYZ" was completed in the field on mm/dd/yy, or Material Evaluation was approved and completed on mm/dd/yy.

## **9.1.12 Establish Priority 1 Effectiveness Review Criteria**

9.1.12.1 Establish criteria to measure the success of the corrective action plan for each Priority 1 Effectiveness Review. Criteria should be:

- Actionable
- Measurable
- Specific enough to address the adverse condition and inappropriate act and to determine if corrective actions have prevented recurrence and achieved the desired goal.

9.1.12.2 The criteria should determine effectiveness at the lowest practical level (end result, end user, or field application). For example, if the CAPR is to provide training, the EREV criteria should include determining the practical knowledge of the people that were trained. If the CAPR is to implement a policy or procedure change, the EREV criteria should determine whether the affected people understand and implemented the change as intended.

9.1.12.3 Examples of performance measures that may be used include:

- Observing the conduct of work or the performance of an evaluation
- Conducting facility inspection, self assessment or other monitoring activity
- Using trends, performance measures and indicators, or lessons learned to ensure the issue has been adequately addressed
- Reviewing appropriate databases for similar problems
- Running a test to challenge the process
- Running a mock item through the process
- Performing a walkthrough of the work , process or evolution
- Interviewing managers and workers on their understanding of, and involvement with, the implemented corrective actions to prevent recurrence
- Surveying the organization to evaluate knowledge and understanding of the actions implemented

9.1.12.4 Include Priority 1 EREV criteria in the Investigation Report.

### 9.1.13 Priority 1 Significant Adverse Condition Investigation Report

**NOTE:** A template for the Significant Adverse Condition Investigation report is contained within Action Tracking in the Priority 1 NCR INVN assignment and Attachment 16.

- 9.1.13.1 Document the Significant Adverse Condition Investigation and corrective action plan using the report format provided in Attachment 16 or 17. A level of detail should be provided such that an uninvolved reader can understand the results, and how the results were derived.
- 9.1.13.2 If the structured investigative techniques described in this procedure were not used then:
- Document the reasoning for this decision in the Investigation Summary.
  - Indicate the Causal Factor Type (Root, Contributing, Common, Selected).
  - Specify the Assignment Type (CAPR, CORR, etc.) in the Corrective Action Plan.

### 9.1.14 Review and Approval

- 9.1.14.1 Conduct a final debrief with the Management Sponsor (including other members of management, subject matter experts, and peers as appropriate) to obtain input and concurrence with the results.
- 9.1.14.2 Incorporate revisions based on the input from the final debrief.
- 9.1.14.3 Using the guidance in CAP-NGGC-0202, complete the assignment attributes to designate whether the investigation should be disseminated as internal or external operating experience.
- 9.1.14.4 Contact the station OE Coordinator if you recommend this event to be disseminated as operating experience.

### Management Sponsor or Designee

- 9.1.14.5 Using Attachment 15, Effective Corrective Action Plans, validate the proposed corrective action plan.
- 9.1.14.6 Ensure the Investigation report is adequate.

## **Self Evaluation Supervisor/Superintendent/Designee**

- 9.1.14.7 Convene Root Cause Review Team (RCRT) to review investigation prior to the investigation being presented to the Quality Review Board (QRB). The RCRT may be waived at the discretion of site management.

## **R2.2.8 Root Cause Review Team (RCRT)**

- 9.1.14.8 Perform an informal review of the Significant Adverse Condition Investigation to ensure that the following elements are properly included:

- Problem Statement
- Investigative technique(s) utilized, data collection/analysis
- Identification of inappropriate acts, contributing and root cause(s)
- Extent of Condition and Extent of Cause
- Operating Experience review including conclusion
- Safety Significance
- Soundness of conclusion
- Appropriateness and timeliness of Corrective Action Plan
- Evaluation of Attachment 18, Worksheet for Evaluation of NRC Safety Culture Aspects as follows:
  - Decision Making
  - Resources
  - Work Control
  - Work Practices
  - Corrective Action Program
  - Operating Experience
  - Self and Independent Assessments
  - Environment of Raising Concerns
  - Preventing, Detecting, and Mitigating Perceptions of Retaliation
  - Accountability
  - Continuous Learning Environment
  - Organizational Change Management
  - Safety Policies

## **Self Evaluation Supervisor/Superintendent**

- 9.1.14.9 Convene Quality Review Board (QRB) to provide review and approval of Significant Adverse Condition Investigations and to ensure thorough evaluations are conducted and corrective actions to prevent recurrence are effective.

## **R2.2.8 Quality Review Board (QRB)**

9.1.14.10 Review Significant Adverse Condition Investigations for thoroughness of :

- Problem Statement
- Identification of inappropriate acts, contributing and root cause(s)
- Extent of Condition and Extent of Cause
- Appropriateness and timeliness of Corrective Action Plan

9.1.14.11 If the QRB review determines that the investigation is less than satisfactory in rigor, then document in QRB minutes and initiate an NCR.

### **Investigator/Team Lead**

9.1.14.12 Incorporate comments received from QRB into the investigation report as applicable.

9.1.14.13 Submit the Significant Adverse Condition Investigation assignment for approval within Action Tracking.

### **Management Sponsor or Designee**

9.1.14.14 Approve the investigation assignment in Action Tracking.

### **Unit/Section Evaluator**

9.1.14.15 Review the submitted assignment

9.1.14.16 Confirm the following:

- Required action has been taken;
- Documentation is adequate to support approval;
- Further actions required are clearly identified; and
- Justification is present for any deviations from the action

9.1.14.17 When reviewing the investigation assignment, verify/document the required trending information per the guidance in CAP-NGGC-0206.

9.1.14.18 Initiate follow-up NCR assignments to accomplish any additional actions identified by the assignee.

9.1.14.19 If the submitted assignment is inadequate, document the basis and return to the assignee.

9.1.14.20 Approve the assignment when the submitted response is acceptable.

## 9.2 Performing a Priority 2a Adverse Condition Investigation – Increased Rigor

### Assignee and Supervisor/Designee

**NOTE:** Priority 2a NCR investigations do not require root cause determinations or the identification of a CAPR.

Structured investigative technique(s) are utilized, along with an evaluation of the Extent of Condition and the use of Operating Experience (internal and external) to determine the apparent cause and corrective actions to reduce the probability of, but not necessarily prevent, recurrence of the condition.

Individual elements of the root cause investigation process may be employed as desired by management.

**NOTE:** Additional guidance for equipment-related investigations may be found in ADM-NGGC-0107.

**NOTE:** A template for the Adverse Condition Investigation - Increased Rigor report is contained within Action Tracking in the Priority 2a INVN assignment and Attachments 19 and 20.

9.2.1. Review the assignment and its requirements and accept.

**NOTE:** Equipment performance, human performance, and organizational factors are frequently interrelated. Therefore, it is often necessary to use more than one analysis technique/approach to address all facets of the event.

9.2.2. Concur regarding the investigative technique(s), rigor, and depth needed to determine the Apparent Cause and Corrective Actions to reduce the probability of, but not necessarily prevent, recurrence of the condition.

9.2.3. Consider and document immediate corrective actions or compensatory measures taken to place the plant in a safe condition or to restore compliance.

9.2.4. As a minimum, the Cause and Effect Analysis should be used to take multiple steps down the “Why Staircase” to identify the Apparent Cause.

9.2.5. If it is decided that structured investigative techniques are not necessary to determine the Apparent Cause and Corrective Actions, then document the reasoning for this decision in the Investigation Summary.

### Investigator

9.2.6. Develop a brief description of the event using information provided in the NCR description. Include other relevant information to ensure the event is completely and accurately understood.

## **9.2 Performing a Priority 2a Adverse Condition Investigation – Increased Rigor**

9.2.7. Develop a Problem Description that clearly identified the problem to be investigated. Consider elements such as the following:

- What Should Be: the requirement, standard, norm or expectation
- What Is: the existing, as-found condition
- How It Happened: the inappropriate act or equipment failure. What did the individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.
- Why It Happened: apparent cause and contributing cause(s) if applicable. Describe why this happened.

9.2.7 Using the investigative techniques(s) agreed upon, determine the apparent cause and contributing cause(s) if applicable.

9.2.8 If the structured investigative techniques described in this procedure were not used, then document the reasoning for this decision in the Investigation Summary.

9.2.9 Determine the Extent of Condition by identifying the set of products, components, or processes that exhibit the same deficiency as the investigated condition.

9.2.10 Perform an Operating Experience review (internal and external) to determine if OE exists that should have prevented the event. If so, then address why it was not effective in preventing the event.

9.2.10.1 Evaluate the previous events to determine if the current investigation is appropriately considering previously recognized causal factors.

9.2.10.2 Evaluate the previous events for insights regarding effective corrective actions for the current event.

9.2.11 Develop a Corrective Action Plan

9.2.11.1 Refer to Attachment 15 for assistance in developing effective corrective action plans.

9.2.11.2 Identify CORR assignments to address the identified condition, the apparent cause, and all identified causal factor(s).

9.2.11.3 Identify Enhancement (ENHN) assignments as appropriate.

9.2.11.4 Obtain concurrence from the Responsible Supervisor for each planned corrective action and due date.

## **9.2 Performing a Priority 2a Adverse Condition Investigation – Increased Rigor**

9.2.11.5 For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability. For example: Work Order 12345 was approved and completed on mm/dd/yy, Engineering Change 12345 was completed in the field on mm/dd/yy, or Material Evaluation 12345 was approved and completed on mm/dd/yy.

9.2.12 Document the Adverse Condition Investigation Increased Rigor and corrective action plan using the report format provided in Attachment 19, Adverse Condition Investigation – Increased Rigor Report, or on Attachment 20, Adverse Condition Investigation – Increased Rigor – Equipment Report. A level of detail should be provided such that an uninvolved reader can understand the results and how the results were derived.

9.2.13 Using the guidance in CAP-NGGC-0202, complete the Attributes for Internal and External Operating Experience (OE).

9.2.14 Contact the station OE Coordinator if you recommend this event to be disseminated as operating experience.

9.2.15 Submit the INVN INCREASED RIGOR assignment for approval within Action Tracking.

### **Supervisor/Designee**

9.2.16 Using Attachment 15, Effective Corrective Action Plans, validate the proposed Corrective Action Plan.

9.2.17 Ensure the investigation report is adequate.

9.2.18 Approve the INVN assignment in Action Tracking.

### **Unit/Section Evaluator**

9.2.19 Review the submitted assignment.

9.2.20 Confirm the following:

- Required action has been taken;
- Documentation is adequate to support approval;
- Further actions required are clearly identified; and
- Justification is present for any deviations from the action.

9.2.21 Verify/document the required trending information per the guidance in CAP-NGGC-0206.

9.2.22 Initiate follow-up NCR assignments to accomplish any additional actions identified by the assignee.

9.2.23 Approve the assignment when the submitted response is acceptable.

## 10.0 RECORDS

Corrective Action Program records are addressed in CAP-NGGC-0200.

**ATTACHMENT 1**  
**Sheet 1 of 1**  
**Possible Data Sources**

Design / Licensing Basis

- Design basis documents (drawings, calculations, DBDs, specifications, etc.)
- Design change documents (ECs, ESRs, PCRs, FCRs, DCNs, etc.)
- Licensing basis documents (FSAR, Technical Specifications, etc.)

Other Internal Sources

- Equipment performance records (Maintenance Rule data, EPIX data, System Health
- Troubleshooting Plans and results
- Work history (work orders, work requests)
- Test results (surveillance tests, performance tests, post-modification tests, etc.)
- Photographs and/or videotapes
- Logs
- Post-Trip / Safeguards Actuation Review results
- Post-Job Critiques
- Interview results
- Written personnel statements
- Laboratory analysis results
- Nuclear Condition Reports
- Operability evaluations
- OPEX items
- Performance Indicators
- Procedures (current and past revisions)
- Self-assessments
- Training and qualification records

External Sources

- Nuclear Regulatory Commission information (Inspection Modules, Generic Letters, Information Notices, etc.)
- Nuclear Safety Advisory Letters (NSALs)
- INPO documents (SOERs, SERs, SENs, etc.)
- Nuclear Network data
- Inspection and assessment reports (NRC, INPO, NAS/PES, etc.)
- 10CFR21 notifications

**ATTACHMENT 2**  
**Sheet 1 of 1**  
**Post Event Personnel Statement**  
Form CAP-NGGC-0205-2-3

Event Date / Time:		Date / Time of Statement:
Task or evolution in progress:		
Statement of (Name)		
Job position, role, and responsibilities during task or evolution:		
Problem Description (Why is this an 'event'?)		
What happened?		
What was expected?		
How was the problem discovered?		
Knowing what happened, what would you recommend be done differently?		
Signed:		

An alternate form or document may be used

**ATTACHMENT 3**  
**Sheet 1 of 1**  
**Interviewing Techniques**

Interviewing is an important and direct method of data-gathering, however it may present a subjective perspective and should not be exclusively relied upon for determining causal factors.

**Interview Preparation**

- Make appointments and obtain the supervisor's permission to interview the worker. If the supervisor was present during the event, interview the supervisor first.
- Select an appropriate location.
- Conduct interviews one-on-one where possible.
- Allow time between interviews to reconstruct notes.

**Introduction/Opening**

The purpose of the introduction is to orient the interviewee and put him/her at ease.

- Explain the purpose of the investigation and the interview
- Inform the interviewee that your investigation is independent from any other investigations, which may have already been conducted.
- Provide the interviewee with an overview of the material to be covered and obtain interviewee's permission to take notes.
- Show interest and get the interviewee involved by emphasizing your need to learn and understand the subject matter.
- Anticipate and answer the interviewee's questions:
  - How will the information be used? (Used to determine true causes).
  - Will my name be used? (No but the report may include a list of contacts).
  - Why do you want to talk with me? (You can help explain what happened)

**Question/Answer**

The purpose of the interview is to obtain the interviewee's recollection and understanding. The following are the features of a successful interview.

- Begin with open-ended questions to allow the interviewee to provide his/her perspective.
- Listen carefully while taking notes. Do not interrupt.
- Be objective, keep the questions short and simple but limit question types that can be answered with a 'Yes' or 'No'.
- Do not ask leading questions and let people use their own words.
- Use primary questions (from the prepared list) to introduce a topic and use secondary questions to clarify information.
- Use diagrams to help the interviewee and if practical, use photographs.
- Determine how the interviewee's behavior in the task of interest was influenced.

**The Closing**

The closing accomplishes more than just concluding the interview. It provides an opportunity to validate information and obtain additional information.

- Summarize the information that was recorded.
- Set up the potential for a follow-up interview.
- Thank the interviewee for his/her help.

**ATTACHMENT 4**  
**Sheet 1 of 3**  
**Topics Suggested For Discussion During Interviews**

**NOTE: The following are interview topics, not interview questions. The Interviewer should ask open ended questions that will reveal information regarding applicable topics.**

**Verbal Communications**

- Were instructions adequate and clear?
- Were communication practices consistent?
- Were plant communication systems adequate?
- Were there problems communicating between work groups?

**Written Document**

- Were documents complete, clear, and understood?
- Were documents used for the task?
- Were other documents referenced?
- Were documents legible and current?
- Were drawings, sketches, tables, etc. useable?
- Were documents technically correct?
- Were documents readily available?
- Did the documents contain appropriate prerequisites, initial conditions, precautions, cautions, and warnings?
- Were problems with documents reported and resolved?
- Were there any problems using the document to identify the correct unit, train, or component?
- Could the task be performed as required by the document?

**Human Factors / Human Performance**

- What were the Critical Steps of the activity?
- Were there any problems distinguishing/identifying components?
- Were components labeled?
- Were label identifiers consistent with work documents?
- Were labels color-coded or otherwise readily apparent?
- How could a mistake be made?
- Was it clear how human performance techniques would be employed?

**Physical Environment**

- Was lighting adequate?
- Were there housekeeping problems (water, oil, debris, etc.)?
- Was there a need to enter a confined space?
- Was protective clothing available and used?
- Was temperature/humidity a problem?
- Was noise a problem?
- Were there obstacles or distractions present?

