Incident Investigation Team Leader Training

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Presenter

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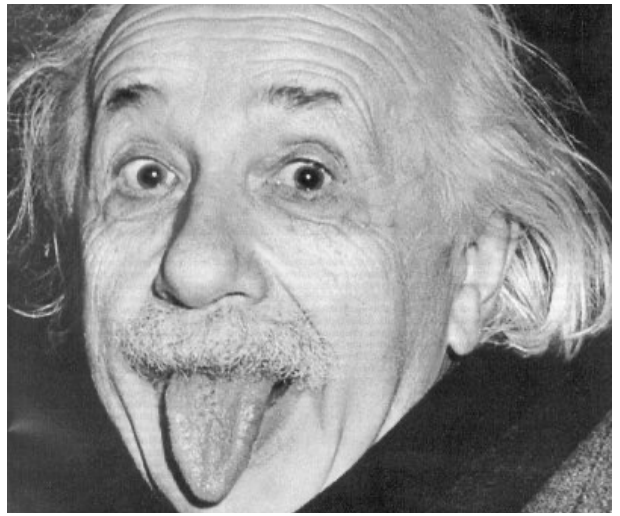
- Senior Consultant
- Long Time IEEE Houston Section Officer
- Numerous other leadership positions in IEEEE including sections, regions, institute, societies and standards
- Numerous leadership positions in ISA including institute and standards
- Leadership positions or participation in API, IEC, NFPA 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

Incident Investigation Team Leader Training

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

Legal View

Texas City - 2005

Texas City - 2005

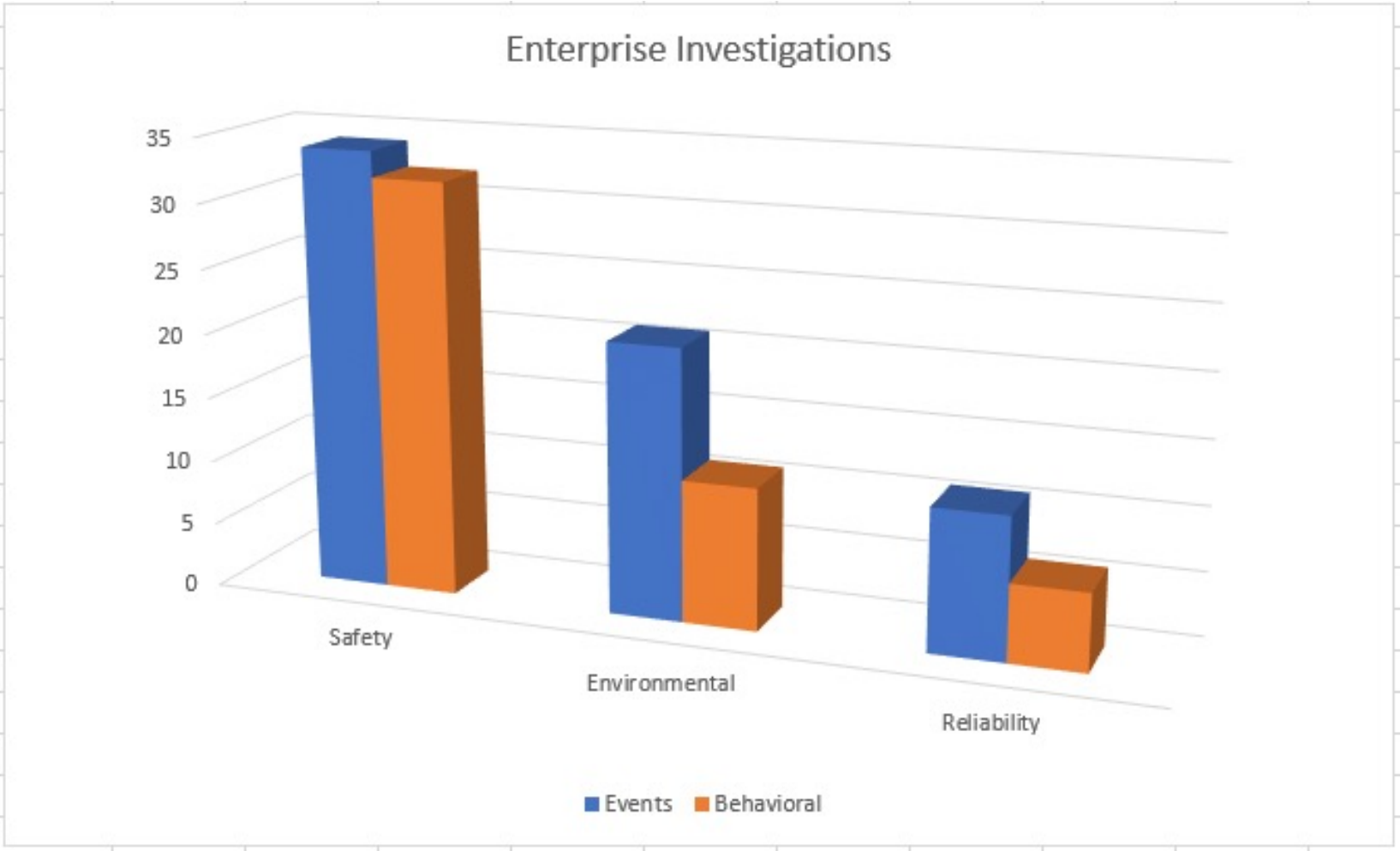
Texas City - 2005

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



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

Problem Statement

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.

