Incident Investigation Team Leader Training

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- Leadership positions or participation in API, IEC, NFPA and PIP
Incident Investigation Training Overview

- Team Leader Responsibilities
- Legal Implication
- Human Error
- Problem Definition
- Working Examples Day #1
- Collecting Evidence
- Interviewing Witnesses
- Prioritization
- Corrective Action Development
- Working Examples Day #2
- Report Writing
- Summary
Team Leader Responsibilities?
The Premise

• Our Success in any endeavor
• Is directly dependent
• On our ability to solve problems
Incident Reporting & Investigation Procedure

Application

• All departments on your site for ALL Incidents:
  ▫ Investigation
  ▫ Documentation
  ▫ Communication
  ▫ Closure

• Events involving both company and non-company personnel
Incident Reporting & Investigation Procedure

Purpose

• Ensure all incidents are appropriately reported & investigated
• Provide a uniform method to investigate incidents
• Establish criteria for developing corrective actions
• Ensure the analysis of historical performance trends
What is an Incident?

Incident / Near Miss
An occurrence or condition which resulted in or could have reasonably resulted in an undesired outcome such as but not limited to:

- Injury or illness
- Fire
- Explosion
- Spill
- SCV Exceedance
- Unpermitted Release
- Property damage
- Significant Production Interruption
- Failure to comply with regulatory requirement
- Reliability failure
Incident Investigation Team Leader Training

Objectives

• Improve consistency of investigations within your organizations
• Refresh investigation team leaders on key techniques for successful investigations:
  ▫ Problem Definition
  ▫ Evidence
  ▫ Interviews
  ▫ Action Items
  ▫ Report Writing
Objectives - Continued

• Introduce additional tools to improve the process
  ▫ 5 Why Technique for Human Factors
  ▫ Prioritization of Causes and their Action Items
  ▫ Legal Department’s View of Process
Discovering Human Error Causes During Incident Investigation
Why Focus on error reduction techniques?

- Additive to most organizations processes
- Can be applied to improve all performance
- Supports OE (Operational Excellence) process
- Error has a major influence on operations
One Companies Investigations

Enterprise Investigations

Safety
Environmental
Reliability

Events
Behavioral

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Understanding and Dealing with Human Error

- Avoid “Blame & Retrain” mentality
- Utilize “5 Why” Concept
How Does the 5 Why Process Work

By repeatedly asking the Question “why” (Five is a good rule of thumb), you can peel away the layers of symptoms that can lead to the root cause of a problem. Very often the first reason for a problem will lead you to another question and then to another. Although this technique is called “5 Whys,” you may find that you will need to ask the question fewer or more times than five before you find the issue related to a problem.
Benefits of The 5 Whys

• It helps to quickly identify the root cause of a problem
• It helps determine the relationship between different root causes of a problem
• It can be learned quickly and doesn’t require statistical analysis to be used
Plant X experienced an emergency shutdown

1. **Why** did Plant X experience an emergency shutdown?
   - Because there was a product release from pump P-100.

2. **Why** was the product released from pump P-100?
   - Because the pump seal failed.

3. **Why** did the pump seal fail?
   - Because the process material degraded the seal material.

4. **Why** did the process product degrade the seal material?
   - Because the seal material did not meet design specifications.

5. **Why** did the seal material not meet design specifications?
   - Because the seal repair vendor substituted a different seal material.
The point of control is not the point of injury
Fix the system, Do Not Place Blame
Human Error is not a root cause

Let’s look at some examples of human factors causes
Lapse of Memory / Recall

- Failure to remember information critical to performing a task, potentially due to the complexity of the task, length of time since training, or interference during performance of the task.
  - Failure to add an ingredient while preparing a batch of catalyst
  - Failure to close a control valve during shutdown
Fitness for Duty – Less Than Adequate (LTA)

• A physical or mental condition potentially causing impairment in one’s normal capability. Reduced physical ability often due to environmental conditions, workload, work duration or current physical or psychological condition.
  ▫ Lack of sleep
  ▫ Illness
  ▫ Traumatic psychological event
Cognitive Overload

- System demands exceed human information processing capability.
  - Panel operators receive multiple critical alarms at the same time and fail to initiate corrective actions to prevent unit shutdown.
For all Event Investigations

- Fully address human factor causes
- Apply “5 Why” concept
- Use the Impact classification of human factors for all investigations
- Develop solutions that have the best possibility to correct human factor causes
Problem Definition
Defining The “Problem”

What It is That Needs to be Investigated

• WHAT – What is the problem?
• WHEN – When did it happen?
• WHERE – Where did it happen?
• SIGNIFICANCE – What is the significance?
The Problem Definition Does Not Contain