**ATTACHMENT 4**  
**Sheet 2 of 3**  
**Topics Suggested For Discussion During Interviews**

**Work Schedule**

- How many hours had been worked prior to the event?
- How much overtime had been worked prior to the event?
- How many consecutive days had the person worked?
- What time of day did the event occur?
- When was the next day off scheduled to occur?

**Work Practices**

- Determine procedure use (verbatim, guideline, not used, etc.)?
- Were tools in good working condition?
- Were all needed tools available?
- Was it clear which human performance techniques would be employed such as place keeping, peer checking, and so forth?
- Were radiological conditions understood?
- Were system conditions understood?
- Were short cuts used?
- Were all the required people present?

**Work Organization and Supervision**

- Who was at the scene where the initiating action occurred?
- Were duties distributed appropriately?
- Was there enough time to prepare for the job?
- Was there more than one simultaneous task?
- Had the job been performed previously?
- Does previous post-job critique information exist and could that information have prevented or mitigated the consequences of this event?
- Were duties and responsibilities clear?
- Was the supervisor at the job location periodically?
- Were tasks coordinated among work groups?
- Were priorities clearly established?
- Was the plan detailed enough to clearly establish who would perform each step task?
- Did the individual or crew find themselves needing to 'figure things out' on the spot?
- How long had this work crew worked together?
- Was there an adequate pre-job briefing?
- Who conducted and participated in the pre-job briefing and walk down?
- Were contingencies established for anticipated problems?
- Were the potential consequences of inappropriate actions and equipment responses discussed?
- Were "what-if" scenarios discussed and evaluated? What type?

## ATTACHMENT 4

### Sheet 3 of 3

## Topics Suggested For Discussion During Interviews

### Training and Qualifications

- Had the workers been trained to perform the task?
- Was any training based on the actual task?
- Did the worker have an understanding of the equipment involved?
- Did the worker read and understand the work instructions?
- Was any applicable training useful; qualified instructors?
- Did any training include mock-ups, simulator, etc.?
- What were the differences between training and actual job?
- How long since training was received?
- Was sufficient time allowed for training?
- How long since the task was last performed?

### Change Implementation

- Was there anything different since the job had previously been performed?
- Did the job situation change from what was expected and if it did, how was it addressed?
- Were changes adequately reflected in procedures, drawings, training, labels, etc.?

### Management and Administration

- Were there any policies, goals, or objectives that influenced the event?
- Did the worker understand whom he/she reports to?
- Were roles and responsibilities clear?
- Were quality requirements clear?
- Is the expectation for problem identification and resolution clearly understood?
- Was support adequate (procedures, training, engineering, planning, scheduling, radiological protection, clearance tagging, protective equipment, etc.)?
- Were parts, materials, and supplies provided to support the job?
- Was the reason for the job clear?
- Was the job within the workers capabilities?
- Were there unnecessary requirements?
- Were there any conditions causing stress?

### Equipment Performance

- What were the initial conditions when the malfunction occurred? Include as appropriate: system line-ups, both mechanical and electrical, plant status, activities in progress, concurrent activities, unusual situations.
- What was the sequence of events just prior to and after the malfunction?
- What were the symptoms displayed at the time of malfunction?
- Is there knowledge of prior events or similar operating experience?
- Have actions been initiated to troubleshoot the malfunction?

**ATTACHMENT 5**  
**Sheet 1 of 1**  
**Task Walkthrough**

**TASK WALKTHROUGH** is either a step-by-step reenactment of a task without actually performing the required actions, or a step-by-step observation of the same task actually being performed in the plant.

Task Walkthrough is appropriate when it is known or suspected that problems encountered during performance of a task contributed to an event. An event may involve multiple tasks or activities each requiring a separate analysis.

Task Walkthrough is intended to provide the following deliverables related to the specifics of the task/activity:

- A clear understanding of HOW the task/activity is normally performed and identification of any differences in HOW it was actually performed
- Discrepancies in procedures or other guidance
- Possible inappropriate actions
- Possible weaknesses in training, knowledge, or skill
- Possible weaknesses in Programs or man-machine interfaces
- Questions about details that need to be answered during the course of the investigation, usually through interviewing

Expertise unique to the task may be required to gain maximum benefit from Task Walkthrough.

**TASK WALKTHROUGH STEPS**

- Review procedures, work documents, etc. to obtain a clear understanding of what the task is about and how it is performed.
- Perform the walkthrough while observing and recording perceived discrepancies or problems.
- Document problems noted and questions that need to be answered.

**ATTACHMENT 6**  
**Sheet 1 of 2**  
**Event & Casual Factors Charting**

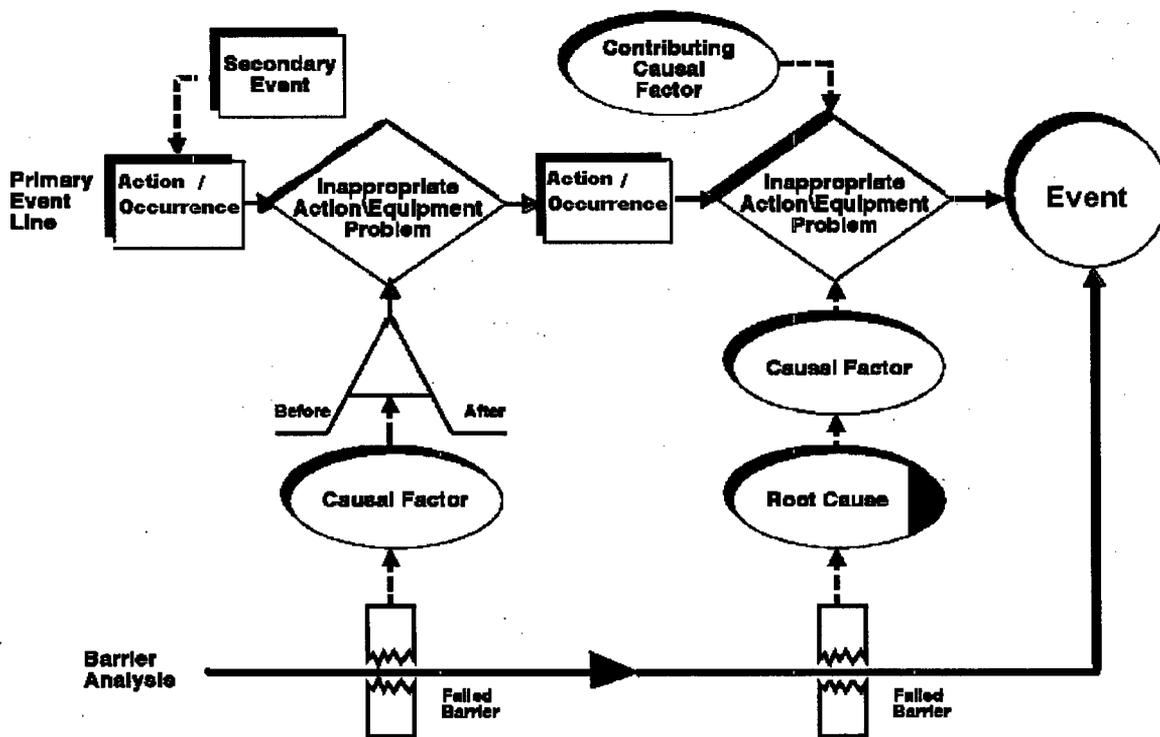
**EVENT & CAUSAL FACTORS CHARTING** is a combination of several techniques (event timeline, change analysis, barrier analysis) used to develop a graphical representation of the entire event, depicting cause and effect relationship.

An **Event & Causal Factors Chart (E&CF)** is a graphically displayed flow chart of an entire event. The sequence of relevant actions and occurrences is plotted on a time line. Beginning and ending points are selected to capture pertinent information. Probable failure modes become evident as the chart is developed. E&CF charts are particularly useful for complex situations and are more meaningful than long narrative descriptions. The E&CF chart provides an excellent graphical display of barriers, changes, cause and effect, and how these factors were involved in an event.

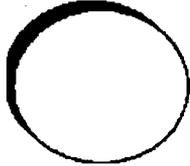
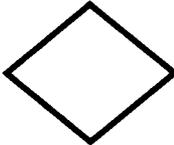
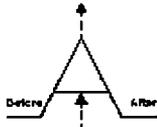
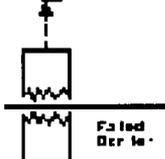
**TO DEVELOP AN E&CF CHART:**

1. Evaluate initial information and data.
2. Define the Event.
3. Construct a preliminary Timeline.
4. Conduct analysis using applicable techniques/approaches (Barrier, Cause & Effect, Change, Equipment Performance Cause Analysis, Human Performance Cause Analysis, etc.)
5. Identify every Inappropriate Act and Equipment Failure, relevant Change, etc.
6. Identify the Causal Factors for each Inappropriate Act and Equipment Failure.
7. Assess each Inappropriate Act and its related Causal Factors to determine the root, validated, and contributing cause(s)
8. Ensure facts are validated and conclusions are supported by facts.

**Example Events and Causal Factors Chart**



**ATTACHMENT 6**  
**Sheet 2 of 2**  
**Event & Causal Factors Charting**

<b>EVENT &amp; CAUSAL FACTORS CHARTING TERMS AND SYMBOLS</b>		
<b>TERM</b>	<b>DEFINITION</b>	<b>SYMBOL</b>
<b>ACTION / OCCURRENCE</b>	A human behavior, or equipment performance, that leads to an outcome. In the Corrective Action Program the outcome of interest is an Event. More than one Action / Occurrence, in series (Primary Event) or concurrent (Secondary Event), may precede the event.	
<b>EVENT</b>	The adverse condition, or consequence, that is the focus of investigation. The following are useful for determining the Event: <ul style="list-style-type: none"> <li>• Single action or happening.</li> <li>• Can be described by objective facts.</li> <li>• Can be described by a short sentence with one noun and one active verb.</li> </ul>	
<b>INAPPROPRIATE ACT / EQUIPMENT FAILURE</b>	A human behavior or equipment performer that is inappropriate for the situation thereby transforming it into an Event.	
<b>CHANGE</b>	A difference that is introduced, and determined to be relevant to the Event.	
<b>CONTRIBUTING CAUSE</b>	A cause that alone would not have caused the event but is important enough to be corrected.	
<b>ROOT CAUSE</b>	The most basic cause(s) of an event that can reasonably be validated and that management has the control to fix. The causal factors that if eliminated would have prevented the event from occurring.	
<b>BARRIER</b>	The administrative or physical control that is intended to inhibit an inappropriate act or equipment failure.	

**ATTACHMENT 7**  
**Sheet 1 of 1**  
**Barrier Analysis**

<b>BARRIER IDENTIFICATION HELP SHEET</b>				
<b>BARRIER CATEGORY</b> <ul style="list-style-type: none"> <li>• Were any physical barriers not functioning as designed?</li> <li>• Were there any barriers that did not perform their functions?</li> </ul>	Identify the barriers that will be assessed	If a barrier category contributed to the event then assess the specific barrier as follows:		
		Barrier is deficient or failed	No barrier in place	Barrier was circumvented or incorrectly applied
<b>SYSTEM/COMPONENT DESIGN CONTROL</b>				
Design Codes/Standards				
Drawing/Dimensions				
Material specifications				
Environmental conditions				
Other				
<b>PHYSICAL BARRIERS</b>				
Engineered Safety Features				
Safety and relief devices				
Conservative design allowances				
Redundant equipment				
Locked doors and valves				
Ground fault protection devices				
Radiation shielding				
Alarms and annunciators				
Fire barriers and seals				
Other				
<b>PROGRAM CONTROL/MONITORING BARRIERS</b>				
Training Program				
Engineering System Monitoring				
Human Performance				
Procedure & Document Management				
Maintenance Rule				
Lessons Learned Programs				
Self Assessment				
Corrective Action				
Operating Experience				
Other				
<b>ADMINISTRATIVE BARRIERS</b>				
Plant Policies & procedures				
Education and Training				
Equipment Clearances				
Radiation Work permits				
Qualification of workers				
Methods of communication				
Certification of engineers				
Regulations				
Supervisory practices				
ALARA				
Other				
<b>Table is NOT intended to be ALL inclusive</b>				

**ATTACHMENT 8**  
**Sheet 1 of 1**  
**Cause and Effect Analysis**

**The intent of this analysis technique is to analyze the relationship between cause and effect by asking the question “why?”**

<u>EFFECT/SYMPTOM</u>	<u>WHY</u>	<u>CAUSE/REASON</u>
MOV Inoperative		Bearing seized
Bearing seized		No lubrication
No lubrication		Grease breakdown
Grease breakdown		No preventive maintenance
No preventive maintenance		Foreman did not plan maintenance
Foreman did not plan maintenance		BOP PM's on MOVs lowest priority despite other failures
BOP PM's on MOVs lowest priority despite other failures		BOP MOVs not considered vital equipment
BOP MOVs not considered vital equipment		No requirement to perform PM – fix only on failure.

**CAUSE AND EFFECT PRINCIPLES**

A bond/relationship exists between cause and effect. The relationship is analyzed by asking the question, “why” usually five to seven times, to determine the most basic cause(s) of an event that can reasonably be validated and that management has the control to fix. Successively asking the question “why” in this manner is known as using the Why Staircase.

- Cause and Effect Analysis is most effective when used within the framework of the E&CF Chart. It is not a stand-alone method because the situation first needs to be evaluated to the point where ALL failure modes are identified. This is particularly true in situations involving multiple failures.
- This process of Cause and Effect Analysis provides a logical, structured guide to maintaining the evaluation on track.
- Often Cause and Effect Analysis will lead to management-controlled causes (also called Organizational and Programmatic causes).
- When more than one cause is responsible for an effect, each cause should be evaluated.

**ATTACHMENT 9  
Sheet 1 of 1  
Change Analysis**

**CHANGE ANALYSIS** is a comparison of a successfully performed activity to the same activity performed unsuccessfully. During the process of collecting information, all identified changes are written down. The differences are then analyzed for their resultant effects in producing the inappropriate action or adverse equipment condition. Change Analysis is used to help develop investigation leads and questions on which to follow up. The results of Change Analysis should be reflected in the Event and Causal Factors Chart to assist in determining causal factors.

The questions that you need to ask are:

“What are the critical factors regarding performance of this task (who, what, when, where)?”

“What was different about this situation from all other times we carried out the same task or activity without an inappropriate action or adverse equipment condition?”

**Potential Pitfalls**

- Gradual changes may not be recognized, e.g., slow increase in contamination in an area
- All changes may not be recognized
- A domino effect of changes may not be recognized
- A change may be incorrectly defined.

**Example of a completed Change Analysis Worksheet:**

Change Analysis Worksheet					
Critical Factors	Event Condition	Successfully Performed Activity	Difference	Effect	Follow Up Questions to Answer
Oil leakage	Oil leakage from new filter	No leakage before oil filter changed	Oil filter was changed	Oil filter change introduced leakage	Is the new oil filter damaged?
Personnel	Mike changed oil & filter	Thomas changed oil & filter	Mike changed oil & filter	Mike's actions introduced leakage	Did Mike install the filter wrong?
Worker Experience	Mike is a new employee	Thomas has changed oil for years	Inexperienced worker?	?	What is Mike's experience level with this type of work?
Location	Joe's Lube Shack	Joe's Lube Shack	None	None	
Oil Filter	Green	Orange	Filter color is different	?	Was the correct oil filter used?