Understanding and Dealing with Human Error - Cont

- 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

Example Factors Contributing to Error

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

Example Factors Contributing to Error

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

Example Factors Contributing to Error

Cognitive Overload

- System demands exceed human information processing capability.
  - Panel operators receives multiple critical alarms at the same time and fails to initiate corrective actions to prevent unit shutdown

Investigator's Responsibilities

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?
- SIGNNIFICANCE – 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 Affected / Incident Summary
- 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
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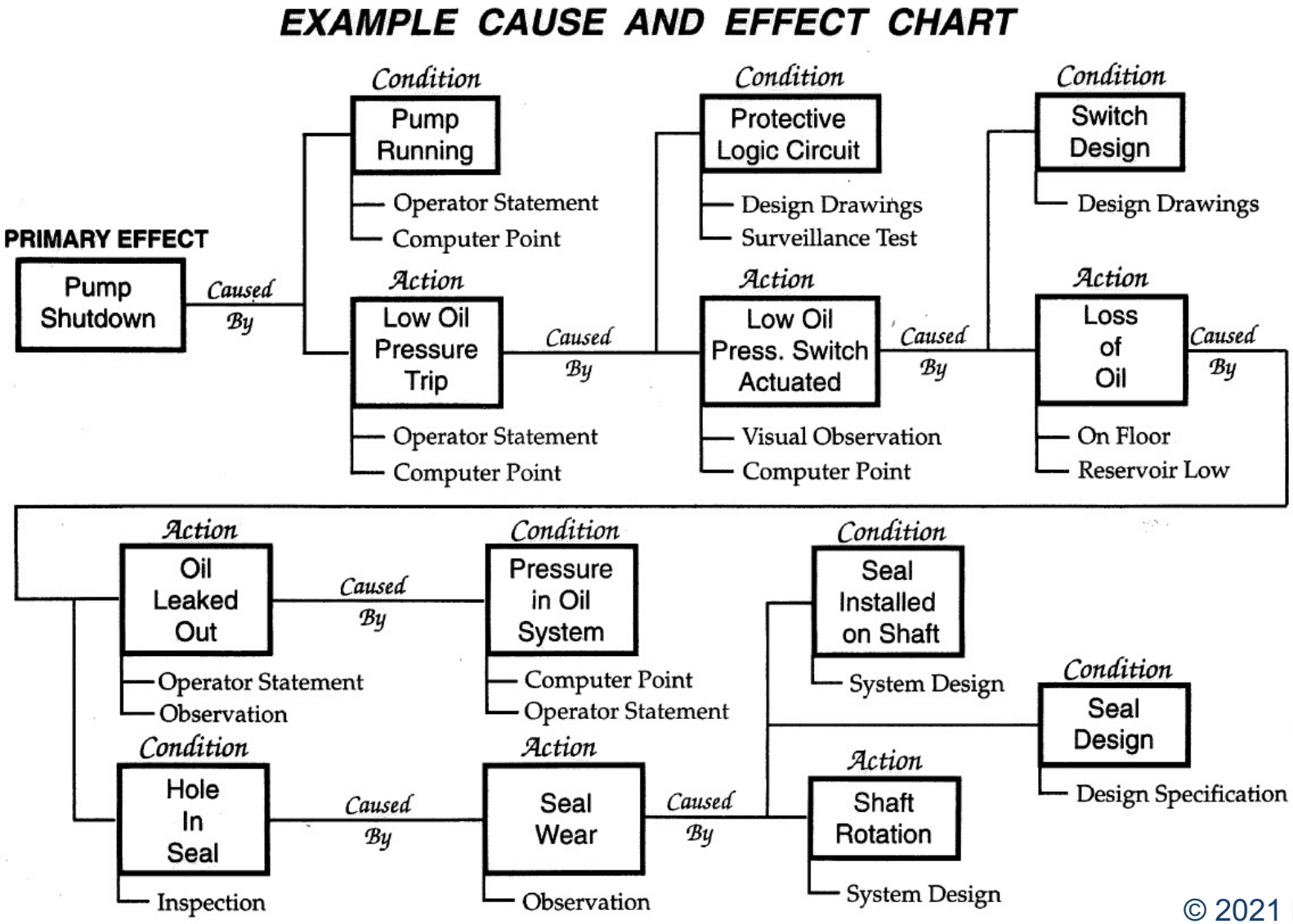
Working Examples Day #1

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

Cause and Effect Chart



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".

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 interviewees 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:

