Accident Investigation

PUBH 3310
November 24, 2008

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Objectives

- Know the need to investigate accidents
- Understand the basics of accident investigation
  - Causes
  - Investigative procedures
 - Problem solving techniques
  - Report

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Introduction

- What is an accident (incident)?
  - Unplanned event that results in personal injury or property damage
- Why investigate accidents?
  - Identify causes so accidents can be prevented
    - Avoid repeat of same accident
    - Prevent other accidents
      - Heinrich accident pyramid
      - Bird's accident pyramid
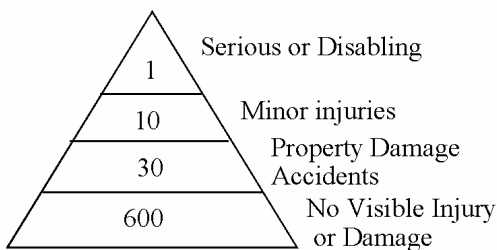 - Determine accident cost, promote safety

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Heinrich's "Classic" Accident Pyramid
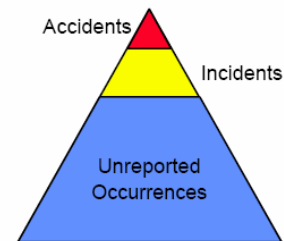
For every major injury, there are about 30 minor injuries and 300 non-injury incidents (H.W. Heinrich *Industrial Accident Prevention: A Scientific Approach, 1931)*
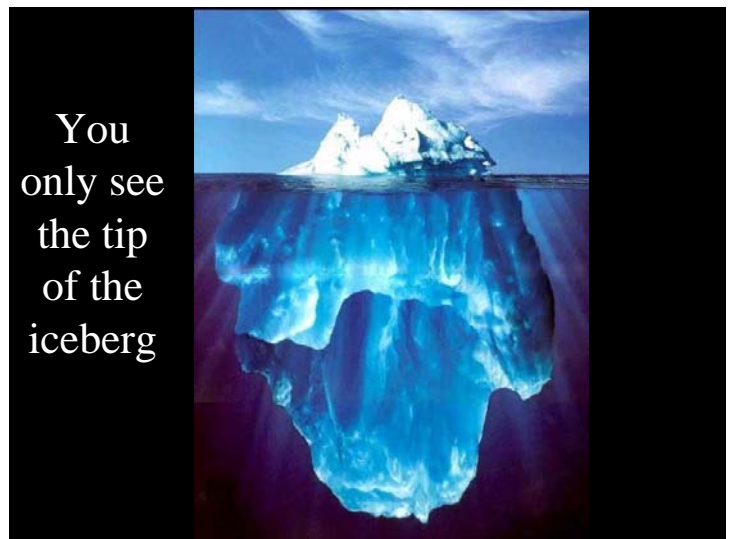
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Bird's Accident Pyramid

Bird accident ratio study
Insurance Company of North America,
1.7 million accidents, 297 companies, 3 billion work-hours

(Frank E. Bird Jr. and George L. Germain, *Practical Loss Control Leadership*, 1969)

You only see the tip of the iceberg

Accident Investigation Principles

- Investigate all accidents
  - Thoroughly investigate accidents that cause death or serious injury
  - "Near-miss" incidents
- Conduct the investigation as soon as possible
  - Minor accidents
    - "Incident report" and investigation by Supervisor
  - Major accidents:
    - Immediately report to Safety
    - Inform OSHA of serious injury or death
    - Assemble team and begin investigative procedures

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Accident Investigation Principles

- Find facts, not fault
  - Who was injured
  - Where did the accident happen
  - When did the accident occur
  - What were the causes
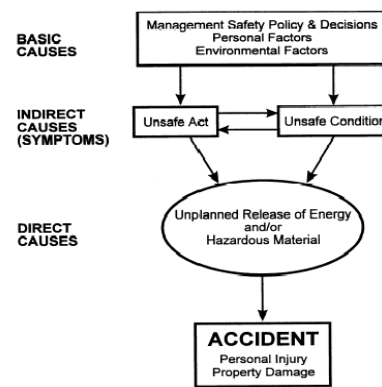 - How a similar accident can be prevented

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Accident Causes

- Accidents usually are complex
- Three causation levels
  - Direct Cause
    - Energy or hazardous material
  - Indirect Cause
    - Unsafe acts and conditions
  - Basic Causes ("root" causes)
    - Poor management
    - Personal or environmental factors

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Accident Causes

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Investigative Procedures

- Procedures depend on nature and result of the accident
  - Define the scope of the investigation
  - Select the investigators and assign specific tasks to each
    - Production
    - Safety
    - Engineering
    - Etc.

