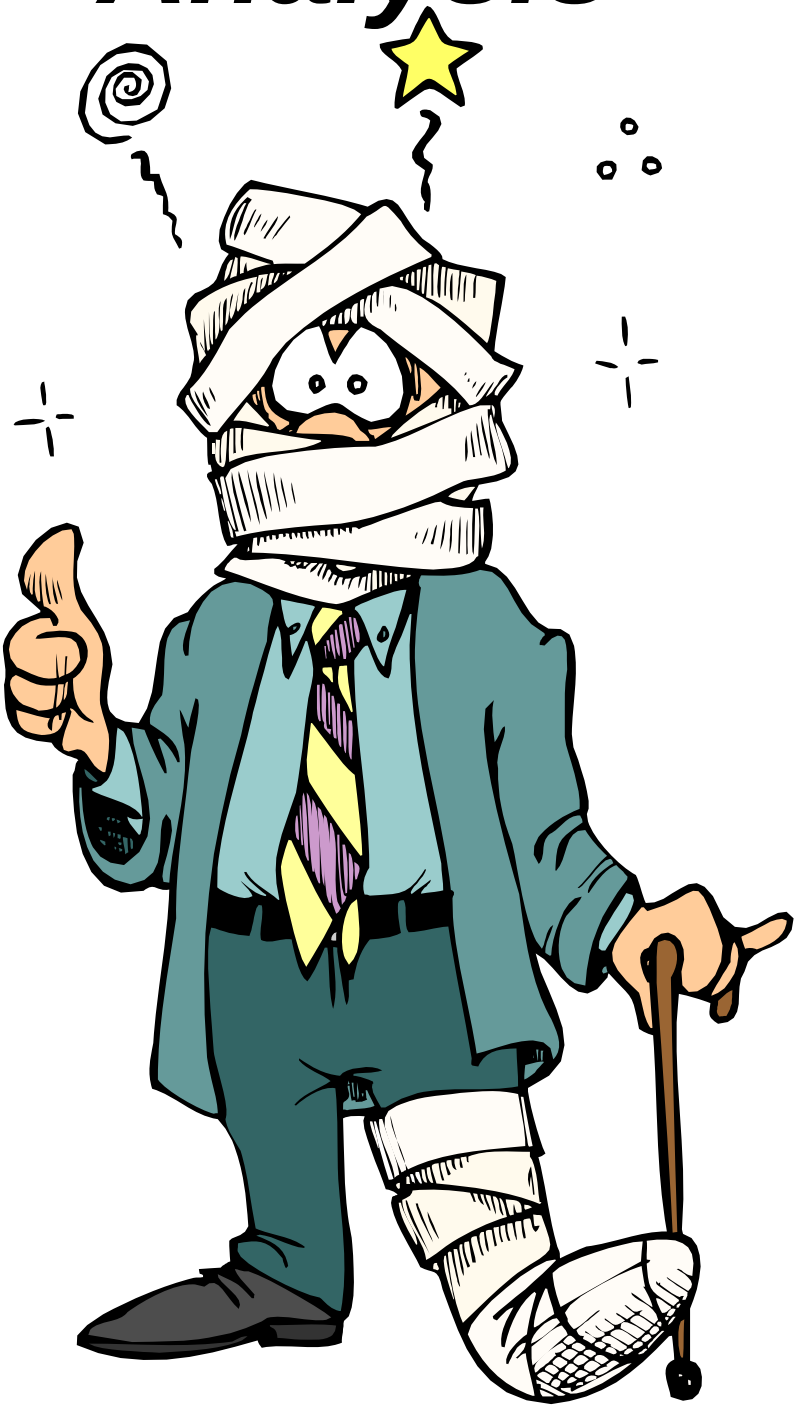
Introduction to effective

Incident/Accident Analysis



Introduction

The three primary tasks of the accident investigator is to gather useful information, analyze the facts surrounding the accident, and write the accident report. The intent of this workshop is to help you gain the basic skills necessary to conduct an effective accident investigation at your workplace. Only experience will give you the expertise to fine-tune those skills.

Most of the information about conducting an accident investigation will come directly from the class as we discuss issues, answer basic questions and complete group activities. If you have prior experience in accident investigation, we hope you will participate actively so others may benefit from your valuable input.

