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Ohio Safety Congress & Expo

Learn from the present to improve the future — root cause analysis in incident investigation

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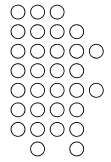
Session SCH143

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Accident Investigation SCH 143

Learn From the Present to Improve the Future –
Root Cause Analysis in Incident Investigation

Ralph Oliveti, CSP



Objectives

- Identify reasons for conducting incident investigation
- Define root cause analysis
- List pros and cons of root cause analysis
- Describe 4 types of root cause analysis methods



Why Investigate Incidents?

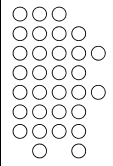
“Those who do not learn from history are condemned to repeat it”

Apollo 13

- Rapid release of oxygen from a tank on board the Apollo 13 led to severe damage and an almost catastrophic incident.
- The oxygen tank was shipped apparently in “good” condition.
- Going backwards from the incident to the point when everything was in satisfactory shape identified 12 “failures”.



The Investigation Process



Identify Causes

- What do you know?
- What don't you know?
- How can you find out what you don't know?



Causal Chain

- An ordered sequence of events in which any one event in the chain causes the next.
- Breaking the chain at any point can prevent the unwanted event.
- Finding out what caused the chain reaction to start can prevent the incident from ever occurring.



Causes



- Proximate Cause
 - an event which is *closest*, or immediately responsible, for causing some observed result
- Single Cause
 - Based on the belief that there is a single cause for any outcome that, if prevented, would prevent the outcome itself
- Multiple Causes
 - Based on the belief that there can be more than one root cause that can contribute to the existence of the proximate cause

Root Cause



- The beginning of the causal chain
- That element or group of elements that allowed the proximate cause to exist.
 - Interest
 - Inattention
 - Knowledge
 - Understanding

Root Cause Analysis



- System for finding the underlying causes of an event.
- When using root cause for accident analysis The event is the accident.

Why Root Cause Analysis



- Find the “Causes” of the cause.
- Typical accident investigations stop when the investigator identifies the proximate cause
- Proximate cause is the event that led directly to the incident.

Potential Investigation Failures

- The investigation concludes when a proximate cause is determined.
 - The employee slipped because there was oil on the floor.
- The investigator has a preconceived idea of the cause.
 - The oil was on the floor because the person responsible for clean-up wasn't doing his/her job.
 - The person who slipped wasn't watching where he/she was going.
- Result
 - Employee disciplined for not cleaning the floors (Poor job performance)
 - Person counseled for not watching where they were going.



Potential Investigation Failures

- Follow-up
 - Employee responsible for cleaning the floors increases the number of times that they clean the floor from 2 times per day to 6 times per day.
 - Opportunity for slipping in that location is reduced significantly.
 - Other responsibilities not fulfilled creating other opportunities for incidents to occur.



Potential Investigation Failures

- The investigator doesn't understand the process well enough to ask the right questions in the investigation.
- The investigator doesn't understand the significance of the answers that they are getting.
- The investigator doesn't like or believe potential causes that are discovered.



How Does Root Cause Help

- Does not stop with the proximate cause.
 - So why was there oil on the floor?
 - Because of a leaking flange.
 - Why was the flange leaking?
 - Wrong gasket.
 - Why was the wrong gasket being used?
 - Supplier doesn't have the correct gasket.
 - Why not use a different supplier?
 - That supplier is the only one available on the approved vendor list.
 - Why are they the only ones on the approved vendor list?
 - Their prices were significantly lower than anyone else.



System Approach



- Requires a set of questions be asked and answered regardless of the circumstance and regardless of how “Obvious” the answer.

How Does Root Cause Help



- Team Approach
 - Reduces the likelihood that a potential cause will be ignored or eliminated because the investigator doesn't like or believe the potential cause (s).
 - Different perspectives of the same set of conditions.

Investigation Process



- Team members:
 - Supervisor
 - Individual involved
 - Co-worker/witnesses
 - Trained facilitator
 - ERT representative
 - Technical Expert

Fact Gathering



- Gather all possibly relevant facts that may contribute to understanding the accident.
 - What do we know?
 - What do we think we know?
 - What don't we know?
 - How can we confirm what we think we know and find out what we don't know?

Evaluation

- Is the information consistent with the facts?
- Is the information plausible?
- Let the analysis begin!



Types of Root Cause Analysis

- 5 Whys
- Change Analysis
- Ishikawa Diagram - also known as the fishbone diagram or cause and effect diagram
- Fault Tree



5 Whys

- Start from the result and work backward

I fell on my face

- Why? Tripped over my shoelaces
Why? My shoe laces weren't tied
Why? Too much effort to bend down and tie them
Why? Completely out of shape
Why? Too lazy to exercise



5 Whys

- Simple
- Can be done in minimal time
- Single person investigation
- Needs to be reviewed by a second investigator



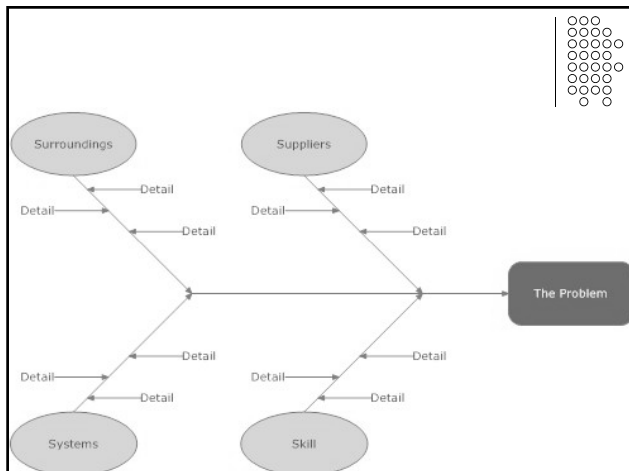
Change Analysis

- Compare two similar circumstances.
- One has no problems and one does.
- What are the differences that could have led to the existence of the problems?



Ishikawa (Fishbone) Diagram

- Diagram analysis into categories
 - Equipment, Materials, People, Procedures
- http://www.classtools.net/main_area/fishbone.htm
- Best used to identify the proximate cause or causes.



Ishikawa Diagram

- More detailed than 5 Whys
- Uses "brainstorming" as means of identifying potential causes.
- Select 3 most likely causes from each category and investigate
- Find the proximate cause or causes
- Use 5 Whys to determine root cause



Fault Tree Analysis

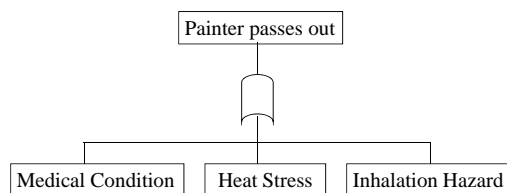
- In depth investigation tool
- The incident is taken as the top event of a logic tree.
- Each situation that could cause that incident is added to the tree as a series of logic expressions.
- Identifies causes and eliminates “non”-causes

Methods

- Start with the result
- Work backwards using “and” gates and “or” gates.
- “And” gates are used if more than 1 factor is required to achieve the result
- “Or” gates are used if any one of several factors alone can lead to the result.

Example

- A painter passes out while sandblasting the top of a chemical tank containing Acetone



Additional Information

- Painter was wearing an airline respirator
- Initial thought is it can't be an inhalation hazard
- Three potential points of failure
 - Respirator Face Piece
 - Air Hose
 - Air Compressor