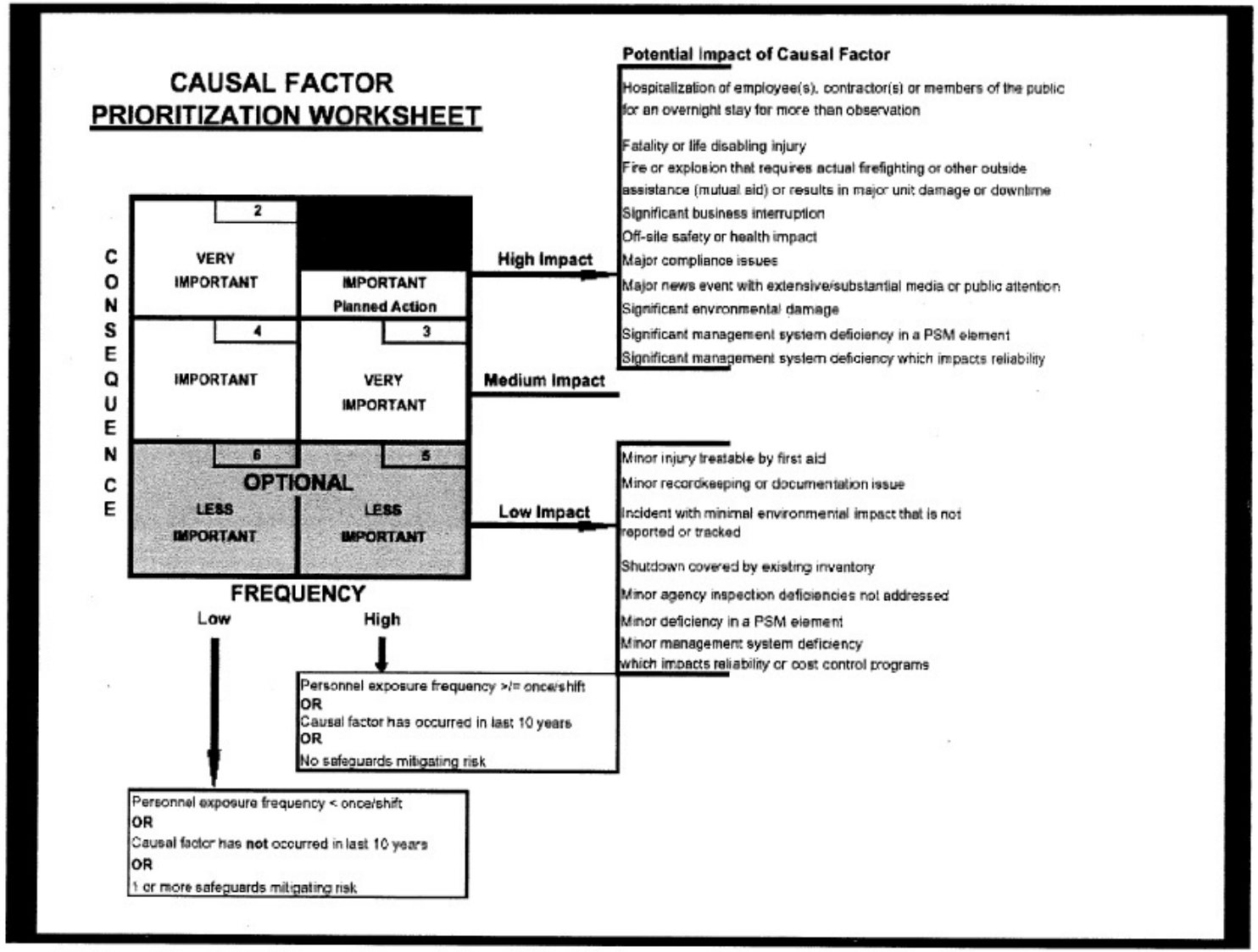
- Determine the potential impact that can be "reasonably" expected if that factor is not corrected
  - High, Medium, or Low Impact