• WHO
  ▫ The focus is on prevention not blame

• WHY
  ▫ Detracts from defining the problem
  ▫ Example, “Who knows why widgets break?”
The WHAT

• The problem you want to prevent from occurring
  ▫ Don’t get stuck trying to pick the “right” problem
  ▫ It is often the symptom or indicator of a problem

• Often, the name or “Incident Title”
The WHAT

The “Primary Effect” (Apollo) or “Incident” (TapRoot)

• Frequently there may be more than one for a given event
• It is the point where we start asking “Why?”
• Not universally known by everyone, it depends on each individual's perspective
• As we begin to understand how the puzzle of causes fits together, we often go from many Primary Effects to one
• If we choose to change our point of focus, we simply create another “Primary Effect” or “Incident”
The WHAT

Examples:

- **What**:
  - Injury, Equipment failure, Production loss, Job delay

- **What**
  - Computer unavailable, lost customer sales
The WHEN

- Capture the Actual Timing of the problem
  - Capture the date and time
  - Sometimes it is important to be very precise when listing the time
  - The nature of the particular problem will dictate the detail required

- “Date & Time of Incident”
The WHEN

• Capture the Relative Timing or Status
  ▫ What was happening when this particular event occurred?
  ▫ You may ask:
    • Was it close to shift change?
    • Was it the first time this equipment had been used?
    • What was the status of the system?
    • Was it during start-up?
    • Was it raining?
The WHEN

Example:

- **When:**
  - July 28, 2018 @ 4:32 PM
  - Returning to station after routine test run
  - During high wind gusts of 30+ mph
The WHERE

• Capture the specific location of the problem
• Include enough information for a reader, at some time in the future, to understand the setting
• This may be the identification of a work process, a manufacturing process, a facility operation or a piece of equipment

• “Facility Affected” & “Area Affected” The detail should be reported in the “Incident Summary”
The WHERE

Examples:

• Where:
  ▫ **SW Region > Utilities > Building 43 > MCC 235 > Panel 2**

• Where:
  ▫ **Boulder Site > Data Center > Aux. Cooling Unit > Floor**
The SIGNIFICANCE

- Importance
  - Significance asks the question, “Why are we even working on this issue?”
  - The significance helps to prioritize your incidents
  - A seemingly minor issue may be your most significant, once the frequency is considered
  - Issues with no immediate impact, but serious potential should be identified

- “Problem Definition / Significance of Event”
The SIGNIFICANCE

• Goals
  ▫ The significance section should reflect the overall goals of the business or organization
  ▫ The significance should be measurable where possible
The SIGNIFICANCE

• Use of Language:

**NO!**
- Injury
- Release
- Shutdown
- Late Delivery

**YES!**
- Lost use of hand
- Killed 7000 fish
- Lost $500,000 in product
- $1M in contract penalties
The SIGNIFICANCE

Examples:

- Significance:
  - Safety: No injuries, Serious potential
  - Environmental: None
  - Production: Reduced Rates 4 hours at 30,000 lbs/hr 120,000 lbs. Total $82,000
  - Maintenance: Materials $8,000, Labor $14,000
  - Frequency: 2x in 2017, 4x in 2018
Incident Report

Where to report this information on the Incident Report

- **What**: Incident Title
- **When**: Date & Time of Incident
- **Where**: Facility Affected / Area
- **Significance**: Problem Definition / Significance of Event
PROBLEM DEFINITION

Example:

• Problem Definition

  ▫ What : Equipment failure, Production loss, Delay
  ▫ When : July 28, 2018 @ 4:32 PM
  ▫ Where : SW Region > Utilities > Building 43 > MCC 235 > Panel 2
PROBLEM DEFINITION

Example:

- **Significance**
  - Safety: No injuries, Serious potential
  - Environmental: None
  - Production: Reduced Rates 4 hours at 30,000 lbs/hr 120,000 lbs.
    - Total $82,000
  - Maintenance: Materials $8,000, Labor $14,000
  - Frequency: 2x in 2017, 4x in 2018
Working Examples Day #1
Process

- **STEP #1** - Define the problem by writing the following:
  - What – When – Where – Significance
- **STEP #2** - Create a Cause and Effect Chart
  - For each Primary Effect ask Why
  - Look for causes in Actions & Conditions
  - Connect causes with “Caused By”
  - Support causes with Evidence or use a “?”
- **STEP #3** – Identify effective solutions
  - Challenge the causes and offer solutions
  - Identify the best solutions – they must:
    - Prevent recurrence
    - Be within your control
    - Meet your goals and objectives
- **STEP #4** – Implement the best solutions