Ultimately, we want you to leave this workshop knowing how to conduct an accident investigation and properly complete an accident investigation report with confidence using our systematic approach.

Objectives

After attending this workshop you should be able to:

1. Describe the primary reasons for conducting an accident investigation.
2. Discuss employer responsibilities related to workplace accident investigations.
3. Conduct the six step accident investigation procedure

The basics

We like to think that accidents are *unexpected* or *unplanned* events, but most of the time, that's not so. Most accidents result from unsafe conditions and work practices that have been ignored or tolerated for weeks, months, or even years. In such cases, it's not a question of "if" the accident is going to happen: it's only a matter of "when." But unfortunately, the decision is made to take the risk.

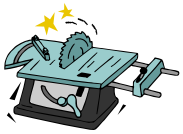
What's the definition of an accident?

_____

_____

What two key conditions must exist before an accident occurs?

H_____ and E_____



What causes the most accidents?

- Hazardous conditions account for 3 % of all workplace accidents.
- Unsafe/inappropriate behaviors account for 95 % of all workplace accidents.
- Uncontrollable acts account for 2 % of all workplace accidents
- Management is able to control, to some degree, the factors that produce 98 % of all workplace accidents.

What is the purpose of an OSHA <u>accident investigation</u> and and employer's <u>accident analysis</u>? Why are they different?

_____

_____

_____

No-Fault Accident Analysis

If someone deliberately sets out to produce loss or injury, that is called a crime, not an accident. Yet many accident investigations get confused with criminal investigations… Whenever the investigative procedures are used to place blame, an adversarial relationship is inevitable. The investigator wants to find out what actually happened while those involved are trying to be sure they are not going to be punished for their actions. The result is an inadequate investigation. (Kingsley Hendrick, Ludwig Benner, Investigating Accidents with STEP, p 42. Marcel Dekker, Inc. 1987.)

*Accident investigation is "**fact-finding**" not "fault-finding."*

The six-step process

What are the basic steps for conducting an accident investigation?

Gather the information. The first two steps ensure the accident scene does not change and information is gathered immediately.

Analyze the facts. Steps three and four break the incident/accident "process" into distinct steps so that each of them may be analyzed for surface and root causes.

Implement solutions. The final two steps recommend and communicate corrective actions and management solutions to make sure similar incidents/accident do not recur.

Step 1 - **Secure the accident scene**

Step 2 - **Collect facts about what happened**

Step 3 - **Develop the sequence of events**

Step 4 - **Determine the causes**

Step 5 - **Recommend improvements**

Step 6 - **Write the report**

The first two steps in the procedure help you gather accurate information about the accident.

Step 1: Secure the accident scene

Your primary goal in this step is to gather information accident that can give critical clues into the causes associated with the accident. To do that you must first **secure the accident scene**.

When is it appropriate to begin the investigation?

_____

_____

_____

What are effective methods to secure an accident scene?

_____

_____

_____

Step 2: Collect facts about what happened

In this step, you will use various tools and techniques to collect pertinent **facts about the accident** to determine the:

- Direct cause of injury.
- Hazardous conditions and unsafe employee/management behaviors (surface causes) that produced the accident.
- System weaknesses (root causes) that produced the surface causes for the accident.

List methods to document the accident scene and collect facts about what happened.

_____ _____

_____ _____

_____ _____

What documents will you be interested in reviewing? Why?

_____ _____

_____ _____

_____ _____

Interviewing

When is it best to interview? Why?

_____

_____

Who should we interview? Why?

_____

_____

Where should we conduct the interview?

_____

_____

Cooperate, don't intimidate

What are effective interviewing techniques?

What should we say?.	Why?

What should we do?	Why?

What should we <u>not</u> say?	Why?

What should we <u>not</u> do?	Why?

Team Exercise: Cooperation is the Key

Purpose. Gaining as much information as possible about an accident is extremely important. Interviewing witnesses is both a science and an art, and can make the difference between a failed or a successful accident investigation. This exercise will help you gain a greater awareness of those interviewing techniques that will help ensure your success as an investigator. Remember, you must communicate a message of cooperation, not intimidation.

Instructions. Your instructor has had an accident. Your team and the instructor are located at the scene of the accident (classroom) and your job now is to ask follow-up questions to gather information about the accident.