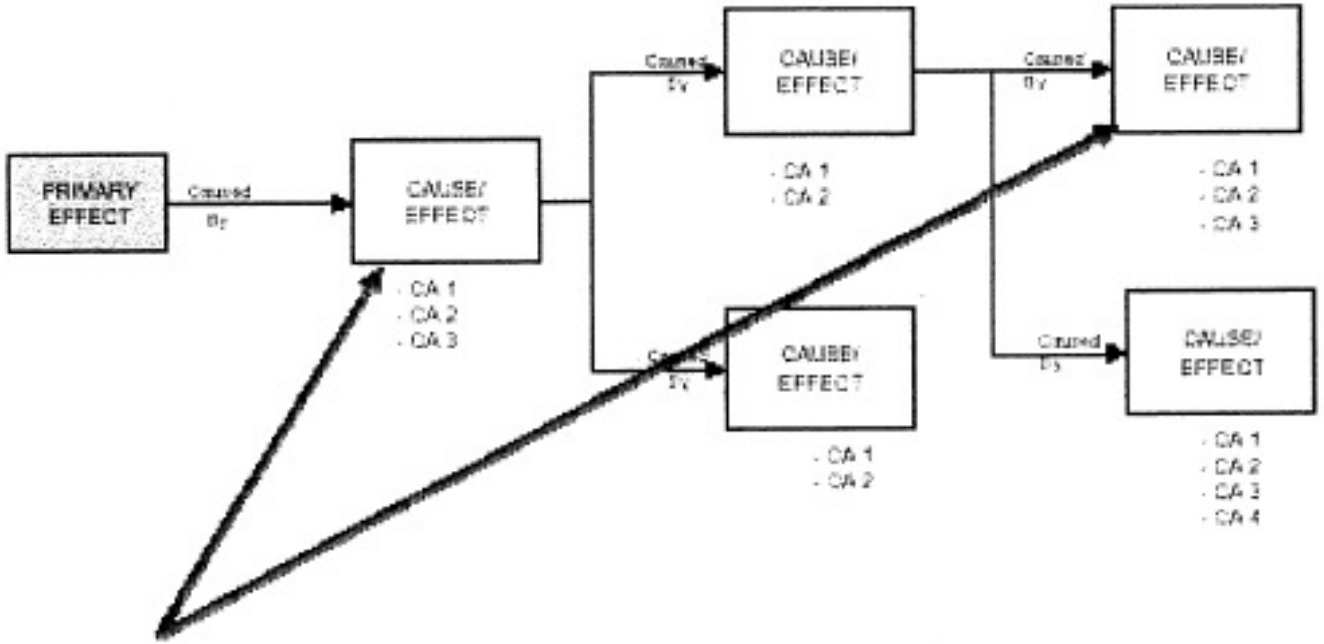
PRIORITIZING CORRECTIVE ACTIONS

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

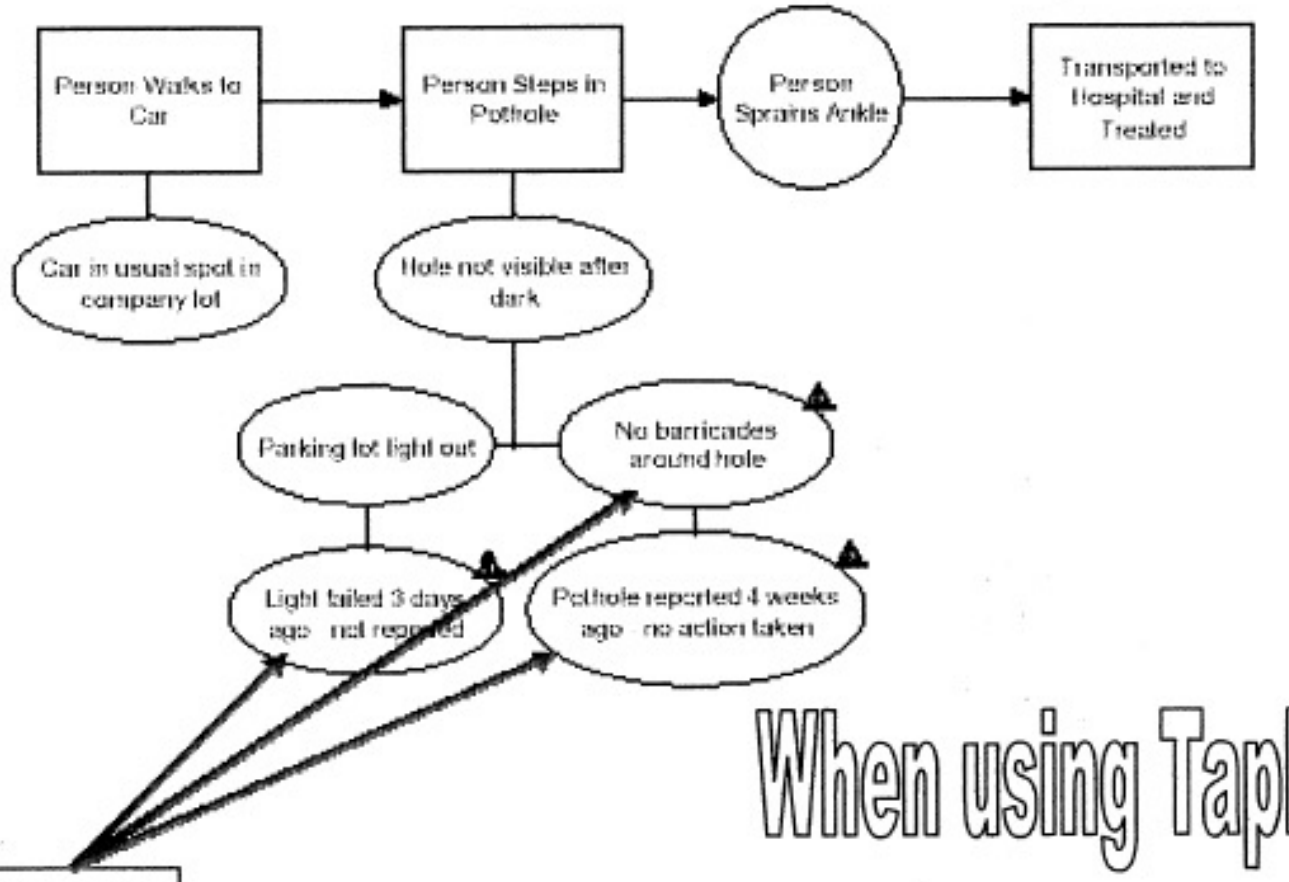




Answer questions on matrix as they relate to "Causes". Priority determined is for all CA's tied to that cause.