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Cause and Effect Chart

EXAMPLE CAUSE AND EFFECT CHART

PRIMARY EFFECT

Pump Shutdown

Caused By

Condition

Pump Running

Operator Statement
Computer Point

Action

Low Oil Pressure Trip

Operator Statement
Computer Point

Condition

Protective Logic Circuit

Design Drawings
Surveillance Test

Action

Low Oil Press. Switch Actuated

Visual Observation
Computer Point

Condition

Switch Design

Design Drawings

Action

Loss of Oil

On Floor
Reservoir Low

Action

Oil Leaked Out

Operator Statement
Observation

Condition

Hole In Seal

Inspection

Condition

Pressure in Oil System

Computer Point
Operator Statement

Action

Seal Wear

Observation

Condition

Seal Installed on Shaft

System Design

Condition

Seal Design

Design Specification

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Working Example #1

• Incident
  ▫ A/C Unit caught fire in analyzer building #230 in the utility's outfall area at 2:30 AM, Sunday July 8, 2018
Working Example #2

- Incident
  - Hydrogen compressor motor failed which caused a shutdown of the olefins unit at 1:00 AM, Saturday July 6, 2019
  - On Monday, while you are starting the investigation the replacement motor fails
  - On Tuesday, the third motor fails, and the starter and cable also fail
Collecting Evidence
EVIDENCE

• Data that supports a conclusion
EVIDENCE

• Evidence falls into two categories:
  ▫ Sensed Evidence
  ▫ Inferred Evidence
EVIDENCE

• Sensed Evidence:
  ▫ Directly perceived by an individual
  ▫ Sight, Sound, Hearing, touch, Smell
**EVIDENCE**

- Inferred Evidence:
  - Known by repeatable causal relationships
  - Should be verified before including in completed chart
EVIDENCE SOURCES

- Computer Data:
  - Process Data
  - SAP or Business System Data
  - E-mail
EVIDENCE SOURCES

- Physical Evidence:
  - Equipment
  - Tools
  - Materials
EVIDENCE SOURCES

• Photography:
  ▫ Pictures
    • Scene
    • Aerial
    • Digital Camera

• Caution Should be Exhibited in Taking Pictures!!!
EVIDENCE SOURCES

• Photography Documentation:
  ▫ ONLY photograph if it contributes to the investigation process
  ▫ Record on clean film, magnetic or electronic memory media, video tape
  ▫ Include ONLY items necessary to investigation
  ▫ Exclude unnecessary items e.g. equipment, people, voices
  ▫ Utilize a scale reference where appropriate
EVIDENCE SOURCES

• Photography:
  ▫ Ultraviolet & Infrared
  ▫ Videotape
  ▫ Materials Testing
  ▫ X-ray
  ▫ Thermal Scan, etc…
EVIDENCE SOURCES

• Medical:
  ▫ Autopsies
  ▫ X-rays
  ▫ Drug/Alcohol Testing
EVIDENCE SOURCES

• Diagrams and Sketches:
  ▫ Process & Instrument Diagram (P&ID’s)
  ▫ Enterprise Functional Diagram (EFD’s)
  ▫ Schematics
EVIDENCE SOURCES

• Procedure’s / Checklists:
  ▫ Operating
  ▫ Maintenance
  ▫ Safety
  ▫ Site and/or Corporate
EVIDENCE SOURCES

• Records / Documents:
  ▫ Codes & Standards
  ▫ Work Permits
  ▫ Instructions
  ▫ Work Orders
  ▫ Previous Investigation Reports
EVIDENCE SOURCES

• Records / Documents:
  ▫ Process Hazard Analysis (PHA’s)
  ▫ MOC Documentation
  ▫ Audits
  ▫ Documentation of Closure on Corrective Actions

• Why is Documented Closure Important???
PRESERVING EVIDENCE

• Short Term:
  ▫ Secure the area and related equipment (barricade tape)
  ▫ Control access to the area (sign in and out)
  ▫ Protect evidence from the elements
  ▫ Preserve condition and location of equipment, tools & materials
  ▫ Prepare a chain of custody
  ▫ Maintain good documentation
  ▫ Photography / Video
PRESERVING EVIDENCE

• Photographic Evidence Documentation:
  ▫ Maintain chain of custody
  ▫ Record The Following:
    • Photographer’s name and location
    • Location, date, time when photograph / video taken
    • Description of photograph / video content
PRESERVING EVIDENCE

• Short Term:
  ▫ **Electronic information:**
    • Downloaded in storable format
    • Or hard copy produced

• Very Important!!! Many Control and Data Acquisition Systems overwrite data
PRESERVING EVIDENCE

