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Implementation of a Graded Approach to the Apparent Causal Analysis Process

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EFCOG Spring Meeting – CAS Sessions – May 2-3, 2023

SRNS-MS-2023-00143

Agenda

1. Previous State of the Causal Analysis Program
2. Catalyst for Change
3. How Did We Start?
4. Change Preparation
5. How does the ACA Graded Approach Process work?
6. Supporting Objectives
7. Accomplishments

Previous State of the Causal Analysis Program

- **The Causal Analysis Process was not being performed in a timely manner.**
  - In 2021, there were 45 Causal Analyses performed which closed in an average of 74 days.
  - In 2022, there were 51 Causal Analyses performed which closed in an average of 67 days.

- **There was an insufficient number of Qualified Causal Analysts to lead the Causal Analysis Processes.**
  - As of January 2022, there were 15 Qualified Causal Analysts to lead Causal Analyses across the site.

Previous State of the Causal Analysis Program

- **There are no designated roles to support the Causal Analysis Process.**
  - The Qualified Causal Analysts are performing the causal analyses in addition to their job functions.

- **The Causal Analyst's Qualification Process was lengthy.**
  - As of January 2022, the average time to complete the qualification process was 16 months.

- **The documentation of Apparent Cause Analyses performed for Equipment Failures was not consistent.**

It was identified during a Board of Directors review of the Contractor Assurance System that “SRNS should allow for simplified Causal Analysis techniques to be used where appropriate and reserve the use of more sophisticated Causal Analysis methods (e.g., BlueDragon®) for only the highly complex events when required by the event categorization”.

How Did We Start?

Benchmarking of the Idaho National Laboratory's (INL) Risk-Based Approach to Cause Analysis:

- Reached out to over 25 DOE facilities and field offices to help identify best practices in Apparent Cause Analysis.
- Used a modified version of the Nuclear Energy Institute's guidance on risk-based approach to cause analysis.
- Developed a process that offers a true graded approach to cause analysis which was implemented in August 2022.

How does the ACA Graded Approach work?

The Graded Approach to the Apparent Cause Analysis (ACA) process starts with a focused conversation.

Recognize that often, a good understanding of the Apparent Cause of an event occurs during the Issue Investigation meeting, also referred to as the data gathering stage of the investigation.

How does the ACA Graded Approach work?

For well-defined, non-complex issues, the Issue Investigation process and associated Causal Analysis can effectively identify and document Apparent Causes and corrective actions to prevent recurrence.

The implementation of the Graded Approach to Apparent Cause Analysis streamlines the process.

How does the ACA Graded Approach work?

When there is a need to complete an Apparent Causal Analysis, the Responsible Manager (RM) may elect to proceed by performing, at minimum, one causal analysis method and documenting using the Formal Causal Analysis Report.

-OR-

Alternatively, the RM may elect to proceed by using the *Consequence and Cause Uncertainty Guidance* to determine the level of analysis necessary for the ACA, or Graded Approach.

How does the ACA Graded Approach work?

The **Consequence and Cause Uncertainty Guidance** is based upon an understanding of the *consequences* (or potential consequences) of the Issue versus the *uncertainty* of cause. It is used to determine what causal analysis approach should be used to perform the ACA of the Issue.

Consequence and Cause Uncertainty Guidance

		Cause Uncertainty	
		Cause is Clear	Cause is Uncertain
Consequence	Low (Marginal/ Negligible)	▪ Complete the Apparent Causal Analysis Determination Initial Assessment Form. ▪ Identify and document causal codes from the DOE Causal Analysis tree in the STAR CTS Record. ▪ Document using the Issue Investigation Report, if necessary. ▪ The Formal Causal Analysis Report is not necessary.	▪ Complete the Apparent Causal Analysis Determination Initial Assessment Form. ▪ Document using the Apparent Causal Analysis Questionnaire. ▪ The Formal Causal Analysis Report is not necessary.
	Medium (Significant)	▪ Complete the Apparent Causal Analysis Determination Initial Assessment Form. ▪ Document using the Apparent Causal Analysis Questionnaire. ▪ The Formal Causal Analysis Report is not necessary.	▪ Complete the Apparent Causal Analysis Determination Initial Assessment Form. ▪ Perform one causal analysis method (The Apparent Causal Analysis Questionnaire may be used if applicable). ▪ Document the results on the Formal Causal Analysis Report.
	High (Crisis/Critical)	▪ Perform one causal analysis method (Apparent Causal Analysis Questionnaire shall not be used). ▪ Document results on the Formal Causal Analysis Report.	▪ Perform one causal analysis method (Apparent Causal Analysis Questionnaire shall not be used). ▪ Document results on the Formal Causal Analysis Report.

