

Root Cause Analysis

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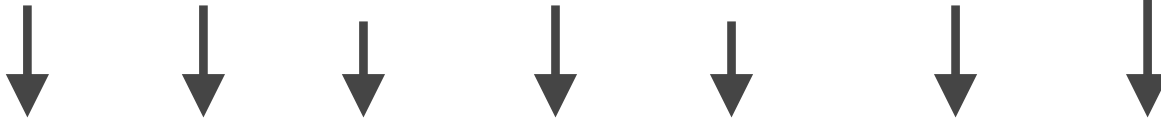
May 13, 2008

Agenda

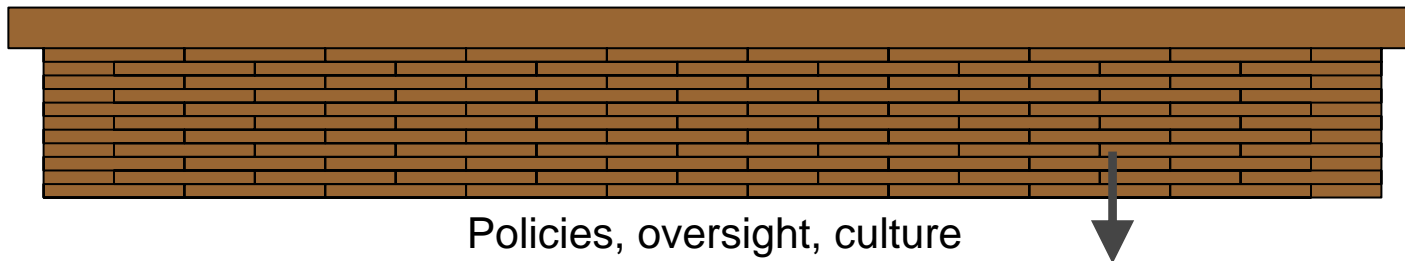
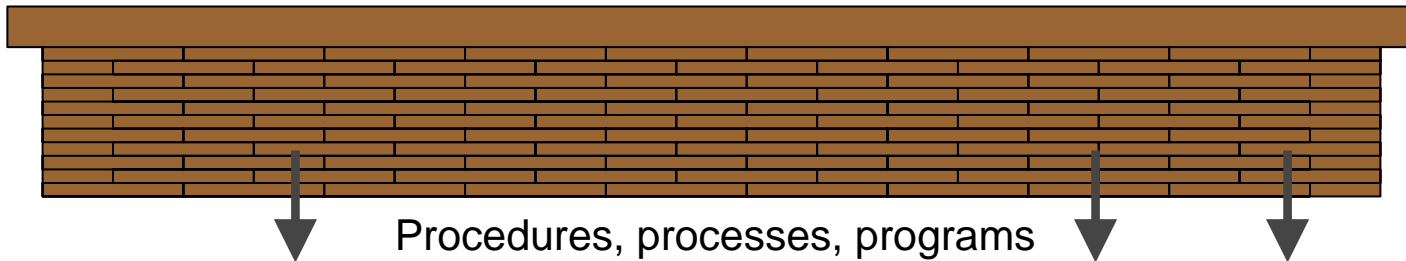
- What is root cause analysis?
- When is root cause analysis used?
- Root cause analysis process
- Questions / Discussion

Why Problems Occur

Human Performance, Equipment Performance, System Performance



Potential human errors, equipment malfunctions, system misoperations



Problem Solving

- People have been solving problems since the beginning of time, so why Root Cause Analysis?