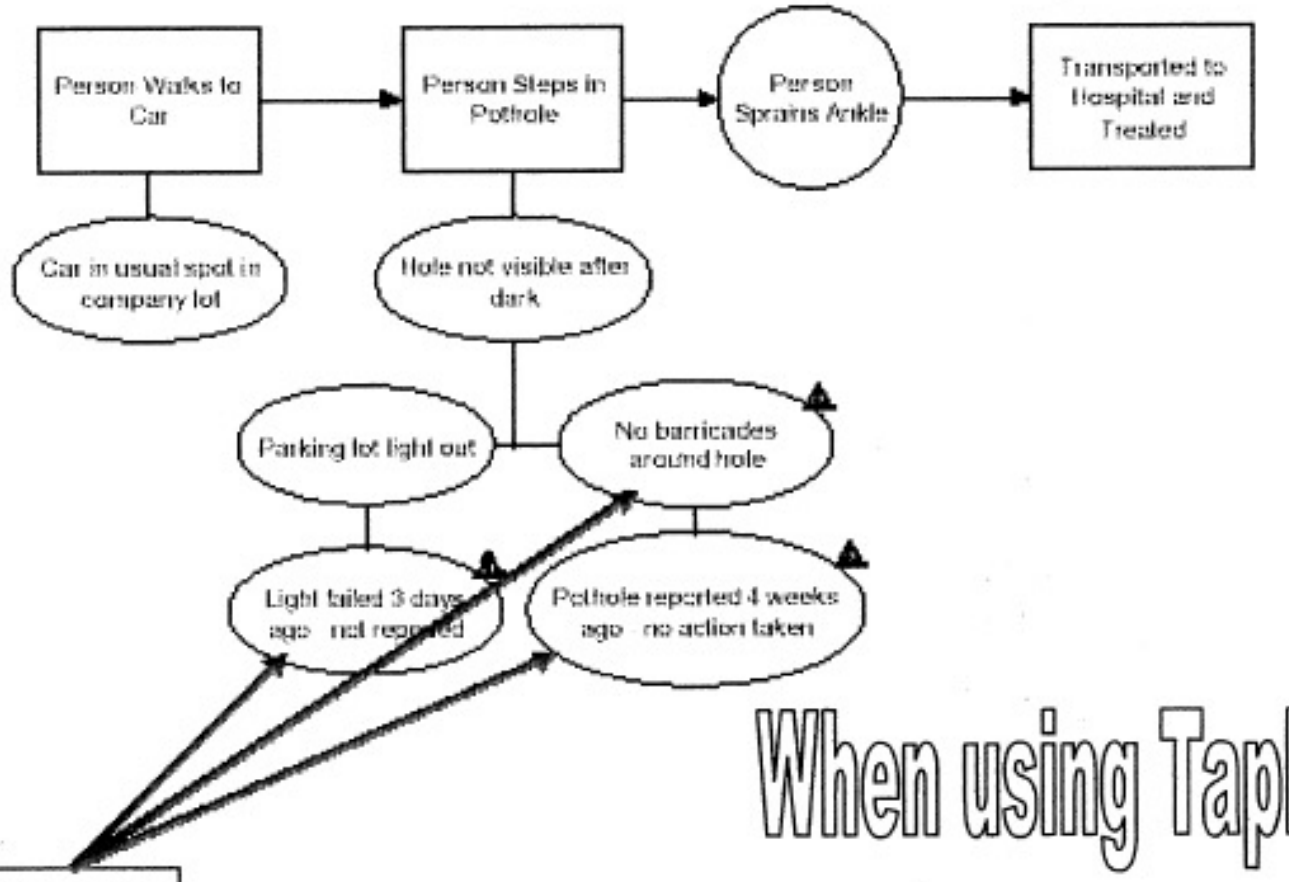
When using Apollo

evaluate the cause in the "cause / effect" box as indicated here



When using TapRoot