• Long Term:
  ▫ Protection from the elements
  ▫ Secure location
  ▫ Controlled Access
  ▫ Chain of custody maintained
  ▫ Submit original media to Incident Investigation Team Leader (recording transfer of custody)
  ▫ Original media shall be sealed and submitted per site/corporate procedures (recording transfer of custody)
Interviewing
INTERVIEWING

• The Purpose of an Interview is to Gather Information to be Used in Defining an Historical Action or Event

• No Bright lights and Good Cop, Bad Cop Routines…
INTERVIEWING

An Interview is NOT:

• An Inquisition
• An Effort to Find Fault
• An Effort to Place Blame
• Just a Friendly Chat
INTERVIEWING

An Interview SHOULD BE:

• A Well Planned Dialogue
• An Effort to Find Facts
• More Listening than Talking
INTERVIEWING

Interview Preparation:

• Review what is known so far
  ▫ Use the preliminary chart
  ▫ Use the Level 1 report
INTERVIEWING

Interview Preparation:

• Prepare a list of people to be interviewed
• Preserve a private, neutral area for the interview
• Determine the appropriate types or types of interviews to be conducted
INTERVIEWING

Interview Preparation:

• Interview Types
  ▫ One on One
    • The simplest
  ▫ Two on One
    • One asks / One records
INTERVIEWING

Interview Preparation:

• Interview Types

  ▪ One on Many
    • Group problem solving
    • Must understand the group dynamics prior to the interview
INTERVIEWING

Interview Preparation:

• Interview Types
  ▫ Many on One
    • Allows all team members to hear the same information
    • May be intimidating to the interviewee
INTERVIEWING

REMEMBER:

• Fact Finding
  ▫ Not Fault Finding
• Problem Solving
  ▫ Not Interrogation
The INTERVIEW

• Sit on the same side of the table, about 3-5 feet away
• Introduce yourself and explain the purpose of the interview
• Explain the interview process
• Ask a few simple questions to break the ice (time on the job, length of employment. Etc.)
The INTERVIEW

• Have them explain “in their own words” what they observed from start to finish

• **DON’T INERRUPT!!!!!!**
The INTERVIEW

• Once they have finished ask questions
  ▫ Do NOT ask “why”
  ▫ Instead use “how” or “what”
The INTERVIEW

• Next start at the end and work backwards – for each step what did they:
  ▫ Do, See, Hear, Smell, Feel, Taste…. 
The INTERVIEW

• Review the chart with them
  ▫ Is it accurate?
  ▫ Can they explain gaps / inconsistencies?
  ▫ Can they make it better / add details?
The INTERVIEW

• ASK: Do they have any important information that has not been shared yet?

• Very important to ask this question.....
The INTERVIEW

• Tell them collecting information is an ongoing process – ask if it’s OK to follow up later with more questions (if needed)

• Thank them, and ask if they would call if they think of anything else
The INTERVIEW

• Recording information for L3 & L4 Incidents
  ▫ Witnesses shall not make any written and signed statements unless directed by Legal
  ▫ Handwritten interview notes shall record facts ONLY
  ▫ Witness interview notes should be turned over to Incident Investigation Team Leader
    • Maintaining witness interview notes does not require Legal approval
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Interviewee feels investigation is attempt to place
  ▫ **Approach** – Communicate investigation is Fact finding, not Fault finding. Let the interviewee know their names will not appear in any reports.
The INTERVIEW

• Obstacles to Interview

  ▪ **Obstacle** – Hostility on the part of the person to be interviewed
  ▪ **Approach** – Have someone they respect conduct the interview. Collaborate with this person on the purpose and specific questions
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Fear of saying the wrong thing, or fear of punishment
  ▫ **Approach** – Make introductory remarks to put the person at ease. Emphasize fact finding, not fault finding. Explain how information will be used. Use chart to focus on “what Happened” instead of “Who to Blame”.

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The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Pressure to “sanitize” the story
  ▫ **Approach** – Conduct interview as a One on One interview as soon as possible. Interview quickly and keep management informed of facts.
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Covering up or “creating” information
  ▫ **Approach** –
    • Make NO judgmental comments
    • Ask “how” or “what” questions NOT “why” questions
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Covering up or “creating” information
  ▫ **Approach** –
    • If a person gives evasive answers (e.g. That’s about all. I can’t think of anything else. I would deny that.)
    • Ask the question again worded slightly differently
The INTERVIEW

• Obstacles to Interview
  ▫ Signs of Stress, Hitting a Nerve, or “Creating” Information:
    ▫ Women tend to have a higher pitch in their voice and men tend to become louder when they are nervous
    ▫ Fast body position change also indicates nervousness
The INTERVIEW