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Investigative Procedures

- Procedures depend on nature and result of the accident (cont.)
  - Present a preliminary briefing to the investigating team
    - Description of the accident, with damage estimates
    - Normal operating procedures
    - Maps (local and general)
    - Location of the accident site
    - List of witnesses
    - Events that preceded the accident

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Investigative Procedures

- Fact Finding
  - Interview witnesses as soon as possible
  - Inspect the accident site before any changes occur
  - Take photos and make sketches of the accident scene
  - Record all pertinent data on maps
  - Get copies of all reports

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Investigative Procedures

- Fact Finding (cont.)
  - Obtain operating procedures, flow diagrams, maintenance charts, reports of difficulties, etc.
  - Keep complete and accurate notes in a bound notebook
  - Record pre- and post conditions, accident sequence
  - Document location of victims, witnesses, machinery, energy sources, and hazardous material

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Investigative Procedures

- Interviews
  - Get preliminary statements as soon as possible
  - Locate position of each witness on a master chart
  - Explain the purpose of the investigation
  - Let each witness speak freely, no distractions
    - Tape recorder only with witness consent

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Investigative Procedures

- Interviews (cont.)
  - Use sketches and diagrams to help witness
  - Emphasize areas of direct observation
  - Record the exact words used by the witness
  - Be sure the witness understands each question
  - Identify witness qualifications
  - Supply each witness with a copy of their statements

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Problem Solving Techniques

- Specialized methods to determine the cause of accidents
  - Change Analysis
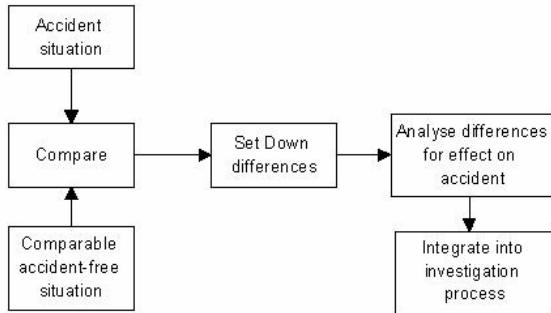 - Job Safety Analysis (JSA)
  - Root Cause Analysis

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Problem Solving Techniques

- "Change Analysis" technique, to determine the "change" that caused the accident
  - Define the problem (What happened?)
  - Establish the norm (What should have happened?)
  - Identify, locate and describe the change (What, where, when, to what extent)
  - Specify what was and what was not affected
  - Identify the distinctive features of the change
  - List the possible causes
  - Select the most likely causes

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Change Analysis

Problem Solving Techniques

- Job Safety Analysis (JSA) technique
  - Already a part of many existing accident prevention programs
  - JSA breaks the job into basic steps
    - Identifies hazard of each step
    - Prescribes controls for each hazard
  - Review JSA if one has been conducted before the accident
 - Perform JSA if one is not available to determine the events and conditions that led to the accident

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Problem Solving Techniques

- **"Root Cause Analysis"**
  - Entire chain of events is evaluated to find "Root Causes" as well as the immediate cause
  - Promoted by National Safety Council, etc.
  - "Root causes"are safety system inadequacies
    - Personal factors
    - Physical or mental condition, skills, knowledge, etc.
    - Job factors
    - Equipment, workplace conditions
  - Recommendations may include:
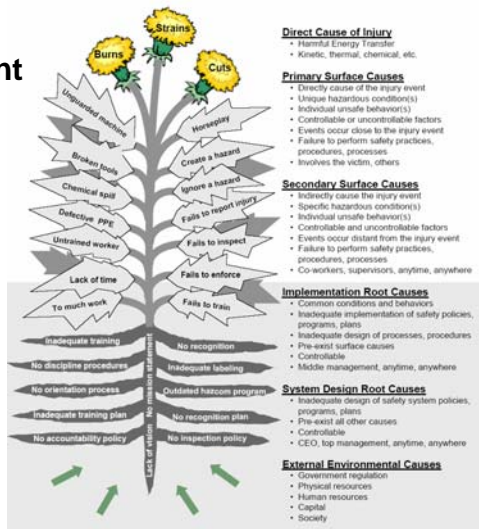   - Policies
    - Equipment
   - Training