evaluate the marked causal factors as indicated here



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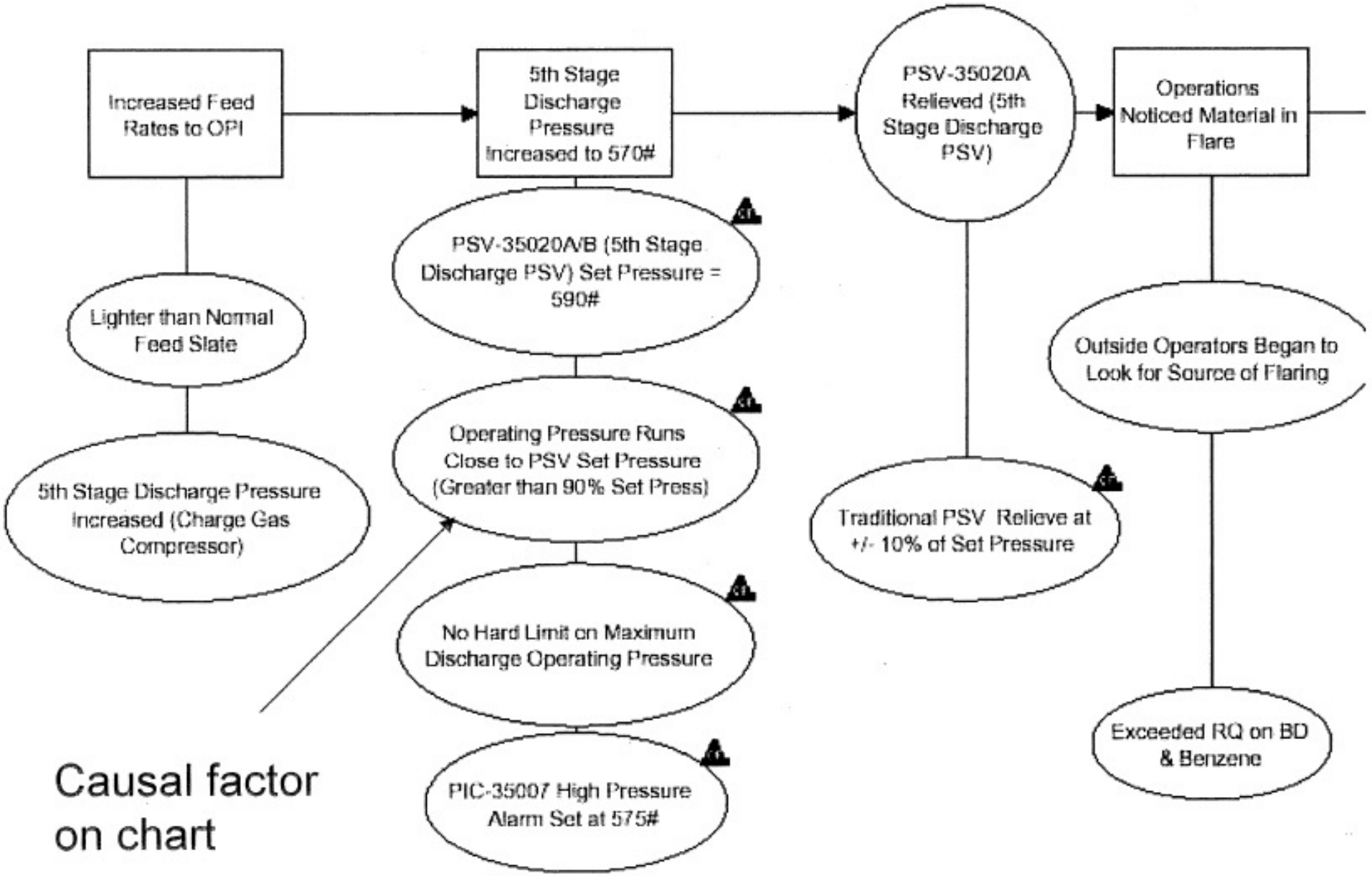
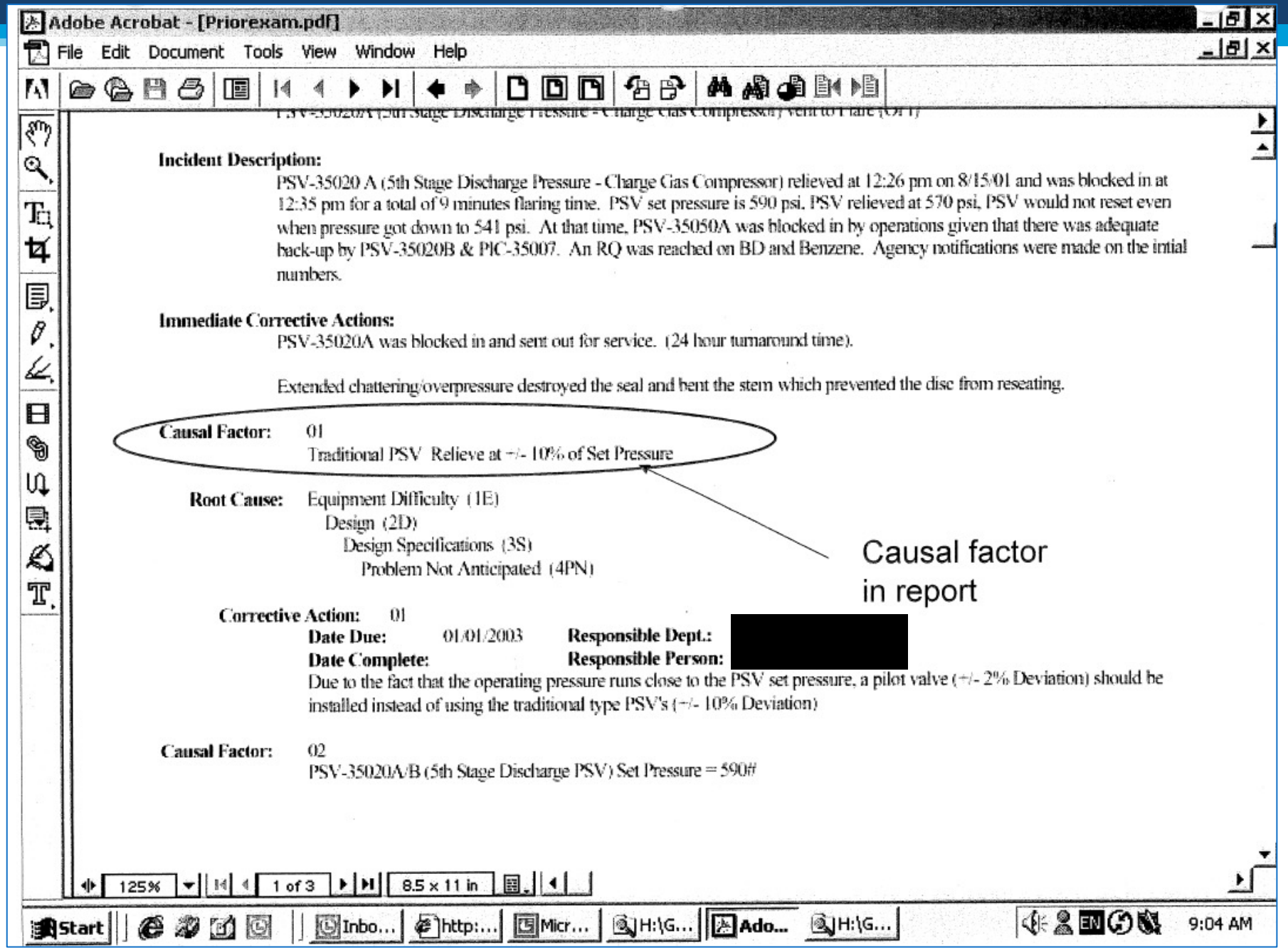