How does the ACA Graded Approach work?

The Responsible Manager uses the information gathered in the initial stages of Issue Investigation and the *Consequences and Cause Uncertainty Guideline* to provide a recommended approach to proceed with the Causal Analysis. The recommendation is documented on the *Apparent Causal Analysis Determination Initial Assessment Form*.

The recommended approach for use should be approved by the Causal Analysis Program Manager or Designee prior to proceeding with the Causal Analysis. It is recommended to obtain this approval within 10 working days from the Issue's date of discovery.

How does the ACA Graded Approach work?

- If approval is not obtained by the Causal Analysis Program Manager, further analysis of the Issue will be performed by performing, at minimum, one Causal Analysis method and documenting using the Formal Causal Analysis Report.
- All documentation (Forms and/or Reports, as applicable) will be attached to the appropriate Issue Documentation Record after they are completed and approved.
- To meet established performance metrics for the customer, the Causal Analysis process is to be completed within 45 calendar days from the date of discovery of the Issue.

How does the ACA Graded Approach work?

Three standardized forms were created for use in this process:

- The **Apparent Causal Analysis Determination Initial Assessment** form is used to document the recommended approach to proceed with the Causal Analysis.
- The **Apparent Causal Analysis Questionnaire** form is used for causal analysis documentation when approved for the graded approach.
- The **Equipment Failure Engineering Evaluation** is used for standardized documentation of causal analyses performed for equipment failures that are ORPS reportable.

A focused effort was placed on increasing the number of Qualified Causal Analysts and reducing the cycle time for completing the qualification process.

- The Causal Analysis Program Owner coordinated registering site employees for third-party Blue Dragon® Training.
- Individual practical participation in Causal Analysis events were also coordinated.

Accomplishments from Supporting Objectives

As of March 2023:

- ✓ The cycle time for Causal Analyst Qualification has reduced from 16 months to 4 months.
- ✓ The number of qualified Causal Analysts has increased from 15 to 29.
- ✓ The average cycle time for Causal Analyses steadily decreased during 2022. Currently, the average time from the date of discovery of an Issue to its closure has reduced from 67 days (FY2022 avg) to 44 days (FY2023 avg - to date).

Accomplishments


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The **Apparent Causal Analysis Determination Initial Assessment** form documents the following:

Part A: Identifying Information and Problem Statement

Part B: Apparent Causal Analysis Approach as determined by the *Consequences and Cause Uncertainty Guideline*

Part C: Approval of Apparent Causal Analysis Approach

Part D: Apparent Causal Analysis Initial Assessment Signatures

The **Apparent Causal Analysis Questionnaire** form documents the following:

Part A: Identifying Information and Problem Statement

Part B: DOE Causal Analysis Tree (CAT) Node Questions

Part C: Node Determination

Part D: Cause(s)

Part E: Extent of Condition Evaluation

Part F: Apparent Cause Analysis Questionnaire Signatures

Equipment Failure Engineering Evaluation Form

The **Equipment Failure Engineering Evaluation** form standardizes the documentation of equipment failures and ensures that the complete causal analysis is performed consistently. It documents the following:

- Part A: Failed Equipment Description
- Part B: Failure Scenario
- Part C: Analysis
- Part D: Results
- Part E: Corrective Actions
- Part F: Concurrence
- Part G: Approvals

Apparent Causal Analysis Determination Initial Assessment

Proc. Ref. 22Q-CA-1

Part A: Identifying Information and Problem Statement

Provide identifying information and problem statement.