- Structured and systematic approach
- Honest and objective appraisal, removing any pre-existing biases
- In-depth examination of the problem
- **Defines actions to prevent recurrence**

Root Cause Analysis

- Technique and tool set to assist in the evaluation and analysis of a problem or event.
- Answer the questions:
 - WHAT happened?
 - HOW did it happen?
 - WHY did it happen?
- Provide an opportunity for improvement

When To Use Root Cause Analysis

- Decision to perform a root cause analysis:
 - Significant event that had a major business, safety, reliability, or operations impact
 - Repetitive event that could lead to a significant business, safety, or operations impact
 - Discretionary decision to investigate a moderate event
 - Event over which management has control and can develop effective recommendations

When Not to Use Root Cause Analysis

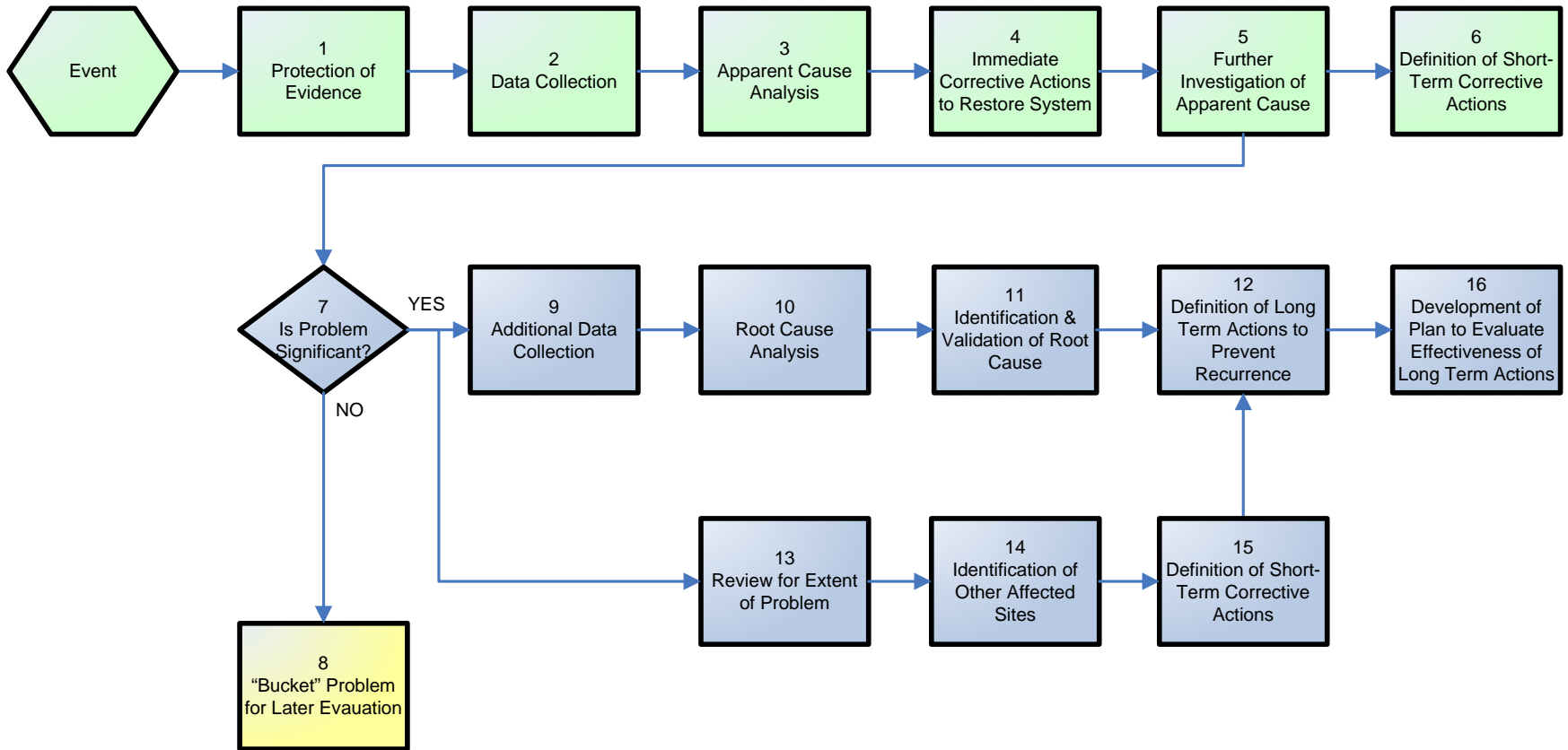
- A problem may not warrant a root cause analysis if:
 - The problem is already being evaluated or was previously evaluated.
 - The cause is identified in a simple manner with certainty.
 - Effect or impact of the problem is negligible (relative to safety, financial, operability, regulatory)
 - Cost or time to evaluate and resolve the problem is far in excess of the impact of the event.