• Obstacles to Interview
  ▫ Signs of Stress, Hitting a Nerve, or “Creating” Information:
  ▫ If you ask a question and they look up 20 degrees and:
    • To their left, they are remembering visual information
    • To their right they may be creating visual information
The INTERVIEW

- Obstacles to Interview
  - Obstacle – People Forget
  - Approach –
    - Interview quickly
    - Get the person in the same circumstances they were in during the incident (e.g. posture, position, location, etc.)
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – People Forget
  ▫ **Approach** –
    • Have the interviewee start at the beginning and “in their own words” describe the details they remember
    • Have them start with the incident, work backwards and describe what they saw
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – People Forget
  ▫ **Approach** –
    • Have the interviewee put themselves in someone else’s shoes and describe what that person would have seen or experienced
    • Ask if there are other things you haven’t asked that they think might be important
The INTERVIEW

• Obstacles to Interview
  ▼ Obstacle —
    • People Rationalize What Happened
    • People Develop Personal Conflicts
    • People Get Transferred or Moved
  ▼ Approach —
    • Interview Quickly
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Interviewer interrupts and talks too much
  ▫ **Approach** –
    • Limit your time talking (strive for 20% interviewer talking and 80% interviewee talking)
    • Wait for interviewee to provide complete answer before asking the next question
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Interviewer is Overly Aggressive
  ▫ **Approach** –
    • Ask questions without being sarcastic, accusing or demeaning
    • Keep voice in “leveler” mode (if they get louder, you get quieter)
    • Make no judgements on information being provided
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Interviewer is Disinterested, Non-Empathetic
  ▫ **Approach** –
    • Maintain good eye contact
    • Allow periods of silence during interview
    • Try to place yourself in interviewee's shoes (be empathetic)
The INTERVIEW

• Obstacles to Interview
  ▫ **Obstacle** – Interviewer Let’s Interview Turn into Gripe Session
  ▫ **Approach** –
    • Acknowledge concerns
    • Use chart to keep focus on the incident
AFTER The INTERVIEW

• Review documentation
• Share important information with team
• Update chart if needed
Prioritization
PRIORITIZING CORRECTIVE ACTIONS

The Concept:
- Use your Enterprise Prioritization Worksheet
- Consistent with Enterprise Risk Management Philosophy
- Consistent with OE Audit Findings Prioritization
- Helps Focus on Most Leveraging Items
PRIORITIZING CORRECTIVE ACTIONS

The Process:

• Follow the guidelines for a good incident investigation
• Determine the root cause(s) for the incident
• Develop corrective actions that address the identified root causes(s)
• Prioritize those corrective actions using the Enterprise matrix
PRIORITIZING CORRECTIVE ACTIONS

The Approach:

• Select the causal factor(s) for the root causes that have been identified
  ▫ In Apollo this is the “Cause” box
  ▫ In TapRoot this is the marked “Causal Factor”
PRIORITIZING CORRECTIVE ACTIONS

The Approach:

• A Causal Factor is any problem associated with the incident that, if corrected, could have prevented the incident from occurring or would have significantly mitigated its consequences
PRIORITIZING CORRECTIVE ACTIONS

The Approach:

• Determine the potential impact that can be “reasonably” expected if that factor is not corrected
  ▫ High, Medium, or Low Impact
PRIORITIZING CORRECTIVE ACTIONS

The Approach:

• Determine the potential frequency of the occurrence (High or Low) based on:
  ▫ Personnel Exposure Frequency
  ▫ History of Recurrence
  ▫ Presence of Other Safeguards

• Determine the priority using the matrix

• Apply that priority to all corrective actions associated with correcting or eliminating that causal factor
Causal Factor Worksheet

CAUSAL FACTOR PRIORITIZATION WORKSHEET

Potential impact of Causal Factor
- Hospitalization of employee(s), contractors, or members of the public for an overnight stay for more than observation
- Fatal or life disabling injury
- Fire or explosion that requires actual firefighting or other outside assistance (mutual aid) or results in major unit damage or downtime
- Significant business interruption
- Off-site safety or health impact
- Major compliance issues
- Major news event with extensive/substantial media or public attention
- Significant environmental damage
- Significant management system deficiency in a PSM element
- Significant management system deficiency which impacts reliability

Consequence

High Impact

Medium Impact

Low Impact

FREQUENCY

Low

High

Personal exposure frequency < once/shift
OR
Causal factor has occurred in last 10 years
OR
1 or more safeguards mitigating risk
When using Apollo evaluate the cause in the "cause/effect" box as indicated here.
When using TapRoot

evaluate the marked causal factors as indicated here

Answer questions on matrix as they relate to “Causes”. Priority determined is for all CA’s tied to that cause.
Person Walks to Car
  - Car in usual spot in company lot

Person Steps in Pothole
  - Hole not visible after dark

Person Sprains Ankle
  - No barricades around hole
  - Pothole reported 4 weeks ago - no action taken
  - Light failed 3 days ago - no repair

Transported to Hospital and Treated

Answer questions on matrix as they relate to "Causes". Priority determined is for all CA's tied to that cause.