**ATTACHMENT 10**  
**Sheet 1 of 5**  
**Trend/Common Cause Analysis (CCA) Investigation Assignments**

**Preparation**

1. Develop a clear statement of the purpose and desired outcomes from the common/root cause analysis. Develop a Corrective Action Plan to address any common causal factors.
2. Bound the analysis by identifying the criteria to be evaluated for collective significance and common/root cause. Consider criteria such as:
  - Affected facility, organizational section, organizational unit, or crew
  - Group Responsible
  - Keyword, Event Code, Cause Code
  - Building, system, or component
  - Plant operating mode, work evolution, process, procedure step
  - Season, day of week, time of day, or weather conditions
3. Identify and collect the data sources to be used in the analysis. Typically, the following document types are considered for inclusion:
  - Nuclear Condition Reports
  - Observation Program data
  - Independent assessments by INPO, NAS/PES, etc.
  - Regulatory performance (NOV, LER, Inspection Reports)
  - Self-Assessments
  - Equipment performance records (CAPR 123794-17).
  - Other corrective action documents with causal analysis (If adequate detail is not provided in the applicable Adverse Condition Investigations or if there is reason to question the accuracy of previously performed investigations, additional investigation may be required to allow proper analysis. CAPR 123794-17).

<p><b>NOTE:</b> For equipment Malfunction investigations, data sources above and beyond documented functional failures may be required to expand the data set to allow proper analysis (CAPR 123794-17).</p>
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4. Review the data sources and exclude specific examples that:
  - Occurred outside the period of interest
  - Involve personnel, organizations, or activities outside the scope of the analysis

**ATTACHMENT 10**  
**Sheet 2 of 5**  
**Trend/Common Cause Analysis (CCA) Investigation Assignments**

**Identify Whether Common Cause Analysis is Warranted**

1. Determine the specific information to be gleaned regarding each Inappropriate Act or Equipment Malfunction. Consider Information Categories such as:
  - Responsible Organization, crew, etc.
  - Day of week, time of day, shift, etc
  - Program or Process
  - Work Activity
  - Cause code and other causal factor descriptors
  
2. Record the Inappropriate Acts/Equipment Malfunctions associated with each NCR or other data source on one axis of Worksheet similar to this sample:

**EXAMPLE COLLECTIVE SIGNIFICANCE REVIEW MATRIX**

INFORMATION CATEGORIES →	Responsible Crew	Day of Week / Shift	Procedure Being Performed	Environmental Conditions
INAPPROPRIATE ACT OR EQUIP. MALFUNCTION ↓				
Skipped Procedure Step	Crew A	Monday	OP-202	Observers watching Crew

3. On the other axis of the Worksheet list each of the selected Information Categories.

**ATTACHMENT 10**  
**Sheet 3 of 5**  
**Trend/Common Cause Analysis (CCA) Investigation Assignments**

4. For each Inappropriate Act/Equipment Malfunction, record data relevant to each Information Category. In cases where such information is not available make a limited attempt to obtain missing information. If unsuccessful, leave a blank and continue (Annotate information that is logically concluded from available data but is not explicitly known).
5. Compare data within each information category to identify groupings that stand out as recurring/common. Look for:
  - Data with magnitude that appears significant when compared to the rest of the data set (e.g., most errors are occurring on nightshift).
  - Data that represents a noteworthy decline in performance when compared to the results of previous assessments (e.g., the number of documentation errors on work packages has significantly increased).
  - Data that represents a generic concern affecting multiple organizations, programs and/or processes.
  - Data that represents a level of performance below management expectations.
6. Special circumstances may be a factor in explaining the data. For example, a sudden rise in the number of procedure violations may be due more to increased management emphasis on procedure compliance than to an actual increase in the rate of occurrence. An increase in personal safety shortfalls may be due to more workers being present during outage periods, or to increased monitoring for infractions, rather than to an actual increase in the rate of occurrence.
7. When looking for commonalities, consider using charts or graphs to display and manipulate the data, as these tools can highlight information that warrants further review. For example, graphing the data by organization may reveal that the problem is primarily confined to one or two groups.

If desired, and if 50 or more data points exist, data can be determined to be statistically significant using the formula for an 80% confidence factor: Expected Error (EE) = 100% \* 1.282 (.21/n)<sup>1/2</sup> where 'n' is the number of data points. Typically, if this technique is used, areas in which the number of data points exceeds twice the EE rate warrant further analysis. This technique/approach is not mandatory as its application is not appropriate for all analyses.

## ATTACHMENT 10

### Sheet 4 of 5

#### Trend/Common Cause Analysis (CCA) Investigation Assignments

- 8 Determine if the identified commonalities are sufficient to further evaluate the group of events from the perspective of Common Cause Analysis.
9. If further analysis is not warranted, document the basis for this decision and consider other analysis techniques to determine the root cause and identify CAPRs.
10. If further analysis is warranted, develop problem statements to clearly establish the focus of the Common Cause Analysis. For example: During fourth quarter, six of 15 events involving noncompliance with procedures are attributed to the "A" work crew.

#### Common Cause Analysis

1. Based upon analysis of the data, develop causal theories regarding common causes for recurring/multiple events.
  - Look beyond the initiating circumstances to identify the organizational weaknesses that may be behind recurring conditions and undesirable levels of human or equipment performance.
  - The Pareto concept may be beneficial when evaluating data sets. The Pareto approach is based upon the fact that, "within any collection of data, a few of the individual data points are more significant than the remaining majority." Using the Pareto approach for equipment reliability issues means that you may only have to perform failure mode analysis on 20% of identified failures to eliminate 80% of the overall reliability issue (CAPR 123794-17).
  - If a certain program, process, or procedure is spawning an unusual number of problems, look for specific activities or interfaces within that program, process, or procedure that may be causing problems. Process mapping is particularly useful in this regard. Process mapping involves developing a flowchart that breaks down a program, process, or procedure into its component steps. Process maps should identify interfaces, responsibilities, time requirements, communication methods, and desired products/results.
1. Systematically validate causal theories that are supported by the data and eliminate those that are not supported. If needed, obtain additional related and relevant information to validate causal theories by:
  - Conducting interviews with subject matter experts and other cognizant personnel
  - Reviewing previous in-house evaluations (audits, surveillances, self-assessments, trending, etc.)
  - Reviewing external evaluations (NRC, INPO, WANO, Industry peer evaluations, special teams, etc.)
  - Reviewing historical plant documents (procedures logbooks, plant data printouts, etc.)

## ATTACHMENT 10

### Sheet 5 of 5

#### Trend/Common Cause Analysis (CCA) Investigation Assignments

- Cross-comparing problem issue groupings (for example, if organizational complacency is suspected to be a cause for problems in one activity, then complacency should also be apparent in other activities within that organization if it is a valid cause).

#### **Corrective Action Plan**

1. Using Attachment 15, Effective Corrective Action Plans, develop a Corrective Action Plan to address the identified common/root cause.
2. For equipment malfunctions, where a common cause is not clearly identified, the goal of the investigation corrective action plan should be to improve the reliability of the applicable performance monitoring group (CAPR 123794-17).
3. Recognize that the causal factors that are not common, or remain undetected, may continue to cause other events. Also, Corrective Actions to Prevent Recurrence (CAPR) that are based on a Common Cause Analysis provide strong assurance that similar events will not continue due to the common causal factors. These CAPR do not provide assurance that similar events due to other causal factors will be prevented.

#### **Investigation Report**

Prepare a report using Attachment 17, Trend/Common Cause Analysis Investigation Report.

**ATTACHMENT 11**  
**Sheet 1 of 4**  
**Equipment Performance Analysis**

## **The Nature of Equipment Failures**

Ironically, cause analysis of equipment failures usually results in identifying causes involving a human element, rather than causes related to inadequately designed or manufactured parts. For example, equipment can fail if it is not installed properly, repaired correctly or monitored adequately. The same component might also fail if we do not perform the right preventive maintenance tasks on it at the right frequency, or if we simply choose to operate it past the end of its service life. Accordingly, the investigator must look past the failure itself, and the physical conditions that induced it, to identify if deeper organizational weaknesses were at play.

## **Identifying Equipment Failure Scenarios**

Successful root cause analysis for equipment failures rests with the investigator's ability to accurately identify the **Failure Scenario**. The Failure Scenario is the sequence of actions or occurrences leading to an Equipment Failure Event, and represents exactly how and why the failure occurred. Nailing down the Failure Scenario requires the identification of several key factors:

- **Failure Mode**
- **Failure Mechanism**
- **Degradation Mechanism**
- **Degradation Influences**

Only then is it possible to move beyond the immediate failure to the deeper root causes.

**Failure Mode** represents the specific type or manner of failure exhibited by the subject equipment (e.g., failed to open, failed to close, failed to regulate flow, failed to energize). Once the Failure Mode is known, the next step is to identify the failure mechanism.

**Failure Mechanism** represents what actually went wrong with the equipment. For example, the equipment may have failed when:

- *linkage between the valve hand wheel and remote operator broke*
- *the regulator's diaphragm tore*
- *the breaker's control power fuse blew*
- *foreign material lodged between the valve's seat and disc.*

**ATTACHMENT 11**  
**Sheet 2 of 4**  
**Equipment Performance Analysis**

After establishing the Failure Mechanism the next step is to identify the specific problem that's preventing proper operation of the equipment...its Degradation Mechanism.

**Degradation Mechanism** is the process or physical phenomena involved in the failure. Degradation Mechanisms either alter material dimensions (e.g., corrosion, wear, pitting, erosion, expansion, shrinkage, melting, yielding, fracture, cracking); or inhibit component operation: (i.e., moisture, blockage, sticking, etc.). Once the Degradation Mechanism(s) are identified, focus can be placed on the Degradation Influences.

**Degradation Influences** are adverse conditions that when present, result in equipment susceptibility to a Degradation Mechanism. Degradation Influences include loss of lubrication, moisture intrusion, contamination, aging, excessive flow, excessive force, and high resistance. ***Remember, Degradation Influences are not causal factors...they exist only because the causal factors allowed them to be present!***

### **Identifying Failure Modes, Failure Mechanisms, Degradation Mechanisms, and Degradation Influences**

When it comes to equipment failures, Support/Refute Methodology (S/RM) provides a sound approach for finding the links in our Failure Scenario. S/RM prompts the investigator to identify all possible ways a piece of equipment could fail such that it produces the undesirable consequence(s) experienced during the event. Use Attachment 13 as applicable.

Some of the possible Failure Modes may be readily refuted and eliminated from consideration. Others might only be eliminated as possibilities following detailed troubleshooting and testing. Use Attachment 13, Support / Refute Methodology, as applicable.

The investigator continues by identifying the possible Failure Mechanisms that could produce each of the remaining Failure Modes. The process of brainstorming and refuting continues on down through the Degradation Mechanisms and Degradation Influences until only one possible failure path is remaining.

**ATTACHMENT 11**  
**Sheet 3 of 4**  
**Equipment Performance Analysis**

Change Analysis is also particularly useful when it comes to equipment root cause analysis, and should be used in conjunction with S/RM. Change Analysis prompts the investigator to look for changes in equipment operation, maintenance, design, etc. that might explain why something that once worked fine isn't! Change Analysis also provides a method for comparing similar equipment that are experiencing dissimilar failure rates, thereby helping the investigator narrow in on differences that may hold the secret to why equipment is failing.

In conjunction with S/RM, Change Analysis, and other RCA techniques/approaches, one or more of the following information sources should be utilized when identifying, refuting, or validating possible Failure Modes, Failure Mechanisms, Degradation Mechanisms, and Degradation Modes for the equipment that failed:

- Troubleshooting
- Review of relevant operating experience (e.g., INPO Website searches, EPRI Documents, Vendor Bulletins, etc.) including EPIX.
- Interviews with subject matter experts, including engineering peers at other plants using similar equipment.
- Non-destructive/destructive testing and inspection.
- Pre-existing charts/tables outlining potential failure scenarios for components and systems.

Destructive/Non-Destructive testing and inspections can be expensive and must be considered on the basis of cost vs. gain. If testing and inspection is warranted, consult with your Management Sponsor and engineering supervision. NGG possesses limited capabilities to test certain components, such as some types of circuit cards. The use of an outside vendor or outside expertise should be considered for more difficult or complex equipment problems. This consultation should stress independence from the equipment manufacturer to obtain an unbiased investigation and root cause analysis.

**ATTACHMENT 11**  
**Sheet 4 of 4**  
**Equipment Performance Analysis**

**Finding the Root Cause of Equipment Failures**

At this point the Failure Scenario from Degradation Influences to adverse consequence(s) should be known. Degradation Influences are typically present for one of the following reasons:

1. Run-to-Failure – A conscious decision (right or wrong) was made to operate a component beyond its service life.
2. Design Deficiency – The design of systems or components is inadequate (did not account for certain conditions, doesn't meet license requirements, etc.).
3. Material/Fabrication Deficiency – Components supplied by the vendor did not meet design specifications (a part was manufactured incorrectly, wrong material specifications, etc.).
4. Improper Application – A component was utilized in an application for which it was never intended.
5. Inadequate Performance Monitoring – Insufficient attention to or tracking/trending of operational characteristics/parameters that may have indicated degradation was occurring.
6. Inadequately Scoped Preventive Maintenance Program – PMs were not optimized based upon vendor recommendations and/or operating experience.
7. Inadequately Scoped Predictive Maintenance Program – Predictive Maintenance was inadequate to provide early indication of degradation and/or the presence of Degradation Influences.
8. Human Performance Deficiency – Operation of equipment outside design specifications; improper maintenance or assembly; inadequate or untimely corrective action.

Since equipment must be subjected to Degradation Influences in order to fail, our root cause(s) will rest with the reason(s) why the Degradation Influences were present in sufficient magnitude or of sufficient duration to induce equipment failure. Attachment 8, Cause and Effect Analysis, provides guidance for asking the question "WHY?" until the Root Cause and Contributing Causes for the equipment failure have been determined.

**ATTACHMENT 12**  
**Sheet 1 of 13**  
**Human Performance Analysis**

**Human Performance & Significant Adverse Conditions**

Three out of four industry events occurring from 1995 – 1999 were “triggered” by human error, as opposed to originating with equipment failure. The phrase “triggered by” (as opposed to “caused by”) emphasizes the strides that have been made in understanding human performance. Most human errors are caused by weaknesses in the organization (including processes, supervision, procedures, etc.), rather than by simple mistakes on the part of the individual.

This premise is at odds with our tendency to lock onto the most obvious reason something undesirable happened (i.e., the worker was at fault!). Nuclear stations routinely require employees to do things that humans aren’t always good at, such as handling multiple tasks at the same time, responding rapidly to control signals, applying force consistently and precisely, and processing information deductively. Because of our inherent limitations, we must be provided with a strong support organization in order to succeed with the regularity demanded of nuclear plant workers.

**The Organization Influences Human Performance**

Human Performance is a closed system where any one of its component parts can affect others in the system. The organization provides inputs that will produce certain worker behaviors. The results of those behaviors, either good or bad, are fed back to the organization, which then has the option of modifying itself to produce different inputs. Results also directly reinforce the desirable or undesirable worker behaviors that produced them. For example, a worker is likely to duplicate behaviors if they produce results that receive positive recognition by peers or supervision.

Focus on inputs. Inputs equate to how well the worker is set up for success for a given situation or task. If the task demands (e.g., inherent difficulty, duration, etc.), workplace environmental factors (e.g. distractions, uncomfortable conditions) and/or personal limitations (e.g., stress level, fatigue) are so great as to exceed the worker’s current capabilities (e.g., experience, skill), then an **Error Likely Situation** exists. In effect, the individual is simply not equipped for the task (at least not right now) and is at increased risk of making an error if he or she proceeds.

The role of the organization is to predict, detect, and manage Error Likely Situations. One way to manage them would be avoid doing the task altogether. If avoidance is not a viable option, the organization can choose to accept the risk and proceed anyway. If the consequences of failure are too great, then the organization has a third option: neutralize error-likely situations with adequate defenses. Doing so requires careful identification of potential **Error Drivers** (time pressure, first-time evolution, confusing displays, overconfidence), and ensuring one or more barriers are in place to mitigate it. For example, we can offset worker inexperience with defenses like prescriptive procedures, peer checks and/or closer supervision. In any case, the organization is responsible for establishing the means by which workers can achieve the level of successful performance desired by management.