EXAMPLE - PSV

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

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

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

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:

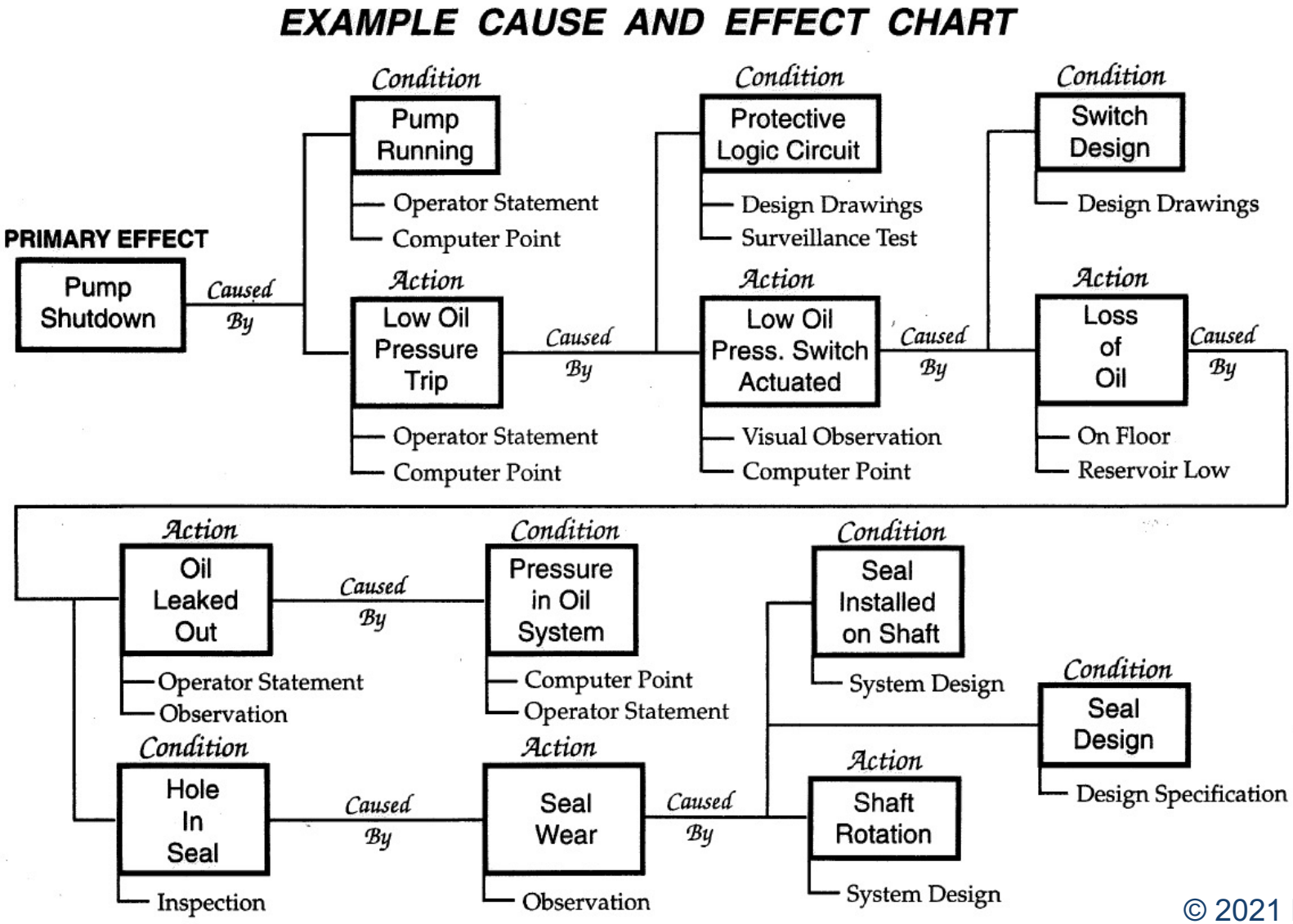
- In Summary, Corrective Actions SHOULD BE:
  - S - Specific
  - M - Measurable
  - A - Accountable
  - R - Reasonable
  - T - Timely
  - E - Effective
  - R - Reviewed

Working Examples Day #2

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

Cause and Effect Chart



Working Example #1

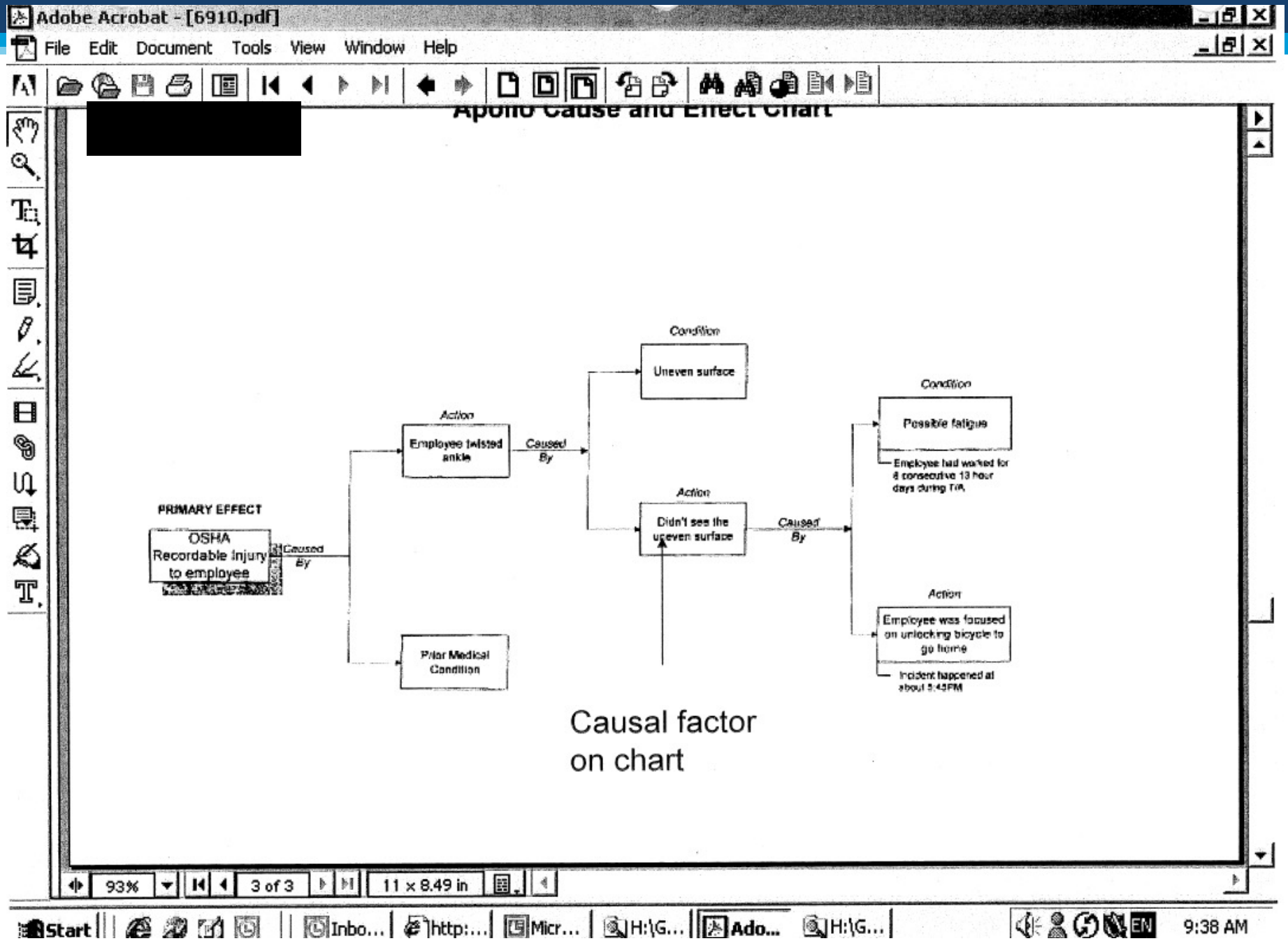
- Incident
  - Butadiene Tank overfilled in olefins unit tank farm at 1:00 PM, Sunday July 7, 2019
  - Outside operator was exposed to the release
  - Vapor cloud drifted outside of facility and crosses a major road drifting towards a subdivision.