Benefits of Timely Problem Solving

- Actions defined to prevent recurrence of problem
- Improved safety, quality, operational performance, and business performance.
- Reduction in expenditure of resources to repeatedly fix complex problems in the workplace (reduced rework).



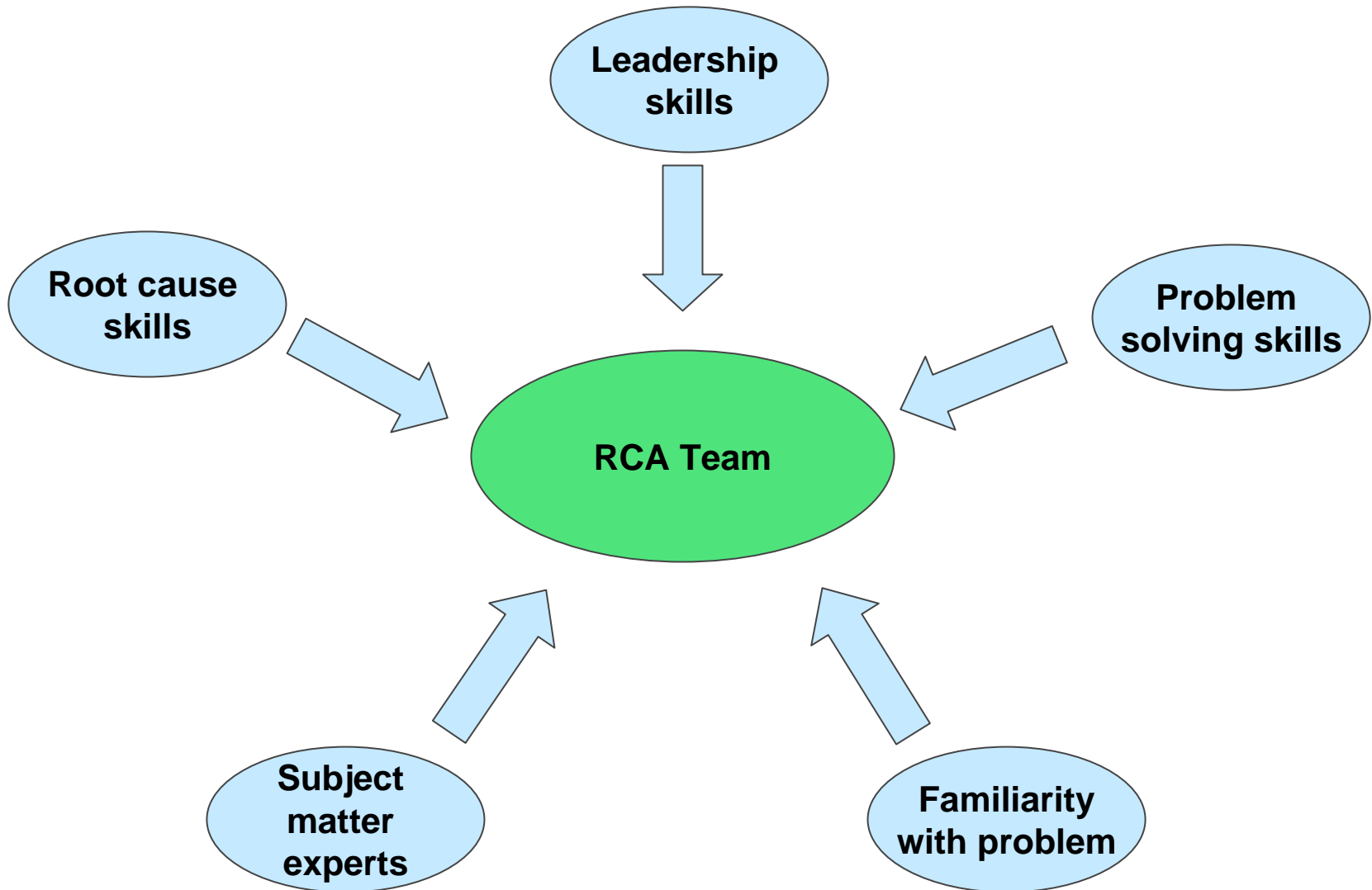
Problem Analysis Approach



Root Cause Analysis Methodology

- Selection of the team members
- Definition of problem statement
- Data protection and collection
- Reconstruct problem scenario (timeline and process)
- Perform root cause analysis
- Define actions to prevent recurrence

Team Selection



Problem Statement

- Definition of Problem Statement
 - Description of the problem to be solved.
 - Characteristics of a good problem statement are:
 - Accurate definition of time frame of problem and frequency of occurrence to focus the review
 - Clear description of scope and substance of problem (statement should address a specific, single problem)
 - Factual description (with no predetermined conclusions or biases)
 - Clarification of significance of problem (safety, financial, regulatory)

Data Protection and Collection

- All data must be protected and collected after an event:
 - Data records
 - Documents (procedures, notes, etc.)
 - Physical evidence (equipment, parts, etc.)
 - Interviews

Data Collection

- Interviews
 - Interviews are utilized to confirm and verify results of document review.
 - Primary information gained from interviews is:
 - Factual information relative to how the work or process was performed that led to the problem
 - Existing environmental conditions at the time of the problem
 - Initial conditions that led to the problem
 - Resolution of any discrepancies in the document review or completion of missing information (“gaps”) in reconstructing the problem scenario

Reconstruct Problem Scenario

- The problem scenario is developed in several ways depending on the problem to be solved:
 - Lab or field testing of equipment (inspections, material analysis, functional, recreation of event, other as appropriate)
 - Analysis and simulation (mathematical analysis of the event to recreate the event)
 - Timeline of event
 - Process comparison (showing both “as defined” and “as is” processes)
- The problem scenario is used to form the basis of the root cause analysis