**ATTACHMENT 12**  
**Sheet 2 of 13**  
**Human Performance Analysis**

**Why do Human Errors Occur?**

One governing principle of human performance is that “all humans are fallible, and even the best make mistakes”. This means that each of us can...and do...make mistakes even when the task set before us is fully within our capabilities. Of course, relatively few significant events occur under these conditions. More often, the human errors that result in significant events occur because one of the following conditions exists:

- Barriers were not established to offset an existing Error Driver.
- Barriers were flawed or otherwise inadequate.
- Barriers were bypassed (either deliberately or unintentionally).

If barriers were needed but not established, then the root cause of the human error rests with the reasons WHY the organization did not do so. For example, barriers may not have been in place because:

- insufficient resources (budget, manpower)
- corrective actions for a known problem were inadequate/untimely
- industry operating experience wasn't used to prevent problems
- insufficient supervisory oversight (so we missed opportunities to reinforce expectations)

If barriers counted upon to offset an error precursor were flawed or otherwise inadequate, then the root cause of the human error rests with the reasons WHY the organization did not have solid defenses. For example:

- If our barrier was a procedure and we followed it, then the cause could be that the procedure is incorrect or confusing.
- If our barrier was having the task done by a qualified technician and it still wasn't satisfactorily completed, then the cause could be that the technician's training was inadequate.
- If our barrier was a second-party review of the completed test package and it didn't catch the fact that the test acceptance criteria wasn't met, then the cause may be that the reviewer wasn't clear as to the required scope of the review.

**ATTACHMENT 12**  
**Sheet 3 of 13**  
**Human Performance Analysis**

If barriers were bypassed, the root cause of the event rests with WHY the individual bypassed them. Until recently, it was widely accepted that the root cause for events occurring because adequate barriers were bypassed rested squarely at the worker-level. We now recognize that this isn't always the case. In fact, much of the time the reason WHY we bypassed the defensive barriers goes beyond the worker and rests at the organization-level. Accordingly, we need to look past the individual when doing root cause analysis and see if organizational weaknesses may be the real root cause of the event. For example:

- We might forget to perform a procedure step if we've been assigned too many tasks at one time. In this case, inadequate defensive barriers against one error precursor (too many concurrent tasks) caused us to circumvent a barrier (prescriptive procedures) for a second error precursor (worker inexperience).
- We might deliberately deviate from a procedure if supervisory personnel were more focused on our doing the job quickly than correctly. In this case, the organization is reinforcing undesirable behaviors in the workplace.
- We might not perform the required action because we never knew a procedure required it. Weaknesses in training or inadequate reinforcement of expectations by supervisory personnel may be at play here.

In each and every human performance-related event investigation, it is the investigator's responsibility to look past the human error that initiated the event and determine if organizational weaknesses are at the root of the problem. Superficial investigations that focus only on the individual are likely to result in corrective actions that only address symptoms, rather than causes of human errors, and are therefore incapable of preventing event recurrence.

### **The Down Side of Defense-in-Depth**

The nuclear industry tends to utilize an organizational & programmatic structure that provides multiple protective barriers for preventing or mitigating adverse consequences (e.g. procedures, training, supervision, self-verification). The premise is that, if some barriers erode or break down altogether, then another in the chain will prevent an event from occurring. Since events that challenge and make it through all these barriers are few and far between, organizations may not always exercise the vigilance necessary to identify gradual erosion of these barriers. The key to preventing events is to detect and correct weak or missing barriers that leave the individual worker's alertness as our last line of defense.

**ATTACHMENT 12**  
**Sheet 4 of 13**  
**Human Performance Analysis**

**Individual Culpability**

Individual culpability must be determined when investigating human performance-related events. Basically, is the individual culpable (personally at fault and therefore subject to correction and / or censure) in the event or not? If so, to what degree is he or she at fault? This information is needed to determine the scope of the corrective action plan.

The key questions relate to intention. If both the action and the consequences were intended, then this is likely in the realm of criminal behavior. **Unintended actions** define slips or lapses (the least blameworthy) while **unintended consequences** cover mistakes and violations. The decision tree usually treats the various error types in the same way, except with regard to the violations questions.

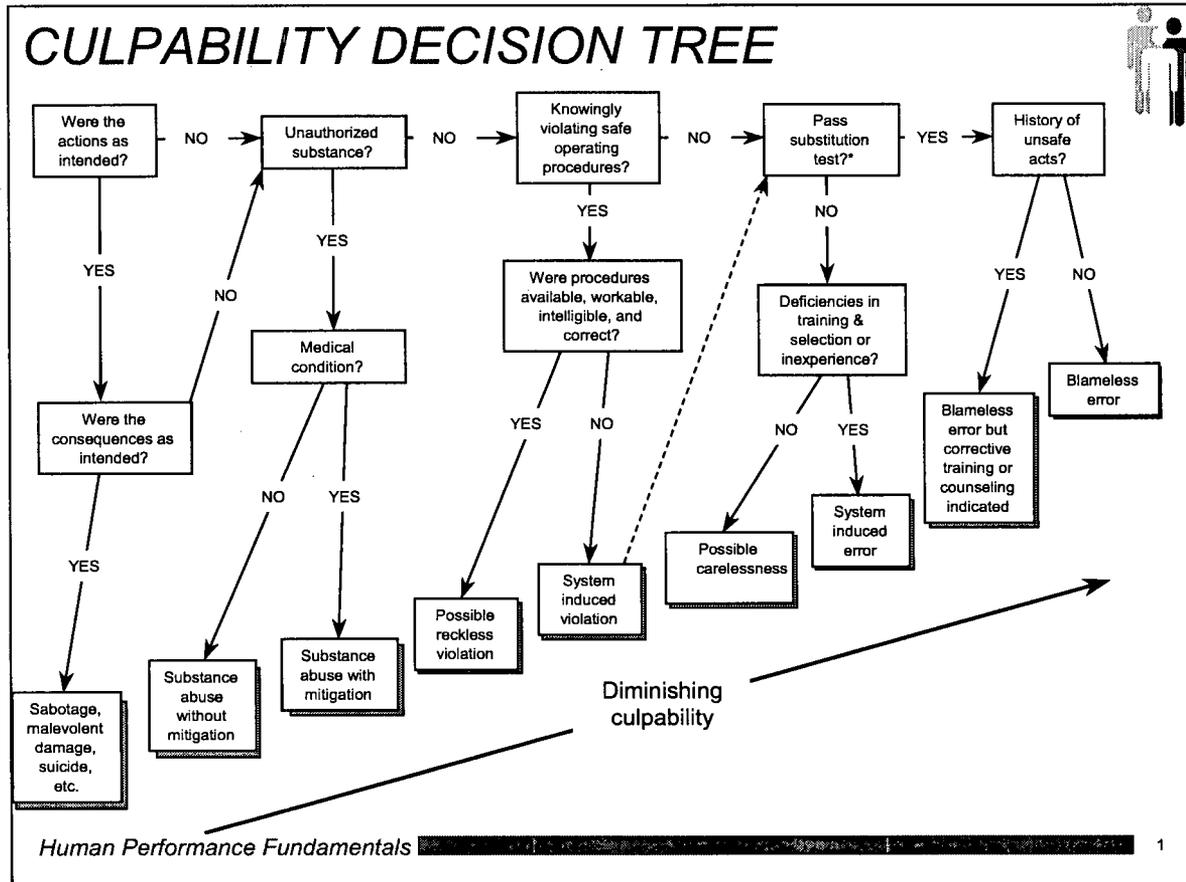
For mistakes, the question reads as shown in the figure below; but for slips and lapses, the questions relate to what the person was doing when the slip or lapse occurred. If the individual was knowingly engaged in violating procedures at the time, then the resulting error is more culpable. Violations increase both the likelihood of making an error and the chances of bad consequences.

The "unauthorized substance" question tries to establish whether or not the individual was under the influence of alcohol or drugs known to impair performance at the time the inappropriate acts was committed. Since use of unauthorized substances is usually a voluntary action, this would indicate a high level of culpability.

Experience suggests that 90 per cent or more inappropriate acts fall into the blameless category.

The following figure is a useful tool for nailing this down:

**ATTACHMENT 12**  
**Sheet 5 of 13**  
**Human Performance Analysis**



\* Substitution Test: YES indicates that another equally qualified individual would not likely make the same error.

**Culpability Decision Tree**

Each human error that directly affected the outcome of the event should be run through the CDT separately. CDT takes into consideration that a worker's inappropriate action may be:

- A deliberate act of sabotage
- A consequence of substance abuse
- A willful decision to take a shortcut
- The result of flaws in the system (bad procedures, etc.)

**ATTACHMENT 12**  
**Sheet 6 of 13**  
**Human Performance Analysis**

- The result of insufficient training
- The result of poor worker selection for a given task
- Symptomatic of an overall poor performance level for the individual
- A simple lapse on the part of a normally reliable worker

A key element of the CDT is the “Pass Substitution Test” block. This block forces the investigator to consider whether the event is isolated to a single individual or not. Basically, if another equally qualified person is likely to make the same error under the same circumstances, then the problem goes beyond the individual.

If the individual has little or no culpability for the event, then coaching on the event (lessons learned) and corrective measures to address organizational weaknesses that induced the human error are appropriate. These measures should focus on appropriate behaviors. In general, the progressive discipline program should not be used as a corrective action for an event unless the error that caused it is willful, negligent, or repetitive in nature. If this is the case then supervision will determine an appropriate course of action.

### **INVESTIGATING A HUMAN PERFORMANCE EVENT**

In each human performance event investigation, it is the investigator’s responsibility to look past the human error that initiated the event and determine if organizational weaknesses are the root of the problem. Investigations focused only on the individual are likely to result in corrective actions that only address symptoms, rather than human errors, and are therefore incapable of preventing event recurrence.

Use the Human Performance Evaluation Worksheet to document each error, inappropriate action, or latent condition that contributed to the event. Use information in this attachment to determine Error Mode and Error Drivers. If Error Drivers exist, the cause likely involves a latent organizational or programmatic weakness. A **LATENT ORGANIZATIONAL OR PROGRAMMATIC WEAKNESS** is an undetected deficiency in the organizational processes or values that create workplace conditions. The undetected deficiency provokes error or degrades the integrity of barriers. Incorporate identified failed barriers into the Event and Causal Factor Worksheet for further analysis.

A chart depicting categories of organizational and programmatic weakness is depicted on page 12 of this attachment.

**ATTACHMENT 12**  
**Sheet 7 of 13**  
**Human Performance Analysis**

HUMAN PERFORMANCE EVALUATION WORKSHEET				
<b>A. Description of Error (either latent or active):</b> Describe the inappropriate act: (Use a separate form for each error evaluated)				
<b>B. Error Mode:</b>	Rule-Based	Knowledge-Based	Skill-Based	
<i>Determine whether each error was a knowledge-, rule-, or skill-based error. Briefly state why the selection was made (e.g., this is a rule-based error because the technician failed to follow the procedure as written).</i>				
<b>C. Error Drivers –</b> <i>List those significant precursors/ drivers that apply and provide a brief factual explanation of why they apply. For example, imprecise communication habits – The technician did not repeat back the ordered action and the controller did not stop the technician to require an accurate repeat back before allowing the activity to proceed.</i>				
<b>If error precursors exist, the cause likely involves latent organizational weaknesses.</b>				
. N/A – No applicable drivers				
<b>D. Human Performance Tools for Individuals/Teams</b> <i>List those individual or team human performance tools that represent failed defenses against successful completion of the task. Provide a brief factual explanation of why these are considered failed defenses. Enter "N/A" if the error was not induced by poor individual or team performance.</i>				
<b>Human Performance Tools for Individuals and Teams</b>	Appropriate for Use in this task	Check if Used	Check if used but ineffective	Check if Represents a failed defense
N/A for this error				
1) Self Checking	1.	1.	1.	1.
2) Peer Checking	2.	2.	2.	2.
3) Independent Verification	3.	3.	3.	3.
4) Knowledge/Training	4.	4.	4.	4.
5) Procedure Use	5.	5.	5.	5.
6) Questioning Attitude	6.	6.	6.	6.
7) Place-Keeping	7.	7.	7.	7.
8) Effective Communication	8.	8.	8.	8.
9) Job Briefing/Reverse Briefing	9.	9.	9.	9.
10) Management/Supv. Involvement and Coaching	10.	10.	10.	10.
11) Turnovers	11.	11.	11.	11.
12) Other:	12.	12.	12.	12.
<b>Briefly explain why the checked items represent failed defenses:</b>				
<b>E. Management Control Systems – Failed Defenses</b> <i>List those "systems" that represent failed defenses against successful completion of the task. Provide a brief factual explanation of why these are considered failed defenses. Enter "N/A" if the error was not induced by poor management control systems.</i>				
<b>Management Control Systems / Failed Defenses, Organization Weaknesses</b>	4. Corrective Action Program	9. Values and Norms		
N/A for this error	5. Observation/Coaching	10. Planning and Scheduling		
1. Training	6. Goals and Priorities	11. Decision Making		
2. Procedures/Programs	7. Task Structure	12. Engineering Analysis		
3. Policies/Expectations/Standards	8. Organization, Roles, and Responsibilities	13. Other:		
<b>Briefly explain why the items checked represent failed defenses:</b>				

**ATTACHMENT 12**  
**Sheet 8 of 13**  
**Human Performance Analysis**

**LIST OF COMMON ERROR DRIVERS, BY TYPE**

Driver Code	1 – TASK DEMANDS	Driver Code	3 – INDIVIDUAL CAPABILITIES
1A	- Time Pressure (in a hurry)	3A	- Unfamiliarity with task/ First time
1B	- High workload (memory requirements)	3B	- Lack of knowledge (faulty mental model)
1C	- Simultaneous, multiple tasks	3C	- New technique not used before
1D	- Repetitive actions/Monotony	3D	- Imprecise communication habits
1E	- Irreversible actions	3E	- Lack of proficiency; Inexperience
1F	- Interpretation requirements	3F	- Indistinct problem-solving skills
1G	- Unclear goals, roles, or responsibilities	3G	- "Can do" attitude for safety-critical task
1H	- Lack of or unclear standards	3H	- Illness or fatigue; general health
1I	- Confusing procedure/Vague guidance	3I	- Unawareness of critical parameters
1J	- Excessive communication requirements	3J	- Inappropriate values
1K	- Delays: idle time	3K	- Major life event; medical, financial, emotional
1L	- Complexity/High information flow	3L	- Poor manual dexterity
1M	- Excessive time on task	3M	- Low self-esteem; moody
1N	- Long-term monitoring	3N	- Questionable ethics (bends the rules)
		3O	- Sense of Control. Learned helplessness
		3P	- Personality type
Driver Code	2 – WORK ENVIRONMENT	Driver Code	2 – NATURAL TENDENCIES/ HUMAN NATURE
2A	- Distractions/Interruptions	4A	- Stress
2B	- Changes/Departure from routine	4B	- Habit patterns
2C	- Confusing displays/controls	4C	- Assumptions
2D	- Work-around/OOS instrumentation	4D	- Complacency/Overconfidence
2E	- Hidden system responses	4E	- Mind set (intentions)
2F	- Unexpected equipment conditions	4F	- Inaccurate risk perception
2G	- Lack of alternative indication	4G	- Mental shortcuts or biases
2H	- Personality conflicts	4H	- Limited short-term memory
2I	- Back shift or recent shift change	4I	- Pollyanna effect
2J	- Excessive degree of group cohesiveness	4J	- Limited perspective (bounded rationality)
2K	- Production overemphasis	4K	- Avoidance of mental strain
2L	- Adverse physical climate (habitability)	4L	- Tunnel vision (lack of big picture)
2M	- No accounting of performance	4M	- "Something is not right"
2N	- Conflicting conventions; stereotypes	4N	- Pattern matching bias
2O	- Poor equipment layout; poor access	4O	- Social preference
2P	- Fear of consequences of error	4P	- Easily bored
2Q	- Mistrust among work groups	4Q	- Close-in-time cause-effect correlation
2R	- Meaningless rules	4R	- Difficult to see own errors
2S	- Unavailable parts or tools	4S	- Frequency & similarity bias
2T	- Acceptability of "cook-booking"	4T	- Overload bias
2U	- "Rule book" culture	4U	- Imprecise physical actions
2V	- Equipment sensitivity (inadvertent actions)	4V	- Limited attention span
2W	- Lack of clear strategic vision or goals	4W	- Spatial disorientation
2X	- Identical & adjacent displays or controls	4X	- Physical reflex
2Y	- Out of service warning systems	4Y	- Anxiety (involving uncertainty)
2Z	- Nuisance alarms		

\* The items in "Bold" are among the most common error precursors and are described on the following pages.