Use the space below for your notes.

The next two steps help you organize and analyze the information gathered so that you may accurately determine the surface and root causes.

Step 3: Develop the sequence of events

An accident is the final event in an accident process

In this step, we take the information gathered in step 2 to determine the events prior to, during, and after the accident. Once the events are clearly understood, we can then continue to examine each event for hazardous conditions and/or unsafe behaviors. Accident "investigations" to place blame may not place adequate emphasis on this step. But, developing the sequence of events is critical in the accident "analysis" process to fix the system.

Each event in the unplanned accident process identifies <u>one</u>:

Actor - Individual or object

- An actor **initiates a change** by performing or failing to perform an action.
- An actor may participate in the process or merely observe the process.

Action – Behavior the actor accomplishes

- Actions may or may not be observable.
- An action may describe something that is done or not done.

Circle the actor and action.

1. "Dale slipped on a banana."

   _____

2. "As Dale lay on the floor, a brick fell on his head ."

   _____

3. "Larry discovered Dale unconscious on the floor and immediately began initial first aid procedures."

   _____

Team Exercise: What happened next?

Use the information gathered about the accident your instructor described in the interview exercise to construct a sequence of events.

Instructions. Identify the events leading up to and including the injury event. Be sure that you include only one actor and one action in each event. Decide where you want to start the sequence, then merely ask, "What happened next?"

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Event __ _____

_____

Step 4: Determine the causes

W. H. Heinrich's domino Theory

"The occurrence of an injury invariably results from a completed sequence of factors, the last one of these being the accident itself. The accident in turn is invariably caused or permitted directly by the unsafe act of a person and/or a mechanical or physical hazard." (W.H. Heinrich, *Industrial Accident Prevention*, 1931)

Multiple Cause Theory

Behind every accident there are many contributing factors, causes, and subcauses. These factors combine in a random fashion causing accidents. We must find the fundamental root causes and remove them to prevent a recurrence. (Dan Petersen, *Safety Management: A Human Approach*, ASSE , p. 10-11)

What may be the cause(s) of the accident according to the multiple causation theory?

_____

_____

_____

_____

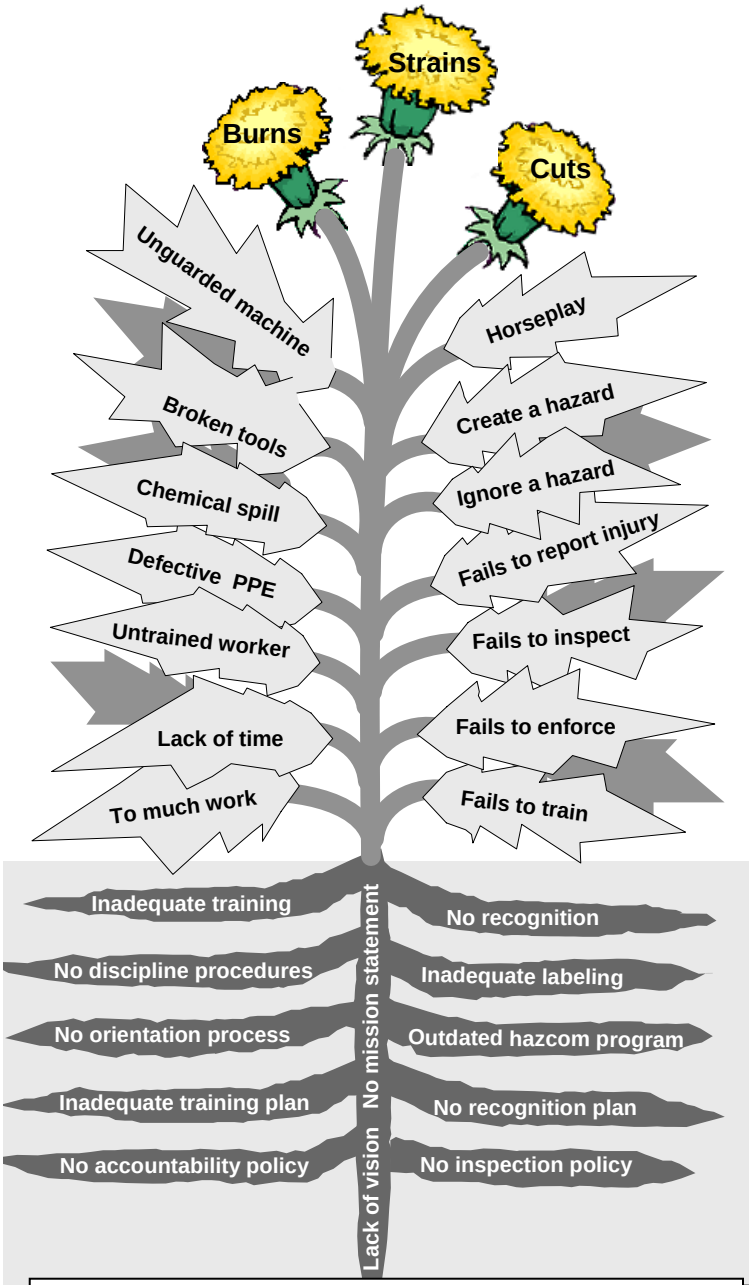
What might be the solutions to prevent the accident from recurring?