When using TapRoot

evaluate the marked causal factors as indicated here

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Increased Feed Rates to OPI → 5th Stage Discharge Pressure Increased to 570#

Lighter than Normal Feed State

5th Stage Discharge Pressure Increased (Charge Gas Compressor)

Operating Pressure Runs Close to PSV Set Pressure (Greater than 90% Set Press)

No Hard Limit on Maximum Discharge Operating Pressure

PIC-35007 High Pressure Alarm Set at 575#

PSV-35020A Relieved (5th Stage Discharge PSV)

Operations Noticed Material in Flare

Outside Operators Began to Look for Source of Flaring

Traditional PSV Relieve at +/- 10% of Set Pressure

Exceeded RQ on BD & Benzene

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Incident Description:
PSV-35020 A (5th Stage Discharge Pressure - Charge Gas Compressor) relieved at 12:26 pm on 8/15/01 and was blocked in at 12:35 pm for a total of 9 minutes flaring time. PSV set pressure is 500 psig. PSV relieved at 570 psig, PSV would not reset even when pressure got down to 541 psig. At that time, PSV-35050 A was blocked in by operations given that there was adequate back-up by PSV-35020 B & PIC-35007. An RO was reached on BD and Benzene. Agency notifications were made on the initial numbers.

Immediate Corrective Actions:
PSV-35020 A was blocked in and sent out for service. (24 hour turnaround time).

Extended chattering/overpressure destroyed the seal and bent the stem which prevented the disc from resetting.

Causal Factor:
01
Traditional PSV Relieve at ~10% of Set Pressure

Root Cause:
Equipment Difficulty (1E)
Design (2D)
Design Specifications (3S)
Problem Not Anticipated (4P)

Corrective Action:
01
Date Due: 01/01/2003
Due to the fact that the operating pressure runs close to the PSV set pressure, a pilot valve (+/- 2% Deviation) should be installed instead of using the traditional type PSVs (+/- 10% Deviation)

Causal Factor:
02
PSV-35020A/B (5th Stage Discharge PSV) Set Pressure = 550#
EXAMPLE - PSV

- Traditional PSV relieves at +/- 10% of set pressure

- Operating pressure runs close to PSV set pressure = 590#

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EXAMPLE - PSV

- Using the matrix, determine the potential impact of not eliminating this causal factor.
  - “If we continue to run with operating pressure at greater than 90% of the setpoint for this PSV we could potentially…”
  - Going through the questions leads us to a “yes” on “major compliance issue” by having a significant release of benzene
  - This puts us into the “High Impact” area
EXAMPLE - PSV

• Next, use the matrix to determine the frequency.
  ▫ The frequency of this causal factor is 3 occurrences in the last 10 years, which puts us in a “High” category
  ▫ Additionally, there are no safeguards in place to mitigate the risk (so even if this had not occurred within the past 10 years, we would still be in a “High” category)
EXAMPLE - PSV

• Based on the matrix, the corrective actions associated with this causal factor would fall into the “1” box making them not only “most important”, but also requiring some immediate action until a long-term fix could be implemented.
Corrective Action Development
CORRECTIVE ACTION DEVELOPMENT

“It is not the root causes we seek, it is effective solutions.”
CORRECTIVE ACTION DEVELOPMENT

Corrective Actions:

- Corrective Actions should meet the following criteria:
  - Prevent Recurrence
  - Be within “Your” Control
  - Meet “Your” Goals & Objectives

- “Your” is the person or persons responsible for the success of the solution to prevent recurrence
CORRECTIVE ACTION DEVELOPMENT

Generating “Effective Corrective Actions”:

• Challenge each cause
  □ Ask what can be done to Change, Control or Prevent the cause

• Be creative – think outside your group

• Evaluate the possible actions using the three criteria

• Choose which action(s) best meet the criteria

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CORRECTIVE ACTION DEVELOPMENT

Beware of Solution Killers!

• That will never work here
• This will take forever
• We’re too busy to do that
• No one will buy it
• We already tried that once
• That’s not our policy here
• That costs too much
• Good thought, but not practical
• Management will never go for it
• No one else does it that way
• We’ve always done it that way
CORRECTIVE ACTION DEVELOPMENT

Creating Actions Items:

• Satisfy the Criteria
• Be Specific
• Write in terms that can be “closed out”
• Avoid actions that are to be carried out in the future, i.e. “review, analyze, investigate” (this may create further action, and the action item will not be closed until all action is complete)
CORRECTIVE ACTION DEVELOPMENT

Creating Actions Items - Continued:

- Avoid actions that will not have lasting effects
- Avoid “re, “i.e. “retrain”
- Assign priority
- Assign responsibility
- Assign “reasonable” target closure dates
- The solution may be to do nothing!!