**ATTACHMENT 12**  
**Sheet 9 of 13**  
**Human Performance Analysis**

**Task Demand as an Error Driver**

Task Demands	Description
Time pressure	Urgency or excessive pace required to perform action or task, usually in less time than humans are capable; No spare time.
High workload (memory requirements)	Mental demands on individual to maintain high levels of concentration, e.g., scanning, interpreting, deciding, while requiring recall of excessive amounts of information.
Simultaneous, multiple tasks	Performance of two or more activities, either mental or physical, possibly resulting in divided attention, mental overload, or reduced vigilance on one task or the other.
Repetitive actions / Monotony	Inadequate level of mental activity due to performance of repeated actions; boring. Insufficient information exchange at the job-site to help individual reach and maintain an acceptable level of alertness.
Irrecoverable/irreversible actions	Action that, once taken, cannot be recovered without some significant delay despite best efforts; No obvious means of reversing an action.
Interpretation requirements	Situations requiring "in-field" diagnosis potentially leading to misunderstanding or application of wrong rule or procedure.
Unclear goals, roles, or responsibilities	Unclear work objectives or expectations; Uncertainty about the duties an individual is responsible for in a task which involve other individuals; Duties that are incompatible with other individuals.
Lack of or unclear standards	Ambiguity or misunderstanding about acceptable behaviors or results; if unspecified, standards default to those of the front-line worker (good or bad).

**ATTACHMENT 12**  
**Sheet 10 of 13**  
**Human Performance Analysis**

**Work Environment as an Error Driver**

Work Environment	Description
Distractions / Interruptions	Conditions of either task or work environment requiring the individual to stop and restart a task sequence diverting one's attention to and from the task at hand.
Changes / Departure from routine	Departure from a well-established routine; Unfamiliar or unforeseen task or jobsite conditions that potentially disturb individual's understanding of task or equipment status.
Confusing displays / Controls	<p>Characteristics of installed displays and controls that could possibly confuse or exceed working memory capability of an individual.</p> <p>Examples (not limited to the following):</p> <ul style="list-style-type: none"> <li>• missing or vague content (insufficient or irrelevant)</li> <li>• lack of indication of specific process parameter</li> <li>• illogical organization and/or layout</li> <li>• insufficient identification of displayed process information</li> <li>• controls placed close together without obvious ways to discriminate conflicts between indications</li> </ul>
Work-around / OOS instrumentation	Uncorrected equipment deficiency or programmatic defect requiring compensatory or non-standard action by a worker to comply with a requirement; Long-term material condition problems.
Hidden system response	System response invisible to individual after manipulation. Lack of information conveyed to individual that previous action had any influence on the equipment or system.
Unexpected equipment condition	System or equipment status not normally encountered creating an unfamiliar situation for the individual.
Lack of alternative indication	Inability to compare or confirm information about system or equipment state due to absence of instrumentation.
Personality conflict	Incompatibility between two or more individuals working together on a task causing a distraction from task due to preoccupation with personal difference with another individual.

**ATTACHMENT 12**  
**Sheet 11 of 13**  
**Human Performance Analysis**

**Individual Capability as an Error Driver**

Individual Capabilities	Description
Unfamiliarity with task / First time	Unawareness of task expectations or performance standards; First time to perform a task (never; not performed in given time; serious procedure change).
Lack of knowledge (mental model)	Unawareness of factual information necessary for successful completion of task; Lack of practical knowledge about the performance of a task.
New technique not used before	Lack of knowledge or skill with a specific work method required for performing a task.
Imprecise communication habits	Verbal communication habits or means that do not enhance accurate understanding by all members involved in an exchange of information.
Lack of proficiency / Inexperience	Degradation of knowledge or skill with a task due to infrequent performance of the activity.
Indistinct problem-solving skills	Unsystematic response to unfamiliar situations; inability to develop strategies to resolve problem scenarios without excessive use of trial-and-error or reliance on previously successful solutions; Unable to cope with changing plant conditions.
"Can Do" attitude for crucial tasks	Personal belief in prevailing importance of accomplishing the task (production) without consciously considering associated hazards; Perception of invulnerability while performing a particular task.
Illness / Fatigue	Degradation of a person's physical or mental abilities due to a sickness, disease, or debilitating injury; Lack of adequate physical rest to support acceptable mental alertness and function.

**ATTACHMENT 12**  
**Sheet 12 of 13**  
**Human Performance Analysis**

**Natural Tendencies / Human Nature as an Error Driver**

Natural Tendencies / Human Nature	Description
Stress	Mind's response to the perception of a threat to one's health, safety, self-esteem, or livelihood if task not performed to standard; Responses may involve anxiety, degradation in attention, reduction in working memory, poor decision making, transition from accurate to fast; Degree of stress reaction dependent on individual's experience with task.
Habit patterns	Ingrained or automated pattern of actions attributable to repetitive nature of a well-practiced task; Inclination formed for particular train/unit due to similarity to past situations or recent work experience.
Assumptions	Suppositions made without verification of facts, usually based upon perception of recent experience; Believed to be fact; Stimulated by inability of human mind to perceive all facts pertinent to a decision; similar to attempting to see all the objects in a locked room through a door's keyhole.
Complacency / Overconfidence	A "Pollyanna" effect leading to a presumption that all is well in the world, and that everything is ordered as expected; Self satisfaction or overconfidence, with a situation unaware of actual hazards or dangers; particularly evident after 7-9 years on the job; Underestimating the difficulty or complexity of a task based upon past experiences with task.
Mind set (intentions)	Tendency to "see" only what the mind is tuned to see (intention); preconceived idea. Information that doesn't fit a mind set may not be noticed and vice versa; may miss information that is not expected or may see something that is not really there; contributes to difficulty in detecting one's own error(s).
Inaccurate risk perception	Personal appraisal of hazards and uncertainty based on either incomplete information or assumptions; Unrecognized or inaccurate understanding of a potential consequence or danger. Degree of risk-taking behavior based upon individual's perception of possibility of error and understanding of consequences.
Mental shortcuts (biases)	Human tendency to look for or see patterns in unfamiliar situations; application of thumb-rules or "habits of mind" (heuristics) to explain unfamiliar situations: <ul style="list-style-type: none"> <li>* confirmation bias</li> <li>* frequency bias</li> <li>* similarity bias</li> <li>* oversimplification bias</li> <li>* overload bias</li> <li>* order bias</li> <li>* close in time</li> </ul>
Limited short-term memory	The mind's "workbench" for problem-solving and decision-making; the temporary, attention-demanding storeroom we use to remember new information; Involved during learning, storing, and recalling information; forgetful; Unable to accurately attend to more than 2 or 3 channels of information (or 5 to 9 bits of data) simultaneously.

**ATTACHMENT 12**  
**Sheet 13 of 13**  
**Human Performance Analysis**

**Common Organizational Weaknesses**

Category	
Training	<ul style="list-style-type: none"> <li>• Lack of effective training</li> <li>• No task qualification requirement when the task is skill-based</li> <li>• Focus on lower level of cognitive knowledge</li> <li>• Failure to have management involved in training</li> <li>• Training not consistent with plant equipment, procedures or process</li> </ul>
Communication	<ul style="list-style-type: none"> <li>• Failure to reinforce use of the phonetic alphabet</li> <li>• Failure to reinforce use of 3-way communications</li> <li>• Failure to use specific unit ID numbers in procedures</li> <li>• Unclear priorities or expectations</li> <li>• Unclear roles and responsibilities</li> </ul>
Planning and Scheduling	<ul style="list-style-type: none"> <li>• Not anticipating failures and providing contingencies</li> <li>• Not considering multiple components out of service</li> <li>• Not providing required materials or procedures</li> <li>• Over scheduling resources</li> <li>• Tunnel vision/failure to consider misoperation or damage to adjacent equipment</li> <li>• Specific type of work not performed</li> <li>• Specific type of issue not addressed</li> <li>• Inadequate resources assigned</li> </ul>
Design or Process Change	<ul style="list-style-type: none"> <li>• Inadequate involvement of users in design change Implementation</li> <li>• Inadequate training</li> <li>• Inadequate contingencies</li> </ul>
Values, Priorities, Policies	<ul style="list-style-type: none"> <li>• Management polices discourage line input</li> <li>• Too high priority placed on schedules</li> <li>• Willingness to accept degraded conditions or performance</li> <li>• Management failure to recognize the need for or importance of related program</li> </ul>
Procedure Development or Use	<ul style="list-style-type: none"> <li>• Human factors not considered in procedure development and implementation</li> <li>• Failure to perform procedure verification or validation</li> <li>• Failure to reference procedure during task performance</li> <li>• Assumptions made in lieu of procedure guidance</li> <li>• Omission of necessary functions in procedures</li> </ul>
Supervisory Involvement	<ul style="list-style-type: none"> <li>• Failure to perform management observations and coaching</li> <li>• Not correcting poor performance or reinforcing good performance</li> <li>• Unassigned or fragmented responsibility and accountability</li> <li>• Inadequate program oversight</li> </ul>
Organizational Interfaces	<ul style="list-style-type: none"> <li>• Unclear interfaces for defining work priorities</li> <li>• Lack of clear lines of communications between organizations</li> <li>• Conflicting goals or requirements between programs</li> <li>• Lack of Self Assessment monitoring</li> <li>• Lack of measurement tools for monitoring program performance</li> <li>• Lack of interface between programs</li> </ul>
Work Practices	<ul style="list-style-type: none"> <li>• Failure to reinforce use of established error prevention tools and techniques (human performance tools)</li> </ul>

**ATTACHMENT 13**  
**Sheet 1 of 2**  
**Support / Refute Methodology**

Identify as many potential Failure Modes as possible. Organize and analyze the available objective evidence to determine which potential Failure Modes are supported or refuted. This comparison of evidence to the potential Failure Modes begins a process of eliminating from further consideration Failure Modes that are refuted by the evidence.

The process of elimination proceeds by asking, "Is there evidence to refute the possible failure mode?" If the answer is yes, the failure mode under examination is eliminated. Otherwise, it remains open for further analysis. For those failure modes with no or inadequate refuting evidence, more information is required. Develop actions or differential tests to provide the missing refuting information and pinpoint true failure modes. These tests may include:

- Taking more data through a test run of the equipment,
- Performing destructive examination of more failed parts,
- Testing changes in equipment operation or design.

Update the support/refute matrix with new information as it accumulates. As the quantity of data and information increases, the un-refuted failure modes decrease. In this way, the root cause and contributing causes are isolated. Do not discard any failure mode that cannot be refuted or disproved. If there is more than one failure mode that cannot be refuted by the process of elimination and differential tests, consider all of them to be true failure modes. Do not eliminate any one based on relative probabilities of occurrence.

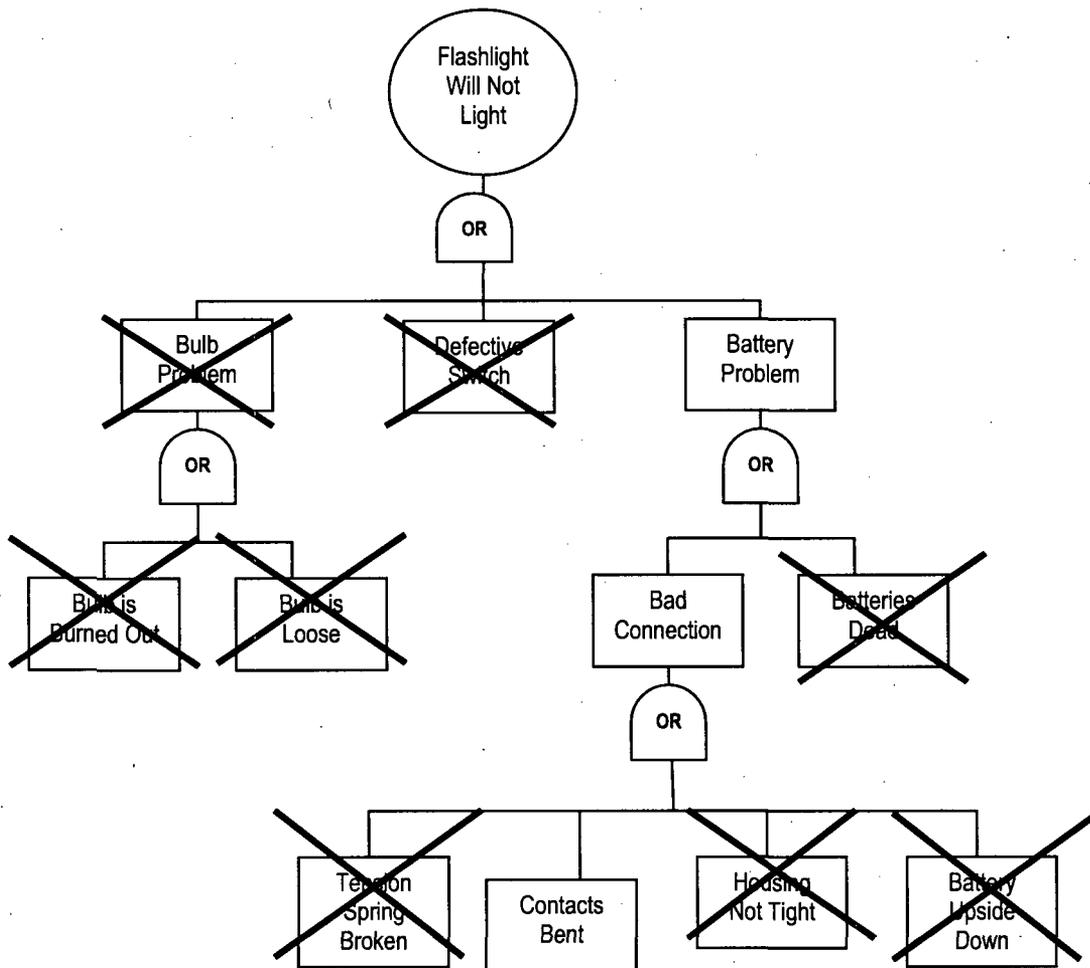
Review the supporting evidence (primary and secondary) to all remaining (un-refuted) failure modes. The root cause is typically the failure mode(s) that has not been refuted by the process above and is supported by solid evidence.

<b>Support/Refute Matrix</b>			
NCR Number: _____		Date: _____	
<b>Problem Statement:</b>			
Failure Modes/Cause	Supporting Evidence	Refuting Evidence	Actions Required to Refute/Support
<b>Action Plan:</b>			

**ATTACHMENT 13**  
**Sheet 2 of 2**  
**Support / Refute Methodology**

Decide which inputs to investigate first. Some investigators may prefer to begin with the most probable scenario, while others prefer to start with the scenario considered easiest to confirm or refute. This phase may require interviews, document reviews, walk downs, and other investigative activities in order to eliminate and/or confirm possibilities. Deductive reasoning may be employed as well. For example, elimination of one input to an AND logic gate would eliminate from consideration all other inputs to that gate as well.

Refuting all possible inputs to a higher-tier input eliminates it as a possible input to the event being analyzed. Continue investigating and eliminating possibilities until only one credible failure path, supported by factual information, is evident.



ATTACHMENT 14  
 Sheet 1 of 1  
**Significant Adverse Condition Investigation Strategy**  
 FORM CAP-NGGC-0205-14-9

**Action Request Number:**

**Sponsoring Manager:**

**Qualified Significant Adverse Condition Investigator / Team Lead:**

**Team Members:** (List the names of all investigators. Identify the approximate resource commitment, e.g., full-time or part-time and number of hours. – Reference Section 9.1.1)

**Problem Description:** (Reference Section 9.1.2)

**Investigation Strategy:** (The scope of the investigation should be clearly stated. The scope may include aspects to be investigated (Human, Organization & Programmatic, Equipment), investigation methods techniques, allocation of resources, schedule for investigation activities, and deliverables necessary to complete the task.)