Working Example #2

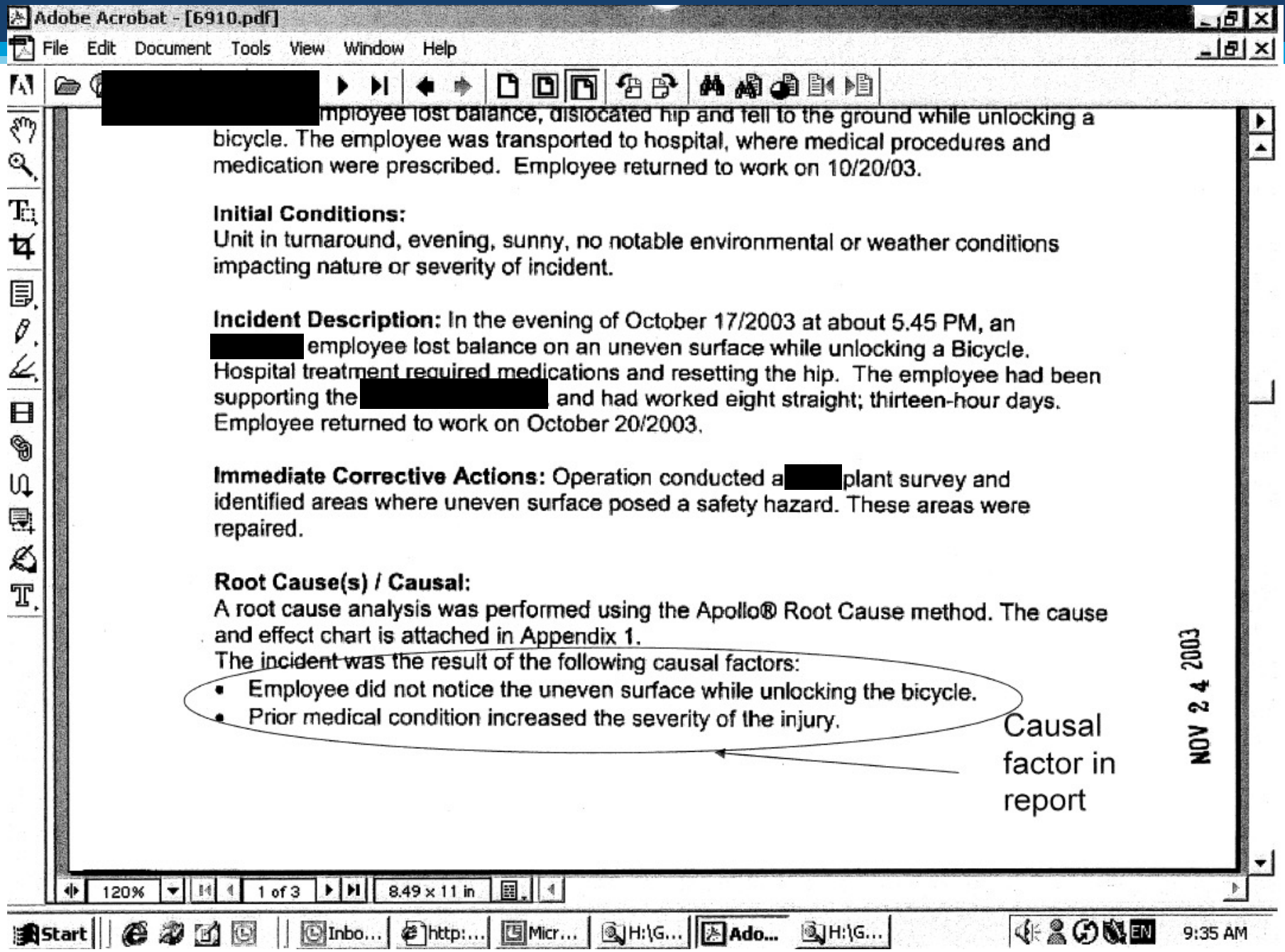
- Incident
  - Engineer while mounting plant bicycle lost balance and fell. Engineer transported to hospital were procedures and medication was prescribed which resulted in OSHA recordable event.
  - 9:00 AM, Monday July 9, 2018

EXAMPLE - Employee

- Employee did not notice the uneven surface while unlocking the bicycle
- Prior medical condition increased the severity of the injury



Causal factor on chart



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	**Try**
accounted for by the fact	because
adverse impact on	hurt, damage
albeit	though
along the lines of	like
analogous	similar
as a means of	to
at the present time	now, currently
close proximity	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 pressue 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 -

CAUSES	CORRECTIVE ACTIONS	NAME	DUE	DONE
Seal Wear (See C&E Chart)	Schedule the seal to be replaced during the annual maintenance outage.	Chuck Smith	4/20/95	4/15/95

REPORT WRITER: 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 damage 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 occurrence)

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