Safety Huddles and Safety Grams should be considered as an expectation & NOT a corrective action
CORRECTIVE ACTION DEVELOPMENT

Local Attention Items (LAI):

- Used for corrective actions that do not apply directly to the causes
- Used for items that are identified outside the scope of the investigation
- Provided directly to the area superintendent or unit supervisor
- NOT INCLUDED IN THE FORMAL INCIDENT INVESTIGATION REPORT!!!
CORRECTIVE ACTION DEVELOPMENT

Corrective Actions:

• In Summary, Corrective Actions SHOULD BE:
  ▫ S - Specific
  ▫ M - Measurable
  ▫ A - Accountable
  ▫ R - Reasonable
  ▫ T - Timely
  ▫ E - Effective
  ▫ R - Reviewed
Process

• STEP #1 - Define the problem by writing the following:
  • What – When – Where – Significance

• STEP #2 - Create a Cause and Effect Chart
  • For each Primary Effect ask Why
  • Look for causes in Actions & Conditions
  • Connect causes with “Caused By”
  • Support causes with Evidence or use a “?”

• STEP #3 – Identify effective solutions
  • Challenge the causes and offer solutions
  • Identify the best solutions – they must:
    • Prevent recurrence
    • Be within your control
    • Meet your goals and objectives

• STEP #4 – Implement the best solutions
Working Example #1

• Incident
  ▫ Butadiene Tank overfilled in olefins unit tank farm at 1:00 PM, Sunday July 7, 2019
  ▫ Outside operator was exposed to the release
  ▫ Vapor cloud drifted outside of facility and crosses a major road drifting towards a subdivision.
Working Example #2

• Incident
  ▫ Engineer while mounting plant bicycle lost balance and fell. Engineer transported to hospital were procedures and medication was prescribed which resulted in OSHA recordable event.
  ▫ 9:00 AM, Monday July 9, 2018
EXAMPLE - Employee

- Employee did not notice the uneven surface while unlocking the bicycle
- Prior medical condition increased the severity of the injury
Apollo Cause and Effect Chart

Causal factor on chart
Employee lost balance, dislocated hip and fell to the ground while unlocking a bicycle. The employee was transported to hospital, where medical procedures and medication were prescribed. Employee returned to work on 10/20/03.

**Initial Conditions:**
Unit in turnaround, evening, sunny, no notable environmental or weather conditions impacting nature or severity of incident.

**Incident Description:** In the evening of October 17/2003 at about 5.45 PM, an employee lost balance on an uneven surface while unlocking a bicycle. Hospital treatment required medications and resetting the hip. The employee had been supporting the and had worked eight straight, thirteen-hour days. Employee returned to work on October 20/2003.

**Immediate Corrective Actions:** Operation conducted a plant survey and identified areas where uneven surface posed a safety hazard. These areas were repaired.

**Root Cause(s) / Causal:**
A root cause analysis was performed using the Apollo® Root Cause method. The cause and effect chart is attached in Appendix 1. The incident was the result of the following causal factors:
- Employee did not notice the uneven surface while unlocking the bicycle.
- Prior medical condition increased the severity of the injury.

Causal factor in report
Report Writing
REPORT WRITING

Purpose of the Written Report:
• Formal record of the incident
• Method of communicating findings and lessons learned within the site and across the Enterprise
• Basis for justifying why resources should be provided for CA’s to prevent recurrence
REPORT WRITING

General Guidance:

• The report is the basis by which the investigation will be judged by many
• The report as well as the chart should be able to stand alone
• Keep the tone of the report factual
• Ensure the same incident is addressed throughout the report
REPORT WRITING

General Guidance:

• Review corrective actions with the person responsible for implementation

• There should be **NO SURPRISES** for the team or management
REPORT WRITING

Common Problems:

• Information in the wrong sections
• Different “story” told in each section of the report
• Root Cause not properly determined / not reached
• No justification for conclusions or recommendations
• Report does not flow smoothly
• Spelling, grammar and typing errors
REPORT WRITING

Sentence Clarity and Precision:

- Avoid Lengthy and Confusing Sentences
- Use Familiar Words
REPORT WRITING

Sentence Clarity and Precision:

**Instead of**
accounted for by the fact
adverse impact on
albeit
along the lines of
analogous
as a means of
at the present time
close proximity