TECHNIQUE/APPROACH	PURPOSE	ATTACH. NO.
Barrier Analysis	To identify physical and administrative barriers and determine their effectiveness.	7
Cause & Effect Analysis (Why Staircase)	Analyzes the relationship between cause and effect by asking the question "Why?"	8
Change Analysis	Provides a starting point when causes of inappropriate action are obscure, and / or when you don't know where to start.	9
Common Cause Analysis	Analyzes a Trend, or multiple similar events to determine if there are common failure modes	10
Equipment Performance Analysis	Analyzes damage to, or degradation of a System, Structure, or Component	11
Human Performance Analysis	Analyzes human performance that deviates from the expected	12
Support / Refute Methodology	Systematically eliminates possible failure modes until one or more failure mode cannot be refuted and is substantiated by the evidence.	13

**Immediate Corrective Actions:** (Corrective actions that will be implemented until CAPRs are implemented, if applicable.)

**Investigation Milestones**

- |  |            |
|--|------------|
| 1. Event Date  | (xx/xx/xx) |
| 2. Investigation Kick-off                                | (xx/xx/xx) |
| 3. Investigation Strategy Review with Management Sponsor | (xx/xx/xx) |
| 4. Management Sponsor Update(s)                          | (xx/xx/xx) |
| 5. Review by Root Cause Review Team (RCRT)               | (xx/xx/xx) |
| 6. Review by Quality Review Board (QRB)                  | (xx/xx/xx) |
| 7. Sponsoring Manager Approval of Investigation Report   | (xx/xx/xx) |
| 8. Review by PNSC (if applicable)                        | (xx/xx/xx) |
| 9. Significant Adverse Condition Investigation Due Date  | (xx/xx/xx) |

Prepared By: \_\_\_\_\_ (Name) \_\_\_\_\_ Date

Approved By: \_\_\_\_\_ (Sponsoring Manager) \_\_\_\_\_ Date

**ATTACHMENT 15**  
**Sheet 1 of 1**  
**Effective Corrective Action Plans**

**Validate the proposed corrective action plan by considering if it meets the following criteria:**

- Specific (can be clearly determined what is needed to complete the action)
- Measurable (effectiveness can be determined)
- Actionable (revise, implement, install – NOT review, develop, consider)
- Reasonable/Realistic (within the capability of management to implement)
- Timely
- Effective (both cost effective and effective in correcting the problem and/or preventing recurrence – commensurate to the safety significance of the event)
- Reviewed (monitored and/or reviewed for effectiveness)
- Compatible (with other programs, licensing basis, and/or other regulatory commitments)
- Addresses the cause without creating another undesirable situation

**Understand the difference between CORR and ENHN Assignments:**

- CORRs are required to fix Causal Factors that contributed to the event/condition. These are items that require the deficiency to be fixed.
- ENHNs are used to address potential Improvement Items (help improve the involved process, but did not cause the event / condition).
- CORRs should not be used to address enhancements.

**Ensure CAPR will clearly result in long-term correction. The following actions are typically NOT appropriate CAPR:**

- Evaluating or reviewing a procedure, process, design, etc.
- Request to review, evaluate, or obtain approval
- One-Time discipline, coaching, or counseling of individuals without determination of individual culpability.
- Short term actions such as tailgate meetings, stand downs, memos
- Reinforcing or clarifying expectations (unless done systematically)
- Reviewing “extent of condition”

**Corrective Action which Involves Multiple Organizations or Supporting Activities to Implement:**

- The corrective action assignment (CAPR, CORR, CORL) will have a completion date established for final implementation.
- Sub-assignments may be used if supporting activities are required to achieve the overall objective.

**Establish appropriate due dates. In addition to CAP-NGGC-0200 requirements, consider the following:**

- How soon and frequently the problem could recur
- Probability and magnitude of consequence if the problem recurs.
- Obtain the responsible unit’s concurrence with the action and completion date.
- Corrective action(s) to revise NGGC procedures should not be issued without the concurrence of the applicable NGG Fleet Functional Area Manager.

ATTACHMENT 16  
Sheet 1 of 4  
**Significant Adverse Condition Investigation Report**  
Form CAP-NGGC-0205-16-9

**EXECUTIVE SUMMARY**

**Action Request Number:**

**Event Date:**

**Sponsoring Manager:**

**Investigation Team:**

**Summary of Event:**

**Summary of Root Cause(s):**

**Summary of Corrective Action(s) to Prevent Recurrence (CAPR):** include completion date for completed CAPR(s) and due date for planned CAPR(s).

ATTACHMENT 16  
Sheet 2 of 4  
**Significant Adverse Condition Investigation Report**  
Form CAP-NGGC-0205-16-9

**Action Request Number:**  
**Facility:**  
**Unit:**

**Event Time:**  
**Event Date:**  
**Investigator:**

**1. Event Description**

Using information provided in the NCR, summarize the event. Describe the observed condition. What was found or occurred.

**2. Problem Description**

Clearly identify the problem to be investigated. Consider elements such as the following, as applicable:

- What Should Be: the requirement, standard, norm, or expectation
- What Is: the existing, as-found condition
- What Is Wrong: the gap or deviation between 'what is' and 'what should be'
- The Consequences: the adverse plant / regulatory / personnel affect
- The Extent of Condition that was initially identified
- Criteria used to classify event as significant adverse condition

**3. Investigation Summary**

- Investigative Techniques employed / reasoning for not using structured Investigative Techniques
- Specific activities being performed
- Work Group / Experience level of personnel involved
- Timeline of occurrences / actions leading to the event
- Environmental conditions and potential error precursors
- Other relevant information
- Include sufficient detail to support conclusions.

Provide a conclusion as to the relevance of the following perspectives:

**3a. Human Performance Factors – Error Precursors**

- Task Demands – time pressure, high workload, multiple tasks, confusing guidance, etc.
- Work Environment – distractions, changes from routine, confusing displays, adverse physical climate, etc.
- Individual Capabilities – unfamiliarity, new technique, inexperience, illness, etc.
- Natural Tendencies/Human Nature – stress, assumptions, habit, mental shortcuts, etc.

**3b. Latent Organizational/Programmatic Weakness**

- Training
- Communication
- Planning and Scheduling
- Design or Process change
- Values, Priorities, Policies
- Procedure Development or Use
- Supervisory Involvement
- Organizations Interfaces

**3c. Equipment Malfunctions**

- Failure Mode
- Failure Mechanism
- Degradation Mechanism
- Degradation Influences
  - Equipment performance issues
  - Equipment design limitations
  - Clarity of expectations/standards
  - Standards reinforcement
  - Trending and monitoring
  - Observation Program effectiveness

ATTACHMENT 16  
Sheet 3 of 4  
**Significant Adverse Condition Investigation Report**  
Form CAP-NGGC-0205-16-9

**3d. Nuclear Safety Culture Aspects (Refer to Attachment 18, Worksheet for Evaluation of NRC Safety Culture Attributes)**

- Decision Making
- Resources
- Work Control
- Work Practices
- Corrective Action Program
- Operating Experience
- Self and Independent Assessments
- Environment for Raising concerns
- Preventing, Detecting, and Mitigating Perceptions of Retaliation
- Accountability
- Continuous Learning Environment
- Organizational Change Management
- Safety Policies

**4. Previous Operating Experience (Internal and External)**

Provide a conclusion as to the relevance of the OE reviewed from the following perspectives:

- Does OE exist that would have prevented the event?
- Ensure that "Lessons Learned" from relevant OE are considered during the development of the Corrective Action Plan.
- Determine if this event involves program or procedure elements that implement INPO SOER, SER or SEN actions.
- Is the current event a Repeat Event? If so, then the investigation should address why previous actions were not effective in preventing the event.

**5. Extent of Cause**

- Is there a set of products, components, processes or persons that possess similar susceptibility to the identified causal factors? If so, describe. What other conditions are at risk due to the same cause?

**6. Extent of Condition**

- Is there a set of products, components or processes that exhibit the same deficiency as the investigated condition? If so, describe. How broad is the problem?

**7. Safety Significance**

- How significant was the occurrence relative to actual and potential plant nuclear safety and personnel safety?

**8. Summary of Results**

- Root Cause (or Selected Cause if appropriate)
- Contributing Cause(s) if applicable

**9. Inappropriate Acts / Equipment Malfunctions/Causal Factors/Corrective Action Plan**

- Complete the below table to identify the required information
- Place information in the non-shaded areas only. This is to help align the cause for each Inappropriate Act and to ensure that each Cause is linked to and addressed with a Corrective Action.
- Clearly describe each causal factor as to how it applies to the investigated event / condition. (Do not just cut and paste the cause definition from CAP-NGGC-0206). Designate each causal factor as "Root" or "Contributing"
- The "Code" column is used to identify the Cause Code (CAP-NGGC-0206 Attachment 2)
- The "ORG" column is used to identify the organization responsible for the Inappropriate act.
- Designate the type of action (CAPR, CORR or ENHN). Reference attachment 15 for guidance as needed.
- For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability, for example; Work Order "ABC" was completed and approved on mm/dd/yy, Engineering Change Request "XYZ" was completed in the field on mm/dd/yy, or Material Evaluation was completed and approved on mm/dd/yy.

ATTACHMENT 16

Sheet 4 of 4

**Significant Adverse Condition Investigation Report**

Form CAP-NGGC-0205-16-9

**Corrective Action Plan**

	DESCRIPTION	CAUSE	CODE	ORG	CORRECTIVE/ACTION	ASSIGNMENT TYPE*	ASSIGNEE/ CONCURRENCE	DUE OR COMPLETION DATE**
<b>ADVERSE CONDITION</b>	Describe the observed condition. What was found or occurred. If no adverse condition exists, recommend downgrading to a Priority 5 NCR	N/A	N/A	N/A	Actions taken or required to correct the CONDITION	CORR	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>N/A or EQ Malfunction</b>	Describe <b>HOW</b> the condition occurred. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.	Describe <b>WHY</b> this happened and identify the type of cause as Root, Contributing, or Common.	Enter Cause Code from list in CAP-NGGC-0206	Responsible Group – list group responsible for individual error or organizational weakness. Not required for equipment malfunctions.	Actions taken or required to correct the identified CAUSE	Must be CAPR for Root Cause Must be CORR for Contributing or Common Cause	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>OTHER</b>	N/A	N/A	N/A	N/A	Actions to improve efficiency or enhance performance	ENHN if not correcting the condition or the cause	Individual responsible for action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>OTHER</b>	N/A	N/A	N/A	N/A	Effectiveness Review	EREV	Individual responsible for action	Due date to be complete.

\* Designate which assignments are Long Term Corrective Action (non-outage related LTCA requires approval by DSO or PGM for plant sites, Director - Fleet Support Services for corporate).

\*\*Provide justification for corrective actions to prevent recurrence (CAPR) with initial due date that exceeds 90 days and for corrective actions (CORR) with initial due date that exceeds 120 days.

**10. Effectiveness Review Criteria:**

**11. Basis, If Effectiveness Review is waived:**

**12. PNSC Review Required?**

• Refer to applicable Implementing procedure

YES

NO

ATTACHMENT 17

Sheet 1 of 3

**Significant Adverse Trend/Common Cause Analysis (CCA) Investigation Report**

Form CAP-NGGC-0205-17-9

**EXECUTIVE SUMMARY**

**Action Request Number:**

**Trend Identification Date:**

**Sponsoring Manager:**

**Investigation Team:**

**Summary of Events:**

**Summary of Common Cause(s):**

**Summary of Corrective Action(s) to Prevent Recurrence (CAPR):** include completion date for completed CAPR(s) and due date for planned CAPR(s).

ATTACHMENT 17

Sheet 2 of 3

**Significant Adverse Trend/Common Cause Analysis (CCA) Investigation Report**

Form CAP-NGGC-0205-17-9

**Action Request Number:**

**Facility:**

**Unit:**

**Event Date:**

**Investigator:**

**1. Event Descriptions**

Using information provided in the NCR, describe the Trend. List or reference the associated NCRs.

**2. Trend Description**

- Develop a clear statement of the purpose and desired outcomes from the Trend Investigation.
- Identify the criteria evaluated for collective significance and common cause.
- Identify the data sources used.
- Summarize the review to determine if the identified commonalities are sufficient to warrant Common Cause Analysis.
- If further analysis is not warranted, document the basis and do not proceed further.
- If further analysis is warranted, provide a problem statement clearly establishing the focus of the Common Cause Analysis.

**3. Summary of Common Cause Analysis**

Briefly describe the methods and analysis that were used to develop and analyze causal theories.

- For each Causal Factor provide a numerical designator so that linkage can be established between each Causal Factor and the Corrective Action Plan
- For each Causal Factor select an applicable Cause Code from CAP-NGGC-0206, and provide the selected code in this report.
- For each Causal Factor specify the Type as Common Cause

**4. Previous Operating Experience (Internal and External)**

Provide a conclusion as to the relevance of the OE reviewed from the following perspectives:

- Does OE exist that would have prevented the event?
- Ensure that "Lessons Learned" from relevant OE are considered during the development of the Corrective Action Plan.
- Determine if this event involves program or procedure elements that implement INPO SOER, SER or SEN actions.
- Is the current event a Repeat Event? If so, then the investigation should address why previous actions were not effective in preventing the event.

**5. Extent of Cause**

Is there a set of products, components, processes or persons that possess similar susceptibility to the identified causal factors? If so, describe. What other conditions are at risk due to the same cause? If so, describe.

**6. Extent of Condition**

Is there a set of products, components or processes that exhibit the same deficiency as the investigated condition? If so, describe.

**7. Safety Significance**

How significant was the Trend relative to actual and potential plant and personnel safety?

**8. Summary of Results**

- Common Cause(s)
- Contributing Cause(s) if applicable

**9. Causal Factors/Corrective Action Plan**

- Complete the below table to identify the required information (Non-shaded areas).
- For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability, for example; Work Order "ABC" was completed and approved on mm/dd/yy, Engineering Change Request "XYZ" was completed in the field on mm/dd/yy, or Material Evaluation was completed and approved on mm/dd/yy.

ATTACHMENT 17

Sheet 3 of 3

Significant Adverse Trend/Common Cause Analysis (CCA) Investigation Report

Form CAP-NGGC-0205-17-9

Corrective Action Plan

	DESCRIPTION	CAUSE	CODE	ORG	CORRECTIVE ACTION	Assignment Type*	ASSIGNEE/ CONCURRENCE	DUE OR COMPLETION DATE**
ADVERSE CONDITION	Describe the adverse trend. If no adverse trend exists, recommend downgrading to a Priority 5 NCR	N/A	N/A	N/A	Actions taken or required to correct the CONDITION	Must be CORR	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
I/A or EQ Malfunction	Describe HOW the condition occurred. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.	Describe WHY this happened. Identify the type of cause as Common.	Enter Cause Code from list in CAP-NGGC-0206	Responsible Group – list group responsible for individual error or organizational weakness. Not required for equipment malfunctions.	Actions taken or required to correct the identified CAUSE of the trend.	Must be CAPR for the Common Cause	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability
OTHER	N/A	N/A	N/A	N/A	Actions to improve efficiency or enhance performance	ENHN if not correcting the condition or the cause	Individual responsible for action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
OTHER	N/A	N/A	N/A	N/A	Effectiveness Review	EREV	Individual responsible for action	Due date to be complete

\*Designate which assignments are Long Term Corrective Action (non-outage related LTCA requires approval by DSO or PMG for plant sites, Director- Fleet Support Services for corporate).

\*\*Provide justification for corrective actions to prevent recurrence (CAPR) with initial due date that exceeds 90 days and for corrective actions (CORR) with initial due date that exceeds 120 days.