_____

_____

_____

Multiple Causation and the Accident Weed



1. Direct Cause of Injury

- Always the harmful transfer of energy.
- Kinetic, thermal, chemical, etc.
- Contact with, exposure too, etc.

2. Indirect (Surface) Cause of Injury

Primary Surface Cause

- Produces the accident
- Unique hazardous condition/unsafe behavior
- Exists/Occurs close to the injury event
- Involves the victim, possibly others

Contributing Surface Cause

- Contributes to the accident
- Unique hazardous condition
- Inappropriate/unsafe behavior
- Exists/occurs more distant from the accident
- Exists/occurs anytime, anywhere by anyone

3. Basic (Root) Cause of the Injury

Inadequate system implementation

- Failure to carry out safety policies, programs, plans, processes, procedures, practices
- Pre-exist surface causes
- Under control of management
- Failure can occur anytime, anywhere
- Produces common surface causes

Inadequate system design

- Poorly written or missing policies, programs, plans, processes, procedures, practices
- Pre-exist surface causes causes
- Under top management control
- Produces inadequate implementation

Any way you look at it, design is the key to an effective safety management system.

If design is flawed, yet perfectly implemented, the system fails. If design is perfect, yet implementation is flawed, the system fails as a result of design flaws in other related processes.

Steps in root cause analysis

1. Injury Cause Analysis. Analyze the injury event to identify and describe the nature of the harmful transfer of energy that caused the injury or illness. **Examples:**

- Laceration to right forearm resulting from contact with rotating saw blade.
- Contusion from head striking against/impacting concrete floor..

2. Surface Cause Analysis. Analyze events to determine specific hazardous conditions and unsafe or inappropriate behaviors.

a. For primary surface causes. Analyze events occurring just prior to the injury event to identify those specific conditions and behaviors that directly caused the accident. **Examples:**

- Event x. Unguarded saw blade. (condition or behavior?)
- Event x. Working at elevation without proper fall protection. (condition or behavior?)

b. For contributing surface causes. Analyze conditions and behaviors to determine other specific conditions and behaviors (contributing surface causes) that contributed to the accident.

Examples:

- Supervisor not performing weekly area safety inspection. (condition or behavior?)
- Fall protection equipment missing. (condition or behavior?)

3. Root Cause Analysis. Analyze system weaknesses contributing to surface causes.

For inadequate implementation. Analyze each contributing condition and behavior to determine if weaknesses in carrying out safety policies, programs, plan, processes, procedures and practices (inadequate implementation) exist. **Examples:**

- Safety inspections are being conducted inconsistently.
- Safety is not being adequately addressed during new employee orientation.