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The "Accident Weed"

The "Accident Weed"

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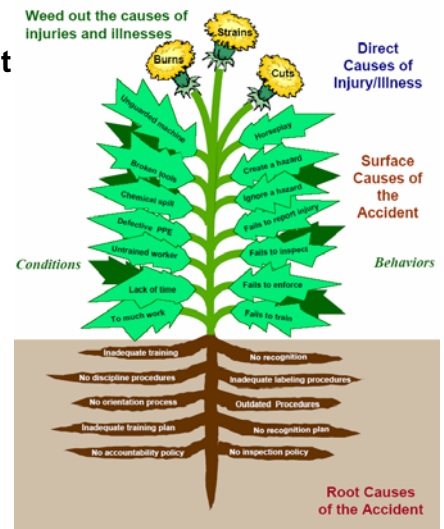
*Finding "root" causes

- Create an event and causal factor tree.
  - Place the undesired outcome at the top of the tree.
  - Add all events, conditions, and exceeded/failed barriers that occurred immediately before the undesired outcome and might have caused it.
  - Brainstorm to ensure that all possible causes are included, *NOT* just those that you are sure are involved.
  - Be sure to consider people, hardware, software, policy, procedures, and the environment.

*http://www.hq. nasa.gov/office /codeq/rca/root causeppt.pdf
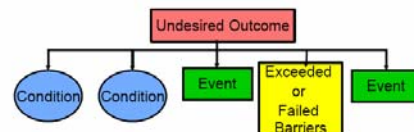
*Finding "root" causes

- After you have identified all the possible causes, ask yourself "*WHY*" each may have occurred.
- Be sure to keep your questions focused on the original issue. For example "Why was the condition present?"; "Why did the event occur?"; "Why was the barrier exceeded?" or "Why did the barrier fail?"
- A fault tree, used to determine system failure causes down to the "basic event" (e.g., system component level), is often used as part of the event tree.
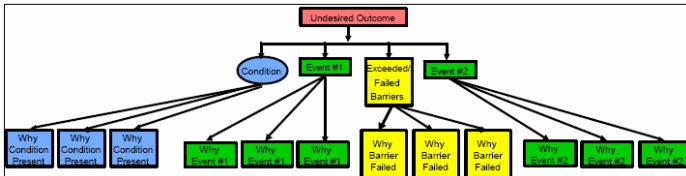
Report of Investigation

- The investigation is not complete until a report is prepared and submitted
- Recommended outline
  - Background Information
    - Where and when the accident occurred
    - Who and what were involved
    - Operating personnel and other witnesses
  - Account of the Accident (What happened?)
    - Sequence of events
    - Extent of damage
    - Accident type
    - Agency or source (of energy or hazardous material)

Report of Investigation

- Recommended outline (cont.)
  - Discussion (Analysis of the Accident - How; Why
    - Direct causes (energy sources, hazardous materials)
    - Indirect causes (unsafe acts and conditions)
    - Basic causes (management policies, personal or environmental factors)
  - Recommendations (to prevent a recurrence) for immediate and long-range action to remedy:
    - Basic causes
    - Indirect causes
    - Direct causes (such as reduced quantities or protective equipment or structures)

Followup

- Assign responsibility to implement recommendations
  - Policies
  - Equipment
  - Training
- Coordinate with management
  - Be sure to include deadlines
  - Verify completion of assignments
- Management must be committed!

Accident Investigation Resources

- OSHA
  - http://www.osha.gov/SLTC/accidentinvestigation/index.html
- NOAA
  - http://www.labtrain.noaa.gov/osha600/refer/menu16a.pdf
- CCOHS
  - http://www.ccohs.ca/oshanswers/hsprograms/investig.html
- NASA Root Cause Analysis
  - http://www.hq.nasa.gov/office/codeq/rca/rootcauseppt.pdf