10. Effectiveness Review Criteria:

11. Basis, If Effectiveness Review is waived:

12. PNSC Review Required?

- Refer to applicable Implementing procedure

YES

NO

**Worksheet for Evaluation of NRC Safety Culture Aspects****Safety Culture Aspect**

- 1. Decision-making** – Were decisions made that demonstrate that nuclear safety is an overriding priority?
- Were safety-significant or risk-significant decisions made using a systematic process, especially when faced with uncertain or unexpected plant conditions, to ensure safety is maintained? Did this include formally defining the authority and roles for decisions affecting nuclear safety, communicating these roles to applicable personnel, implementing these roles and authorities as designed, and obtaining interdisciplinary input and reviews on safety-significant or risk-significant decisions?
  - Were conservative assumptions used in decision-making that adopts a requirement to demonstrate that the proposed action is safe in order to proceed rather than a requirement to demonstrate that it is unsafe in order to disapprove the action? Were effectiveness reviews of safety-significant decisions conducted to verify the validity of the underlying assumptions, identify possible unintended consequences, and determine how to improve future decisions?
  - Were the decisions communicated, along with the basis for the decisions, to personnel who have a need to know the information in order to perform work safely, in a timely manner?
- 2. Resources** – Did we ensure that personnel, equipment, procedures, and other resources are available and adequate to assure nuclear safety? Specifically, those necessary for:
- Maintaining long-term plant safety by maintenance of design margins, minimization of longstanding equipment issues, minimizing preventative maintenance deferrals, and ensuring maintenance and engineering backlogs that are low enough to support safety?
  - Training of personnel and sufficient qualified personnel to maintain work hours within working hour guidelines?
  - Complete, accurate, and up-to-date design documentation, procedures, and work packages, and correct labeling of components?
  - Adequate and available facilities and equipment, including physical improvements, simulator fidelity and emergency facilities, and equipment?
- 3. Work Control** – Were planning and coordination of work activities consistent with nuclear safety? Specifically (as applicable):
- Appropriate plans work activities by incorporating:
    - risk insights?
    - job site conditions, including environmental conditions that may impact human performance; plant structures, systems, and components; human-system interface; or radiological safety.
    - the need for planned contingencies, compensatory actions, and abort criteria?
  - Appropriately coordinated work activities by incorporating actions to address:
    - the impact of changes to the work scope or activity on the plant and human performance?
    - the impact of the work on different job activities and the need for work groups to maintain interfaces with offsite organizations and communicate, coordinate, and cooperate with each other during activities in which interdepartmental coordination is necessary to assure plant and human performance?
    - the need to keep personnel apprised of work status, the operational impact of work activities, and plant conditions that may affect work activities?
    - plan work activities to support long-term equipment reliability by limiting temporary modifications, operator work-arounds, safety systems unavailability, and reliance on manual actions? Is maintenance scheduling more preventive than reactive?

ATTACHMENT 18

Sheet 2 of 4

**Worksheet for Evaluation of NRC Safety Culture Aspects**

- 4. Work Practices** – Did personnel work practices support human performance? Specifically (as applicable):
- Were human error prevention techniques communicated, such as holding pre-job briefings, self- and peer checking, and proper documentation of activities? Were these techniques used commensurate with the risk of the assigned task, such that work activities were performed safely? Were personnel fit for duty? In addition, did personnel stop in the face of uncertainty or unexpected circumstances?
  - Were expectations defined and effectively communicated regarding procedural compliance, and personnel following procedures?
  - Was supervisory and management oversight of work activities, including contractors, such that nuclear safety is supported?
- 5. Corrective Action Program** – Did we ensure that issues potentially impacting nuclear safety were promptly identified, fully evaluated, and that actions are taken to address safety issues in a timely manner, commensurate with their significance? Specifically (as applicable):
- Implement a corrective action program with a low threshold for identifying issues such that the licensee identifies issues completely, accurately, and in a timely manner commensurate with their safety significance?
  - Periodically trend and assess information from the corrective action program and other assessments in the aggregate to identify programmatic and common cause problems and communicate the results of the trending to applicable personnel?
  - Thoroughly evaluate problems such that the resolutions address the causes and extent of conditions, as necessary? This includes properly classifying, prioritizing, and evaluating for operability and reportability conditions adverse to quality. This also includes, for significant problems, conducting effectiveness reviews of corrective actions to ensure that the problems are resolved.
  - Take appropriate corrective actions to address safety issues and adverse trends in a timely manner, commensurate with their safety significance and complexity?
  - If an alternative process (i.e., a process for raising concerns that is an alternate to the licensee's corrective action program or line management) for raising safety concerns exists, then it results in appropriate and timely resolutions of identified problems?
- 6. Operating Experience** – Did we use operating experience information, including vendor recommendations and internally generated lessons learned, to support plant safety? Specifically (as applicable):
- Systematically collect, evaluate, and communicate to affected internal stakeholders in a timely manner relevant internal and external operating experience?
  - Implement and institutionalize operating experience through changes to station processes, procedures, equipment, and training programs?
- 7. Self- and Independent Assessments** – Were self- and independent assessments conducted of activities and practices, as appropriate, to assess performance and identify areas for improvement? Specifically (as applicable):
- Self-assessments at an appropriate frequency; such assessments are of sufficient depth, are comprehensive, are appropriately objective, and are self critical? The licensee periodically assesses the effectiveness of oversight groups and programs, such as the corrective action program, and policies?
  - Track and trend safety indicators that provide an accurate representation of performance?
  - Coordinates and communicate results from assessments to affected personnel and take corrective actions to address issues commensurate with their significance?

ATTACHMENT 18

Sheet 3 of 4

**Worksheet for Evaluation of NRC Safety Culture Aspects**

<p><b>8. Environment for Raising Concerns</b> – Does an environment exist in which employees feel free to raise concerns both to their management and/or the NRC without fear of retaliation, and are employees encouraged to raise such concerns? Specifically (as applicable):</p> <ul style="list-style-type: none"><li>• Do behaviors and interactions encourage the free flow of information related to raising nuclear safety issues, differing professional opinions, and identifying issues in the corrective action program and through self-assessments? Such behaviors include supervisors responding to employee safety concerns in an open, honest, and non-defensive manner and providing complete, accurate, and forthright information to oversight, audit, and regulatory organizations. Past behaviors, actions, or interactions that may reasonably discourage the raising of such issues are actively mitigated. As a result, personnel freely and openly communicate in a clear manner conditions or behaviors, such as fitness for duty issues, that may impact safety, and personnel raise nuclear safety issues without fear of retaliation.</li><li>• If alternative processes (i.e., a process for raising concerns or resolving differing professional opinions that are alternates to the licensee’s corrective action program or line management) for raising safety concerns or resolving differing professional opinions exist, then are they communicated, accessible, have an option to raise issues in confidence, and are independent in the sense that the program does not report to line management (i.e., those who would in the normal course of activities be responsible for addressing the issue raised)?</li></ul>
<p><b>9. Preventing, Detecting, and Mitigating Perceptions of Retaliation</b> – Does a policy exist for prohibiting harassment and retaliation for raising nuclear safety concerns and is it consistently enforced in that:</p> <ul style="list-style-type: none"><li>• All personnel are effectively trained that harassment and retaliation for raising safety concerns is a violation of law and policy and will not be tolerated?</li><li>• Claims of discrimination are investigated consistent with the content of the regulations regarding employee protection and any necessary corrective actions are taken in a timely manner, including actions to mitigate any potential chilling effect on others due to the personnel action under investigation?</li><li>• The potential chilling effects of disciplinary actions and other potentially adverse personnel actions (e.g., reductions, outsourcing, and reorganizations) are considered and compensatory actions are taken when appropriate?</li></ul>
<p><b>10. Accountability</b> – Does management define the line of authority and responsibility for nuclear safety? Specifically (as applicable):</p> <ul style="list-style-type: none"><li>• Is accountability maintained for important safety decisions in that the system of rewards and sanctions is aligned with nuclear safety policies and reinforces behaviors and outcomes that reflect safety as an overriding priority?</li><li>• Does management reinforce safety standards and display behaviors that reflect safety as an overriding priority?</li><li>• Does the workforce demonstrate a proper safety focus and reinforce safety principles among their peers?</li></ul>
<p><b>11. Continuous Learning Environment</b> – Did we ensure that a learning environment exists? Specifically (as applicable):</p> <ul style="list-style-type: none"><li>• Did we provided adequate training and knowledge transfer to all personnel on site to ensure technical competency?</li><li>• Did personnel continuously strive to improve their knowledge, skills, and safety performance through activities such as benchmarking, being receptive to feedback, and setting performance goals? The licensee effectively communicates information learned from internal and external sources about industry and plant issues.</li></ul>

ATTACHMENT 18

Sheet 4 of 4

**Worksheet for Evaluation of NRC Safety Culture Aspects**

**12. Organizational Change Management** – Did management use a systematic process for planning, coordinating, and evaluating the safety impacts of decisions related to major changes in organizational structures and functions, leadership, policies, programs, procedures, and resources? Did management effectively communicate such changes to affected personnel?

**13. Safety Policies** – Did safety policies and related training establish and reinforce that nuclear safety is an overriding priority in that:

- These policies require and reinforce that individuals have the right and responsibility to raise nuclear safety issues through available means, including avenues outside their organizational chain of command, and to external agencies, and obtain feedback on the resolution of such issues?
- Personnel are effectively trained on these policies?
- Organizational decisions and actions at all levels of the organization are consistent with the policies? Are production, cost, and schedule goals developed, communicated, and implemented in a manner that reinforces the importance of nuclear safety?
- Did senior managers and corporate personnel periodically communicate and reinforce nuclear safety such that personnel understand that safety is of the highest priority?

ATTACHMENT 19  
Sheet 1 of 3  
**ADVERSE CONDITION INVESTIGATION – INCREASED RIGOR REPORT**  
Form CAP-NGGC-0205-19-9

**Action Request Number:**

**Investigator:**

**1. Event Description**

- Using information provided in the NCR, describe the trend. List or reference the associated NCRs.

**2. Investigation Summary**

NOTE: The below elements are not required but should be considered, as applicable, to assist in developing a quality investigation. Include sufficient detail to support conclusions.

- What Should Be: the requirement, standard, norm, or expectation
- What Is: the existing, as-found condition
- How it happened: the inappropriate act or equipment failure. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.
- Why it happened: apparent cause and contributing cause(s) if applicable. Describe why this happened. Use investigative technique(s) to determine the apparent cause.
- Corrective Actions: immediate or interim actions taken to correct the adverse condition and the apparent cause.

Provide a conclusion as to the relevance of the following perspectives:

**2a. Human Performance Factors – Error Precursors**

- Task Demands – time pressure, high workload, multiple tasks, confusing guidance, etc.
- Work Environment – distractions, changes from routine, confusing displays, adverse physical climate, etc.
- Individual Capabilities – unfamiliarity, new technique, inexperience, illness, etc.
- Natural Tendencies/Human Nature – stress, assumptions, habit, mental shortcuts, etc.

**2b. Latent Organizational/Programmatic Weakness**

- Training
- Communication
- Planning and Scheduling
- Design or Process change
- Values, Priorities, Policies
- Procedure Development or Use
- Supervisory Involvement
- Organizations Interfaces

**2c. Equipment Malfunctions**

- Failure Mode
- Failure Mechanism
- Degradation Mechanism
- Degradation Influences
  - Equipment performance issues
  - Equipment design limitations
  - Clarity of expectations/standards
  - Standards reinforcement
  - Trending and monitoring
  - Observation Program effectiveness

ATTACHMENT 19

Sheet 2 of 3

**ADVERSE CONDITION INVESTIGATION – INCREASED RIGOR REPORT**

Form CAP-NGGC-0205-19-9

**3. Extent of Condition**

Determine the set of products, components or processes that exhibit the same deficiency as the investigated condition (for example: perform a plant walk-down to determine how broad the problem is).

**4. Operating Experience**

Identify lessons learned from internal (site or NGG) or external (industry) OE that should be considered in development of causal factor(s) and corrective actions for this event.

**5. Summary of Results and Corrective Actions**

Clearly identify Apparent Cause and Contributing Cause(s) if applicable, which were identified from the conclusions in the investigation summary. This should include a summary of the corrective actions to address the identified adverse condition and the cause(s). The corrective action plan should clearly address the identified cause(s) and the adverse condition.

**4. Corrective Action Plan**

- The table below aligns the cause for each Inappropriate Act/Equipment Failure and ensures that each Cause is linked to and addressed with a Corrective Action. Insert additional rows as needed.
- Clearly describe each causal factor as to how it applies to the investigated event / condition. Designate each causal factor as "Apparent" or "Contributing"
- The "Code" column is used to identify the Cause Code (CAP-NGGC-0206 Attachment 2)
- The "ORG" column is used to identify the organization responsible for the Inappropriate Act.
- Designate the type of action (such as CORR or ENHN).
- For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability, for example; Work Order "ABC" was completed and finished on mm/dd/yy, Engineering Change "XYZ" was completed in the field on mm/dd/yy, or Material Evaluation was completed and approved on mm/dd/yy.

ATTACHMENT 19  
 Sheet 3 of 3  
**ADVERSE CONDITION INVESTIGATION – INCREASED RIGOR REPORT**  
 Form CAP-NGGC-0205-19-9

**Corrective Action Plan**

	DESCRIPTION	CAUSE	CODE	ORG	CORRECTIVE ACTION	ASSIGNMENT TYPE *	ASSIGNEE/ CONCURRENCE	DUE OR COMPLETION DATE**
<b>ADVERSE CONDITION</b>	Describe the observed condition. <b>What</b> was found or occurred. If no adverse condition exists, recommend downgrading to a Priority 5 NCR	N/A	N/A	N/A	Actions taken or required to correct the <b>CONDITION</b>	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>I/A or EQ Malfunction</b>	Describe <b>HOW</b> the condition occurred. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.	Describe <b>WHY</b> this happened and identify the type of cause as Apparent, or Contributing (if applicable).	Enter Cause Code from list in CAP-NGGC-0206	Responsible Group – list group responsible for individual error or organizational weakness. Not required for equipment malfunctions.	Actions taken or required to correct the identified <b>APPARENT CAUSE</b>	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability
<b>OTHER</b>	N/A	N/A	N/A	N/A	Actions to improve efficiency or enhance performance	ENHN if not correcting the condition or the cause	Individual responsible for action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.

\*Designate which assignments are Long Term Corrective Action (non-outage related LTCA requires approval by DSO or PGM for plant sites, Director- Fleet Support Services for corporate).

\*\*Provide justification for corrective actions with initial due date that exceeds 120 days.

ATTACHMENT 20

Sheet 1 of 4

**ADVERSE CONDITION INVESTIGATION–INCREASED RIGOR–EQUIPMENT REPORT**

Form CAP-NGGC-0205-20-9

**Action Request Number:**

**Investigator:**

**1. Adverse Condition Description**

- Using information provided in the NCR, identify the problem to be investigated.
- Describe the observed condition. What was found or occurred.
- If no adverse condition exists, recommend downgrading to priority 5 NCR.

**2. Investigation Summary**

NOTE: The below elements are not required but should be considered, as applicable, to assist in developing a quality investigation. Include sufficient detail to support conclusions.

- What Should Be: the requirement, standard, norm, or expectation
- What Is: the existing, as-found condition
- How it happened: the inappropriate act or equipment failure. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.
- Why it happened: *apparent cause and contributing cause(s) if applicable. Describe why this happened. Use investigative technique(s) to determine the apparent cause.*
- Corrective Actions: immediate or interim actions taken to correct the adverse condition and the apparent cause.

This NCR was identified as "Equipment Related" and, as such, the investigation should consider the following equipment reliability questions to determine the program area(s) that are affected, and to help determine where corrective action(s) should be taken. A "No" answer to any question identifies a potential area where a corrective action should be considered.