STAR CTS Tracking Number	Issue Type	Significance Category	Discovery Date

Issue Topic/Description

Results of Consequence	Cause Uncertainty Determination
○ Low ○ Medium ○ High	○ Cause is Clear ○ Cause is Uncertain

Problem Statement (**NOTE** The problem statement should be concise, one to two sentences, and contain the "who, what, when, where, and consequence [actual and potential]" elements.)

Issue Investigation Report Number

Part B: Apparent Causal Analysis Approach

Using the Consequence and Cause Uncertainty Guide, determine the level of analysis to be used for the Apparent Causal Analysis.

Apparent Causal Analysis Approach	Select One
1. No additional investigation required per DOE/NNSA customer.	☐
2. Identify and document causal codes from the DOE Causal Analysis Tree (CAT) in the STAR CTS Record. No additional investigation required. Document as an Issue Investigation Report (OSR 39-363).	☐
3. Complete OSR 28-216, Apparent Causal Analysis Questionnaire.	☐
4. Perform one causal analysis method (OSR 28-216 may be used if applicable). Document the results on the Causal Analysis Report.	☐
5. Investigate the issue as necessary, perform one causal analysis method (OSR 28-216 shall not be used), and document results on the Causal Analysis Report.	☐

Additional Comments for Apparent Causal Analysis Approach

Part C: Approval of Apparent Causal Analysis Approach

Per Manual 22Q Procedure CA-1, Causal Analysis, the determination of the method of apparent causal analysis is made by the Responsible Manager during the Issue Investigation review and approved by the Causal Analysis Program Manager or designee. It is recommended that approval should be granted by the Causal Analysis Program Manager or designee within ten (10) working days from the issue's date of discovery. Signature below serves as confirmation that this requirement was met prior to execution of the apparent causal analysis.

Approved By (Print)	Title	Signature	Date

Comments

Part D: Apparent Causal Analysis Initial Assessment Signatures

Prepared By (Print)	Title	Signature	Date
Reviewed By (Print)	Title	Signature	Date

NOTE

1) After approval of OSR 28-215, upload the complete form into the associated STAR record.

2) If applicable, proceed with using OSR 28-216 to document the identified apparent causes and corrective actions. Alternatively, the DOE CAT Codes (to the C Level) and corrective actions may be entered directly into the associated STAR Record.

Apparent Causal Analysis Questionnaire

Proc. Ref. 22Q-CA-1

A completed copy of OSR 28-215, Apparent Causal Analysis Determination Initial Assessment, must be attached to this form.

Part A: Identifying Information and Problem Statement

Provide identifying information and problem statement.

STAR CTS Tracking Number

Issue Topic/Description

Problem Statement (**NOTE** The problem statement should be concise, one to two sentences, and contain the "who, what, when, where, and consequence [actual and potential]" elements.)

Apparent Causal Analysis - Apparent cause is the most probable cause that can "reasonably be identified" that explains why the issue happened that local/facility management has "the control to fix" and for which effective recommendations for corrective actions to remedy the issue can be generated. Identify all reasonable apparent causes consistent with the issue/event.

Part B: DOE Causal Analysis Tree (CAT) Node Questions

Answer the following questions for each DOE Causal Analysis Tree (CAT) Node. Answer N/A if the question is not applicable.

DOE CAT Node A1 - Design and/or Engineering Problems	Yes, No, or N/A
1. Was the design/engineering (e.g., facility, equipment, calculations) performed without a defect or flaw in design or other factors related to configuration, engineering, layout, tolerances, calculations, ergonomics, etc? **NOTE** If the answer is NO, care must be taken to eliminate worker error as the cause of the design or engineering before this is designated as a cause.	

Comments to Support Node A1 Assessment

DOE CAT Node A2 - Equipment and/or Material Problems	Yes, No, or N/A
1. Did the material/equipment function normally, without failure, malfunction, or deterioration of equipment or parts, including instruments or material? (Consider calibration, maintenance, material control, procurement control, and/or defective or failed material or equipment.) **NOTE** If the answer is NO, care must be taken to eliminate worker error as the cause of the failure or malfunction before this is designated as a cause.	