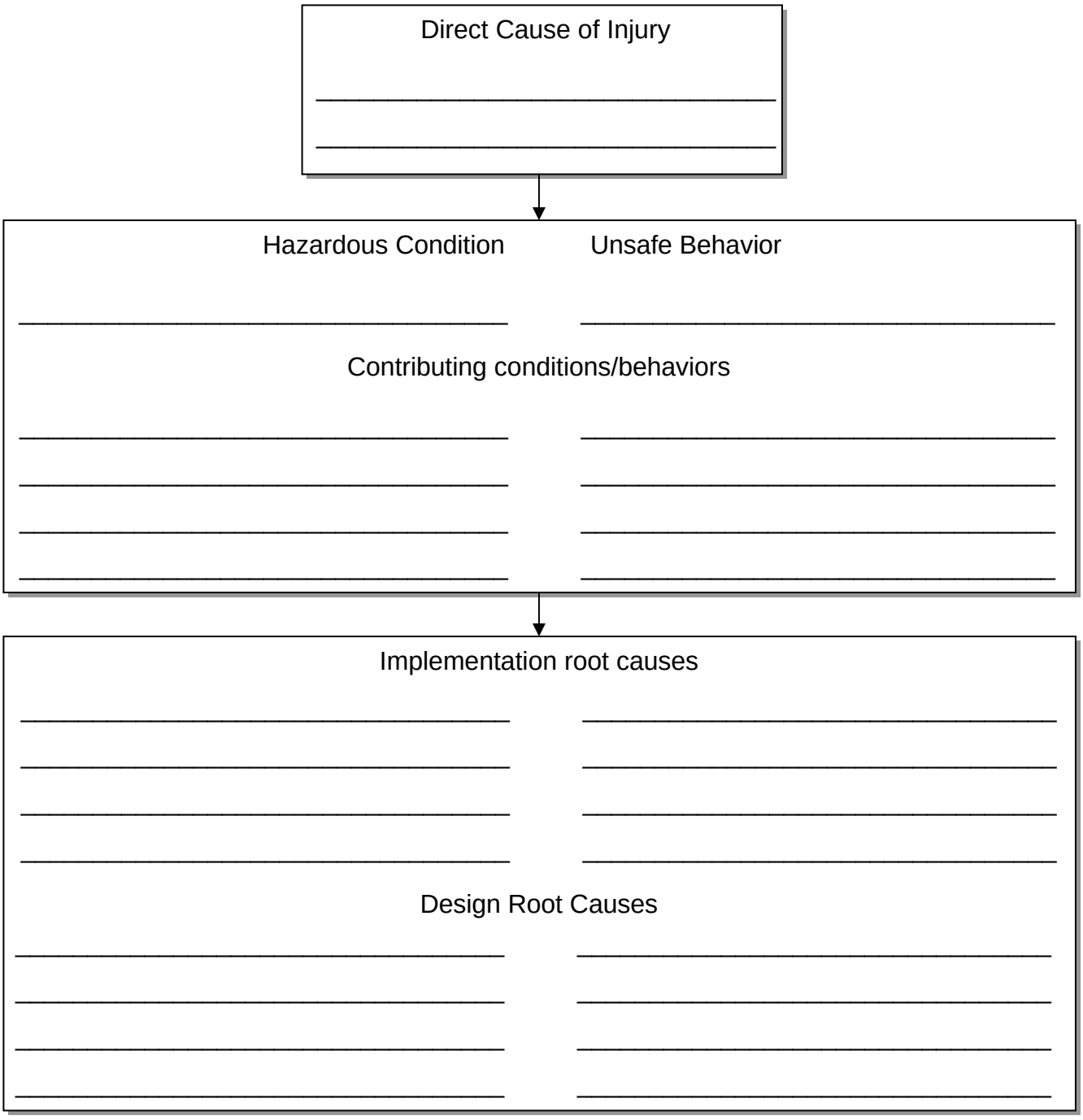
For inadequate planning. Analyze implementation flaws to determine the underlying inadequate formal (written) programs, policies, plans, processes, procedures and practices.

Examples:

- Inspection policy does not clearly specify responsibility by name or position.
- No fall protection training plan or process in place.

Exercise: Digging up the roots

1. Enter the direct cause of injury within the circle below.
2. List one hazardous condition and unsafe behavior from the sequence of events your group developed.
3. Determine contributing surface causes for the hazardous condition and unsafe behavior.
4. Determine implementation and design root causes for contributing surface causes.



The last two steps will help you develop and propose solutions that correct hazards and design long-lasting system improvements.

Step 5: Recommend corrective actions & Improvements

The Hierarchy of Controls

- **Engineering Controls.** Eliminate/reduce hazards through equipment redesign, replacement, substitution, etc.