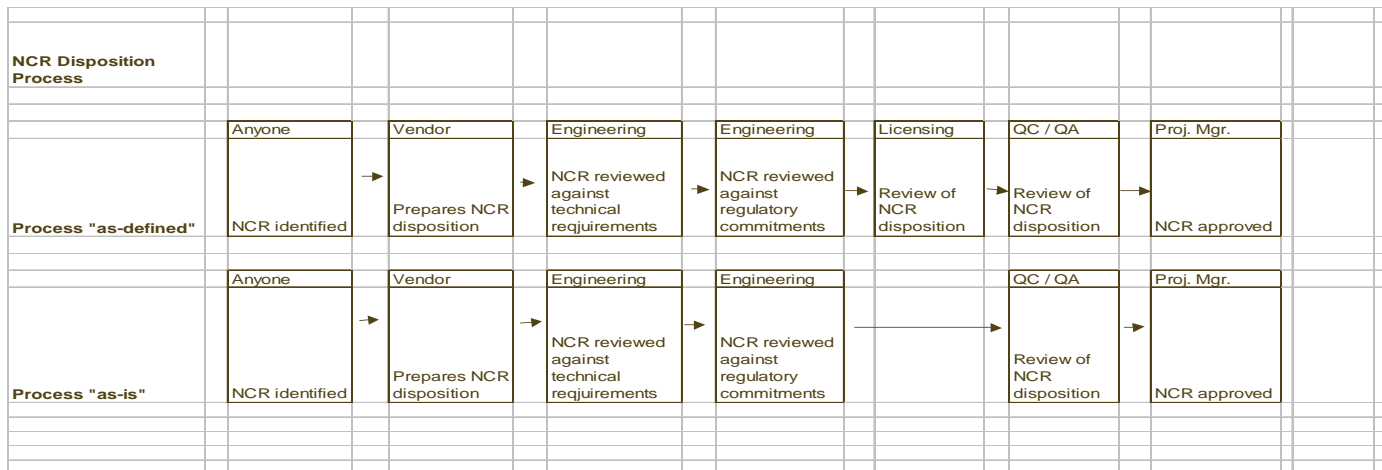
Event Timeline

- Description of the sequence of events leading up to the problem.
- Description of the sequence of events by organization / person
- Constructed from the data review and supplemented by interviews

Time	5/1/2003	5/25/2003	6/30/2003	7/3/2003	7/4/2003	7/30/2003	8/5/2003	8/10/2003
Organization								
Engineering				Prepares calculation and accepts NCR "as-is"				
Procurement	Finalizes procurement documents						Approves shipment	
Quality Control					Review and approves NCR disposition			
Management								
Client								Client rejects item
Vendor		Initiates fabrication	Identifies NCR for "out of tolerance" item			Completes fabrication	Ships item	

Process Comparison

- Process flow charts: The process flow charts are developed for both the “as defined” and “as is” conditions. The key steps are:
 - Define “as-is” and “as defined” processes
 - Compare the process flow charts to identify deviations from the “as defined” process
 - Review “as defined” process for any inappropriate requirements or directions.



Data Analysis

- Perform any additional data analysis
- Various techniques are available, such as:
 - Histograms
 - Pareto charts
 - Scatter charts
 - Relations diagrams

Root Cause Analysis

- The root cause analysis consists of the following basic steps:
 - Review of the problem scenario to identify actions that led to the problem or event
 - Perform a cause and effect analysis for each inappropriate action to identify common causes
 - Perform barrier analysis (or equivalent) on the common causes to identify and verify the root causes
 - Validate the root cause analysis
 - Define actions to prevent recurrence

Root Cause Analysis

- Cause and effect analysis
 - The cause and effect analysis is performed for each identified action to determine a set of common causes.
 - The common causes are developed based on a more rigorous analysis of the action or error.
 - Common cause and effect analysis techniques are:
 - Fishbone diagrams
 - Matrix diagrams
 - Brainstorming (Five Whys)

Root Cause Analysis

- Cause and effect analysis (continued)
 - The techniques examine the following:
 - Assessment of the human or technical cause(s) of the problem based on a review of the timeline and existing conditions
 - Assessment of the procedure, process or program cause of the problem (first line of defense), if appropriate.
 - Assessment of the policy, culture or oversight cause(s) that led to the cause of the problem (second line of defense), if appropriate.

Root Cause Analysis

- Barrier analysis
 - A barrier analysis is utilized with the common causes to identify the true root causes of the problem.
 - The barrier analysis is performed in the following steps:
 - The common cause selected for review is eliminated and a review of the problem or event is performed to determine if the problem would have been prevented.
 - If the barrier analysis indicates that the problem would have been prevented, then this item is considered a “root cause”.
 - Common causes that do not result in a “root cause” are treated as “contributing causes”
 - Each common cause is evaluated in this manner.
 - The “root cause(s)” are compiled.

Root Cause Analysis

- Develop actions to prevent recurrence
 - A set of recommended actions are developed that specifically address the root cause and are intended to prevent future occurrences of the problem or event.
 - Recommended actions should meet the following criteria:
 - Must address the root cause
 - Must be executable by the organization (actions must be capable of being implemented)
 - Must be cost effective
 - Must be consistent with company goals and strategy