Comments to Support Node A2 Assessment

DOE CAT Node A3 - Human Performance Less Than Adequate **NOTE** Node A3 requires a couplet that cannot be another A3 code.	Yes, No, or N/A
1. Did the worker follow the procedure?	
2. Did the worker understand the work to be done?	
3. Did the worker stop when unsure about the task?	
4. Did the worker follow posted instructions or warnings?	
5. Did the worker follow verbal directions from supervisor?	
6. Was the worker physically and mentally capable of performing work?	

Comments to Support Node A3 Assessment

Apparent Causal Analysis Questionnaire (Continued)

Proc. Ref. 22Q-CA-1

DOE CAT Node A4 - Management Problems	Yes, No, or N/A
1. Did the supervisor properly communicate and enforce expectations?	
2. Was the supervisor aware of the status or changes to the work?	
3. Did the supervisor provide the necessary resources to successfully complete the operation?	
4. Did the supervisor take appropriate action(s) to ensure an adequate and secure environment existed for the operation?	
5. Did the supervisor provide adequate emphasis on safety and procedural compliance?	
6. Was the job scoping and planning adequate?	
7. Did the supervisor properly manage any changes in the work activity?	
8. Did the supervisor/manager effectively manage changes to the program, process, or procedures?	
Comments to Support Node A4 Assessment	

DOE CAT Node A5 - Communications Less Than Adequate	Yes, No, or N/A
1. Was there an approved written instruction (e.g., TWD, WP, procedure) in existence for the work taking place?	
2. Was the procedure available to the workers?	
3. Was the procedure sufficiently detailed to enable a qualified worker to perform the task with minimal supervision?	
4. Was the procedure easily understood with required actions clearly stated?	
5. Did the procedure contain a sequence of action steps which conformed to the normal or expected operational sequence?	
6. Was verbal communication adequate (shift communication and between work groups)?	
Comments to Support Node A5 Assessment	

DOE CAT Node A6 - Training Deficiencies	Yes, No, or N/A
1. Was formal training required for the process(es) implicated in the problem or event statement?	
2. Did the training provide adequate hands-on experience or practice prior to actual task performance?	
3. Did the training included all knowledge or skills for the worker to perform the task?	
4. Was refresher training provided at appropriate intervals?	
5. Did the training presentation and materials support adequate instruction?	
6. Was the worker required to attend the training before assignment to duties requiring task performance?	
Comments to Support Node A6 Assessment	

DOE CAT Node A7 - Other Problems	Yes, No, or N/A
1. Was the event or condition the result of external phenomena (e.g., weather, power failure, fire, explosion, or natural phenomena)?	
2. Was the event or condition the result of legacy contamination or an unknown radiological or hazardous material source?	
3. Was the event or condition the result of a legacy issue not related to radiological or hazardous materials?	
Comments to Support Node A7 Assessment	

Apparent Causal Analysis Questionnaire (Continued)

Proc. Ref. 22Q-CA-1

Part C - Node Determination

Based on the Problem Statement in Part A and the answers to questions in Part B, answer the following questions. This will determine which nodes of the DOE Cause Analysis Tree are applicable to the event or condition identified in the problem statement.

CAT Node Identifier		Yes, No, or N/A
1. Was design/engineering adequate?	Cause Code Node A1	
2. Was equipment/material adequate?	Cause Code Node A2	
3. Was personnel performance adequate?	Cause Code Node A3	
4. Was management/supervision adequate?	Cause Code Node A4	
5. Was communication adequate?	Cause Code Node A5	
6. Was training adequate?	Cause Code Node A6	
7. Was there any "other" problem not listed above?	Cause Code Node A7	

Part D - Cause(s) (Consider Direct, Apparent, and Contributing Causes)

Determine cause(s) based on the answers to the questions in Part C above.

1. The questions with a No answer (or a Yes answer on item 7) are causal to the event. Complete the Cause Code table below, adding additional lines as necessary. **NOTE** At least one Cause Code should correspond to each No answer identified in Part C.
2. Use DOE-STD-1197-2011, Occurrence Reporting Causal Analysis for additional guidance for Cause Code selection.

Cause Number	Cause Code(s)	Describe Each Cause and How it Relates to the Issue	Corrective Action Statement (Include Deliverable)	RAM	Due Date

Part E - Extent of Condition Evaluation

☐ N/A (section is not applicable)

Evaluate the Extent of Condition (EOC)	Yes or No
Could other activities, processes, equipment, programs, facilities, or operations **within** your area of responsibility be experiencing this problem? Consider both work in process and other similar activities performed in the past year.	