**Try**
because
hurt, damage
though
like
similar
to
now, currently
near
REPORT WRITING

Words that can weaken your writing:

- Words that are restrictive:

  Always  
  Critical  
  Mandatory  
  Must  
  Needed  
  Required  
  Should  
  Solely  
  Necessary
REPORT WRITING

Words that can weaken your writing:

• Words that can be quantified:

  Absolutely  All  Extensive
  Largely  Might  Minor
  Pervasive  Possible  Rather
  Seems  Severe  Significant
  Substantial  Typical  Unique
  Urgent  Very
REPORT WRITING

Words that can weaken your writing:

• Words that are inflammatory to the public:

  Catastrophe    Contaminate    Disaster
  Lethal         Dump           Spill
  Threaten
REPORT WRITING

Editing Techniques:

• Edit for Readability and Style:
  ▫ Have the readers needs, and technical expertise or limitations been considered?
  ▫ Are there any confusing statements that might be misunderstood or misinterpreted?
  ▫ Has unnecessary technical jargon been eliminated?
  ▫ Are sentences free of wordiness?
REPORT WRITING

Editing Techniques:

• Edit for Readability and Style:
  ▫ Is the “tone of voice” appropriate?
  ▫ Are spelling, grammar, punctuation and usage, correct?
REPORT WRITING

Example Report Format

PURPOSE: Prevention, not blame.

WHAT: Pump Shutdown
WHEN: 3/14/95 at 9:45 AM
After 17,000 hrs of operation
WHERE: Pump House, River Water System, P-144
SIGNIFICANCE: Safety: No injuries
Environmental: No impact
Production: None, Potential plant shutdown
Maintenance: Mtls. $800, Labor $1,100
Frequency: 3x this year

C&E SUMMARY - The pump shutdown was caused by a low oil pressure trip and the pump running. The low oil pressure trip was caused by the low oil pressure switch actuating and the protective logic circuit. The low oil pressure switch actuating was caused by loss of oil and the switch design. The loss of oil was caused by oil leaking out and a hole in the seal. The oil leaking out was caused by pressure in the system. The hole in the seal was caused by seal wear. The seal wear was caused by shaft rotation, seal design and the seal installed on the shaft.

SOLUTIONS -

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>CORRECTIVE ACTIONS</th>
<th>NAME</th>
<th>DUE</th>
<th>DONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal Wear (See C&amp;E Chart)</td>
<td>Schedule the seal to be replaced during the annual maintenance outage.</td>
<td>Chuck</td>
<td>4/20/95</td>
<td>4/15/95</td>
</tr>
</tbody>
</table>

REPORTWRITER: Gerry Grisham
REPORT DATE: 3/23/95
APPROVAL: Tony Topdrawer, Plant Manager

NOTE: This example is intended to illustrate the format necessary for an effective RCA report. It should not be used to create the "right" form. As taught in the Apollo training classes there are many possible solutions (corrective actions) to this problem. The solution listed above is one of the possibilities, but it is not the "right" answer.
REPORT WRITING

Example Report Format

INCIDENT INVESTIGATION FINAL REPORT FORMAT

Incident Number:
Incident Title:
Date & Time of incident:
Level Based On: (Brief statement explaining why the incident is a particular level)

Site:
Area:
Unit / Department:

Incident Summary: (A short paragraph that briefly describes the incident. It should include the extent of injuries, extent of damage, environmental impact, and immediate corrective actions)

Root Cause(s) / Causal Factors: (The most basic cause or causes for the incident that if corrected will prevent this incident, or a similar one, from recurring)

Recommendations / Corrective Actions: (The actions to be taken to prevent the recurrence of each root cause)

Priority:
Target Closure Date:
Corrective Action Owner:

Chronology of Events: (Detailed explanation of the event and its timeline)

Consequence Statement, Including Site History of Similar Incidents: (For PSM incidents) (Brief explanation of types of consequences such as Safety, Environmental, Production, Cost, Frequency of past occurrences)

References and Attachments: (Root Cause Analysis chart, etc.)

Investigation Team: (Names and Titles)

Approval Signatures: (Set by site procedures)
Summary

- All Investigations, FMEA, etc….
  - Gather data quickly
  - Interview individual early
- Legal retain final report only
- Define the problem by writing the following:
  - What – When – Where – Significance
- Create a Cause and Effect Chart
  - For each Primary Effect ask Why
  - Look for causes in Actions & Conditions
  - Connect causes with “Caused By”
  - Support causes with Evidence or use a “?”
- Identify effective solutions
  - Challenge the causes and offer solutions
  - Identify the best solutions – they must:
    - Prevent recurrence
    - Be within your control
    - Meet your goals and objectives
- Implement the best solutions
Thank You.