**If any of the following three statements is true, then check the applicable block(s) below, provide applicable comments, and skip questions A thru J.**

- No failure or substantial degradation of permanent plant equipment function is evident
- Equipment is Run-to-Failure (EDB Requirement Zero Tol – R)
- Cause is not determined (External Event, Historical or Unknown)

Comments (required if cause is not determined):

**A. Equipment Classification:**

Is the "Zero Tol" classification of the component appropriate? Y N

(Ensure the component is correctly cross referenced in the NCR Level Equipment Tab and look up the "Zero Tol" Classification in the Equipment Data Base (EDB).

Comments (if classification is inappropriate):

ATTACHMENT 20

Sheet 2 of 4

ADVERSE CONDITION INVESTIGATION-INCREASED RIGOR-EQUIPMENT REPORT

Form CAP-NGGC-0200-20-9

**B. Performance Monitoring**

Is the System Monitoring Plan (reference EGR-NGGC-0010) and predictive maintenance performed on the equipment adequate?  Y  N  NA

Monitored scope inadequate (i.e. levels, temp, pressures, vibration, etc.)

Monitoring frequency not appropriate

Monitoring execution less than adequate

- Is the monitoring and threshold for action adequate?
- Is there improvement needed in collecting or trending data?

Comments (if inadequate):

**C. Preventive Maintenance (PM)**

Is the PM program adequate?  Y  N  NA

PM did not exist

PM frequency not appropriate

PM task content not appropriate (or less than adequate)

PM template/basis less than adequate

PM feedback not implemented from previous PM performance

Comments (if inadequate):

**D. Work Practices**

Are the maintenance/work practices and behaviors appropriate and acceptable?  Y  N  NA

Work planning, instruction, or preparation less than adequate

PMT not performed or PMT less than adequate

Work activities incorrectly performed

Comments (if inadequate):

**E. Design**

Is the design of this component appropriate for the application?  Y  N  NA

Original design less than adequate (component not appropriate for this configuration/application)

Design change less than adequate (component not appropriate for this configuration/application)

Design change implementation less than adequate

Comments (if inadequate):

**F. Previous Corrective Action Implementation**

Was corrective action to previous similar problem adequate?  Y  N  NA

Previous corrective action(s) less than adequate or untimely

OE use less than adequate

Comments (if inadequate):

ATTACHMENT 20

Sheet 3 of 4

**ADVERSE CONDITION INVESTIGATION-INCREASED RIGOR-EQUIPMENT REPORT**

Form CAP-NGGC-0200-20-9

**G. Operational Performance**

Are the operating procedures and practices appropriate? Y N NA

Equipment was not operated within design

Comments (if inadequate):

**H. Manufacturer/Vendor Quality, Procurement, Shipping or Storage**

Are parts availability and quality adequate? Y N NA

Vendor quality or workmanship issues (mfg. defects)

Procurement less than adequate (specifications equivalence)

Receipt, Inspection and/or Storage less than adequate (environment, shelf life, control of scavenged parts, storage PM)

Comments (if inadequate):

**I. Long Range Plan**

If the condition is attributed to an aging/obsolescence concern, Y N NA

Is the long range plan adequate?

Aging/obsolescence concern, asset management, System Strategic Plan (STGP) less than adequate

Previous Business Plan-related items not implemented, untimely or deferred

Comments (if inadequate):

**J. Inappropriate Act**

Was other human performance adequate? Y N NA

A human performance gap contributes to any of the process failures by Engineering or others

Comments (if inadequate):

**3. Extent of Condition**

Determine the set of products, components or processes that exhibit the same deficiency as the investigated condition (for example: perform a plant walk-down to determine how broad the problem is).

**4. Operating Experience**

Identify lessons learned from internal (site or NGG) or external (industry) OE that should be considered in development of causal factor(s) and corrective actions for this event.

**5. Summary of Results and Corrective Actions**

Clearly identify Apparent Cause and Contributing Cause(s) if applicable, which were identified from the conclusions in the investigation summary. This should include a summary of the corrective actions to address the identified adverse condition and the cause(s). The corrective action plan should clearly address the identified cause(s) and the adverse condition.

ATTACHMENT 20

Sheet 4 of 4

**ADVERSE CONDITION INVESTIGATION-INCREASED RIGOR-EQUIPMENT REPORT**

Form CAP-NGGC-0205-20-9

**Corrective Action Plan**

	DESCRIPTION	CAUSE	CODE	ORG	CORRECTIVE ACTION	ASSIGNMENT TYPE*	ASSIGNEE/ CONCURRENCE	DUE OR COMPLETION DATE**
<b>ADVERSE CONDITION</b>	Describe the observed condition. <b>What</b> was found or occurred. If no adverse condition exists, recommend downgrading to a Priority 5 NCR	N/A	N/A	N/A	Actions taken or required to correct the <b>CONDITION</b>	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>N/A or EQ Malfunction</b>	Describe <b>HOW</b> the condition occurred. <b>What</b> did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.	Describe <b>WHY</b> this happened and identify the type of cause as Apparent, or Contributing (if applicable).	Enter Cause Code from list in CAP-NGGC-0206	Responsible Group – list group responsible for individual error or organizational weakness. Not required for equipment malfunctions.	Actions taken or required to correct the identified <b>APPARENT CAUSE</b>	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability
<b>OTHER</b>	N/A	N/A	N/A	N/A	Actions to improve efficiency or enhance performance	ENHN if not correcting the condition or the cause	Individual responsible for action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.

\*Designate which assignments are Long Term Corrective Action (non-outage related LTCA requires approval by DSO or PGM for plant sites, Director- Fleet Support Services for corporate).

\*\*Provide justification for corrective actions with initial due date that exceeds 120 days.

ATTACHMENT 21

Sheet 1 of 3

**TREND/COMMON CAUSE ANALYSIS INVESTIGATION – INCREASED RIGOR**  
Form CAP-NGGC-0205-21-9

**Action Request Number:**

**Investigator:**

**1. Event Descriptions**

Using information provided in the NCR, describe the Trend. List or reference the associated NCRs.

**2. Trend Description**

- Develop a clear statement of the purpose and desired outcomes from the Trend Investigation.
- Identify the criteria evaluated for collective significance and common cause.
- Identify the data sources used.
- Summarize the review to determine if the identified commonalities are sufficient to warrant Common Cause Analysis.
- If further analysis is not warranted, document the basis and do not proceed further.
- If further analysis is warranted, provide a problem statement clearly establishing the focus of the Common Cause Analysis.

**3. Summary of Common Cause Analysis**

Briefly describe the methods and analysis that were used to develop and analyze causal theories.

- For each Causal Factor provide a numerical designator so that linkage can be established between each Causal Factor and the Corrective Action Plan
- For each Causal Factor select an applicable Cause Code from CAP-NGGC-0206, and provide the selected code in this report.
- For each Causal Factor specify the Type as Common Cause
- Provide a conclusion as to the relevance of the following perspectives:
  - 3a. Human Performance Factors – Error Precursors**
    - Task Demands – time pressure, high workload, multiple tasks, confusing guidance, etc.
    - Work Environment – distractions, changes from routine, confusing displays, adverse physical climate, etc.
    - Individual Capabilities – unfamiliarity, new technique, inexperience, illness, etc.
    - Natural Tendencies/Human Nature – stress, assumptions, habit, mental shortcuts, etc.
  - 3b. Latent Organizational/Programmatic Weakness**
    - Training
    - Communication
    - Planning and Scheduling
    - Design or Process change
    - Values, Priorities, Policies
    - Procedure Development or Use
    - Supervisory Involvement
    - Organizations Interfaces
  - 3c. Equipment Malfunctions**
    - Failure Mode
    - Failure Mechanism
    - Degradation Mechanism
    - Degradation Influences
      - Equipment performance issues
      - Equipment design limitations
      - Clarity of expectations/standards
      - Standards reinforcement
      - Trending and monitoring
      - Observation Program effectiveness

ATTACHMENT 21

Sheet 2 of 3

**TREND/COMMON CAUSE ANALYSIS INVESTIGATION – INCREASED RIGOR**

Form CAP-NGGC-0205-21-9

**4. Previous Operating Experience (Internal and External)**

Provide a conclusion as to the relevance of the OE reviewed from the following perspectives:

- Does OE exist that would have prevented the event?
- Ensure that "Lessons Learned" from relevant OE are considered during the development of the Corrective Action Plan.
- Determine if this event involves program or procedure elements that implement INPO SOER, SER or SEN actions.
- Is the current event a Repeat Event? If so, then the investigation should address why previous actions were not effective in preventing the event.

**5. Extent of Condition**

Is there a set of products, components or processes that exhibit the same deficiency as the investigated condition? If so, describe.

**6. Summary of Results**

- Common Cause(s)
- Contributing Cause(s) if applicable

**7. Causal Factors/Corrective Action Plan**

- Complete the below table to identify the required information (Non-shaded areas).
- For completed or interim actions, provide appropriate completion documentation or ensure that the investigation results contain adequate detail to ensure traceability, for example; Work Order "ABC" was completed and approved on mm/dd/yy, Engineering Change Request "XYZ" was completed in the field on mm/dd/yy, or Material Evaluation was completed and approved on mm/dd/yy.

ATTACHMENT 21  
 Sheet 2 of 3  
**TREND/COMMON CAUSE ANALYSIS INVESTIGATION – INCREASED RIGOR**  
 Form CAP-NGGC-0205-21-9

**Corrective Action Plan**

	DESCRIPTION	CAUSE	CODE	ORG	CORRECTIVE ACTION	ASSIGNMENT TYPE *	ASSIGNEE/ CONCURRENCE	DUE OR COMPLETION DATE**
<b>ADVERSE CONDITION</b>	Describe the observed condition. <b>What</b> was found or occurred. If no adverse condition exists, recommend downgrading to a Priority 5 NCR	N/A	N/A	N/A	Actions taken or required to correct the <b>CONDITION</b>	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.
<b>I/A or EQ Malfunction</b>	Describe <b>HOW</b> the condition occurred. What did individual(s) do that was inappropriate or what was the failure mechanism of the equipment failure.	Describe <b>WHY</b> this happened and identify the type of cause as Common or Contributing (if applicable).	Enter Cause Code from list in CAP-NGGC-0206	Responsible Group – list group responsible for individual error or organizational weakness. Not required for equipment malfunctions.	Actions taken or required to correct the identified <b>CAUSE</b> of the trend	Must be CORR for Pri 2a	Individual responsible for corrective action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability
<b>OTHER</b>	N/A	N/A	N/A	N/A	Actions to improve efficiency or enhance performance	ENHN if not correcting the condition or the cause	Individual responsible for action	Due date to be complete or date action was completed. Include adequate detail to ensure traceability.

\*Designate which assignments are Long Term Corrective Action (non-outage related LTCA requires approval by DSO or PGM for plants, Director-Fleet Support Services for corporate).

\*\*Provide justification for corrective actions with initial due date that exceeds 120 days.

## REVISION SUMMARY (PRR 277176)

Page	Section/Step	Description
2	Table of Contents	Corrected page numbering for Attachments 17 – 19 (PRR 296417).
3	2.1.2	Updated reference – changed INPO 03-004 to 05-005.
4	2.2	Added the following new references: 2.2.7 - ADM-NGGC-0107, 2.2.8 – CAPR 00243389-09, 2.2.9 – HUM-NGGC-0001 and 2.2.10 – OPS-NGGC-1306, Reactivity Management Program. (PRR282132).
8	3.32	Added new definition for Quality Review Board (QRB) and renumbered subsequent definitions (CAPR 00243389-09, NCR 300163).
8	3.33	Added new definition for Root Cause Review Team (RCRT) and renumbered subsequent definitions (CAPR 00243389-09, NCR 300163).
9	3.36	Deleted definition of Significant Adverse Condition Investigation Team, Event Review Team (RNP) and renumbered subsequent definitions.
10	4.1.4	Added statement to Management Sponsor responsibility that the team members should be relieved of other duties as necessary to ensure appropriate focus on the significant adverse condition investigation and team participation (PRR 302086).
10	4.1.10	Added new responsibility for Management Sponsor to present the significant adverse condition investigation to QRB.
12	9.1	Deleted note preceding step that suggested the use of Attachment 14. Step 9.1.5.1 was updated to require the use of Attachment 14 to document the initial investigation plan. (PRR 290406).
13	9.1.1.5	Added note preceding step 9.1.1.5 with guidance on team composition that include training expertise and investigative experience that may be needed for more complex events (PRR 246304, PRR303382, NCR 300163).
13	9.1.1.5	Added statement to end of step that if sufficient expertise is not available at the site, the management sponsor should consider bringing in team members from other PGN plants, corporate, or from outside the company (PRR 303382, NCR 297677, NCR 279860, NCR 300163). Also added statement that team members should be relieved of other duties as necessary to ensure appropriate focus on the Significant Adverse Condition Investigation and team participation.
16	9.1.5.1	Updated step from using Attachment 14 when requested to requirement to use Attachment 14 to document the initial investigation plan and to include it in the completed report (PRR 290406, NCR 300163).
18	9.1.7.7	Added new step to provide a conclusion as to the relevance of the OE reviewed and document in report (PRR 282132, NCR 300163).
18	9.1.8 and 9.1.9	Added information to Extent of Cause and Extent of Condition to clarify the difference between the two (NCR 300163).
20	9.1.11.8	Added new step to consider the need for interim monitoring methods prior to the EREV. Also added a list of examples of performance measures that may be used (PRR 277176, PRR 283857, NCR 300163).
21	9.1.12.2	Added new step to clarify criteria that should be used to determine

		effectiveness of CAPR(s) should evaluate behaviors and included examples (PRR 277176, NCR 300163).
23-24	9.1.14	Revised Section 9.1.14, Review and Approval to incorporate a review by the Root Cause Review Team and by the Quality Review Board via steps 9.1.14.5 through 9.1.14.13 and revised subsequent steps in this section (CAPR 00243389-09, PRR 301437, NCR 300163).
25	9.2.3	Added new step to consider and document immediate corrective actions or compensatory measures taken to place the plant in a safe condition or to restore compliance (NCR 300163).
38	Attachment 7	Minor editorial changes to Barrier Analysis help sheet based on feedback from SACI training classes.
65	Attachment 14	Added statement following Team Members to refer to section 9.1.1, corrected reference to Problem Description from 9.2 to 9.1.2, and added milestones for review by RCRT and QRB (PRR 303600 and 287782).
66	Attachment 15	Added Reasonable/Realistic and Reviewed to the bullets for developing effective corrective action plans and reordered the bullets to spell out S.M.A.R.T.E.R.
66	Attachment 15	Added statement that CORRs to revise NGGC procedures should not be issued without concurrence by the applicable NGG fleet Functional Area Manager.
67-70	Attachment 16	Updated Executive Summary to include completion date for completed CAPR(s) and due date for planned CAPR(s), added requirement to include criteria used to classify event as significant under Problem Description on Sheet 2 of 4, bolded statement in OE section to provide a conclusion as to the relevance of OE, and added requirement to provide conclusion as to the relevance of the Nuclear Safety Culture Attributes (refer to Att. 18) to sheet 3 of 4 (PRR283857, 281199, 282132). Also added PGM to approval for LTCAs and deleted CSERB from bottom of form. (NCR 300163)
71-73	Attachment 17	Updated Executive Summary to include completion date for completed CAPR(s) and due date for planned CAPR(s), corrected the reference to the procedure with the cause codes in Summary of Common Cause Analysis section, bolded statement under OE section to Provide a conclusion as to the relevance of OE (PRR 282132 and PRR 283857). Also added PGM to approval for LTCAs and deleted CSERB from bottom of form.
74-77	Attachment 18	Added questions to Attachment 18 to improve usability (NCR 300163).
78	Attachment 19	Editorial correction to section 2 – changed from Trend Description to Investigation Summary.
81-84	Attachment 20	Updated Equipment-related Increased Rigor INVN form as requested by ER working group and added PGM to approval for LTCAs (PRR 306163, NCR 300163)
85-87	Attachment 21	Added new Attachment 21, Trend/Common Cause Analysis Investigation – Increased Rigor (NCR 294891, NCR 300163)