Document the established scope of the EOC evaluation (what was evaluated and why) and summarize the evaluation approach and results of the activity. If no other instances of the issue were identified, state that.

Are you aware of other activities, processes, equipment, programs, facilities, or operations **outside** your area of responsibility that could also experience or be experiencing this problem?	

Document the established scope of the EOC evaluation (what was evaluated and why) and summarize the evaluation approach and results of the activity. If no other instances of the issue were identified, state that.

Apparent Causal Analysis Questionnaire (Continued)

Proc. Ref. 22Q-CA-1

Identify any action(s) to consider and address other identified situations within your area or responsibility.	
If other instances of the issue are identified, develop additional remedial actions and/or corrective actions as part of the issue's corrective action plan. If no other instances of the issue were identified, state that.	

Part F - Apparent Causal Analysis Questionnaire Signatures

	Name (Print)	Title	Signature	Date
Prepared By				
Other				
Other				
Other				
Other				
Other				
Reviewed By				
Approved By				

Remittance After approval of OSR 28-216, upload the complete form into the associated STAR record.

Equipment Failure Engineering Evaluation

Proc. Ref. 22Q-CA-1

When completing this form electronically, hover over the form fields for additional information and/or guidance.

Failed Equipment Description

CTS Number	ORPS Number Tracking Equipment Failure
Equipment Safety SSC Degradation Description (Problem Statement)	
Facility	System
Functional Classification	CLI Number
Associated Document Numbers (e.g., preventive maintenance, technical work document, surveillance, work order numbers)	

Failure Scenario

Section 1: Failure Mode (Identify the specific type or manner of failure exhibited by the subject equipment. Include definitive statement of the failure mode so interpretation is not required.)

Section 2: Failure Mechanism (Document what failed with the subject equipment.)

Section 3: Degradation Mechanism (Identify the process or physical phenomena involved in the failure.)

Section 4: Degradation Influences (Identify adverse conditions that, when present, result in equipment susceptibility to a Degradation Mechanism.)

Analysis

Method Used (Select all that apply.)

- ☐ Troubleshooting
- ☐ OE Review (e.g., INPO website searches, EPRI documents, vendor Bulletins)
- ☐ SME Interviews (can include engineering peers at other sites)
- ☐ NDE Testing and Inspection
- ☐ Pre-existing data review (e.g., system health reports, equipment history files, TSR surveillance histories, procedure review, corrective maintenance history, OCNs)
- ☐ Other (e.g., design modifications, component replacement, software modification)

Narrative (Provide a detailed explanation for the analysis method[s] used above.)

Results

Causes (Select all that apply.)

☐ Run to failure	☐ End of life failure	☐ Design Deficiency
☐ Material/Fabrication Deficiency	☐ Improper Application	☐ Inadequate Performance Monitoring
☐ Inadequate Preventive Maintenance Program	☐ Inadequate Predictive Maintenance Program	☐ Inadequate Procedure
☐ Human Performance Deficiency	☐ Other (e.g., instrumentation drift)	

Narrative (Provide a detailed explanation for the cause[s] chosen above. Include a conclusion statement.)

Equipment Failure Engineering Evaluation (Continued)

Proc. Ref. 22Q-CA-1

Corrective Actions				
Corrective Action/Opportunity for Improvement (OFI)		**Responsible Action Manager**	**Assignee**	**Target Due Date**
			Add Row	Delete Row

Concurrence			
Name (Print)	Title	Signature	Date
Name (Print)	Title	Signature	Date
Name (Print)	Title	Signature	Date
Name (Print)	Title	Signature	Date
Name (Print)	Title	Signature	Date

Approvals		
Originator (Print)	Signature	Date
Verifier/Checker (Print)	Signature	Date
Engineering Manager (Print)	Signature	Date

Distribution	
Ops Manager (Print)	
Maintenance Manager (Print)	
Causal Analysis Program Manager (Print)	
Other (Print)	Title
Other (Print)	Title