- **Management Controls.** Eliminate/reduce exposure to hazards by controlling employee behaviors. Two primary strategies:

  o Design of safety rules and safe work practices such as using personal protective equipment (PPE) and procedures. These control strategies work as long as employees comply with the controls.

  o Scheduling strategies that include reducing the frequency or duration of a particular task, more frequent breaks, reducing the number of employees, etc.

- **Interim Measures.** These include strategies that are used as a temporary fix while permanent controls are being developed.

Team Exercise: Recommending Corrective actions

Purpose: In this exercise you'll develop and recommend immediate actions to correct the surface causes of an accident.

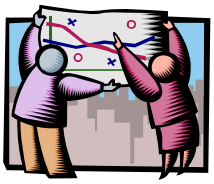
Instructions. Using the control strategies as a guide, determine corrective actions that will eliminate or reduce one of the hazardous conditions or unsafe behaviors identified in the previous exercise. Write your recommendation below.

Recommendation: _____

_____

_____

_____



Improvement strategies to fix the system

Make improvements to policies, programs, plans, processes, and procedures in one or more of the following elements of the safety management system:

1. Management Commitment
2. Accountability
3. Employee Involvement
4. Hazard Identification/Control
5. Incident/Accident Analysis
6. Education/Training
7. System Evaluation

Making system improvements might include some of the following:

- Writing a comprehensive safety and health plan that include all of the above elements..
- Improving a safety policy so that it clearly establishes responsibility and accountability.
- Changing a training plan so that the use of checklists are taught.
- Revising purchasing policy to include safety considerations as well as cost.
- Changing the safety inspection process to include all supervisors and employees.

Team Exercise: Fix the system…not the blame

Purpose: In this exercise you'll develop and recommend one improvement to make sure the case study accident does not recur.

Instructions. Develop and write a recommendation to improve one or more policies, plans, programs, processes, procedures, and practices identified as design weaknesses.

Recommendation: _____

_____

_____

_____

_____

_____

Step 6: Write the report

The primary reason accident investigations fail to help eliminate similar accidents is that some report forms unfortunately address only correcting surface causes. Root causes are often ignored. Let's take a look at one format for ensuring an effective report.

SAMPLE ACCIDENT INVESTIGATION REPORT

Number _____ Date _____

Prepared by _____ _____

SECTION I. BACKGROUND

WHO Victim: _____

Witnesses (1) _____ Address _____ Phone (H) _____ (W) _____
Job Title _____ Length of Service _____

Witnesses (2) _____ Address _____ Phone (H) _____ (W) _____
Job Title _____ Length of Service _____

WHEN Date _____ Time of day _____ Work shift _____
Date Accident Reported _____

WHERE Department _____ Location _____ Equipment _____

SECTION II. DESCRIPTION OF THE ACCIDENT PROCESS. (Describe the sequence of relevant events prior to, during, and immediately after the accident. Attach separate page if necessary)

Events prior to: _____
Injury event: _____
Events after: _____

SECTION III. FINDINGS AND JUSTIFICATIONS. (Attach separate page if necessary)

Surface Cause(s) (Unsafe conditions and/or behaviors at any level of the organization)
_____

Justification: (Describe evidence or proof that substantiates your finding.)
_____

Root Cause(s) (Missing/inadequate Programs, Plans, Policies, Processes, Procedures)
_____

Justification: (Describe evidence or proof that substantiates your finding.)
_____

SECTION IV. RECOMMENDATIONS AND RESULTS (Attach separate page if necessary)

Corrective actions. (To eliminate or reduce the hazardous conditions/unsafe behaviors that directly caused the accident)

_____

Results. (Describe the intended results and positive impact of the change.)

_____

System improvements. (To revise and improve the programs, plans, policies, processes, and procedures that indirectly caused/allowed the hazardous conditions/unsafe behaviors.)

_____

Results. (Describe the intended results and positive impact of the change.)

_____

SECTION V: SUMMARY (Estimate costs of accident. Required investment and future benefits of corrective actions)

_____

SECTION VI: REVIEW AND FOLLOW-UP ACTIONS: (Describe equipment/machinery repaired, training conducted, etc. Describe system components developed/revised. Indicate persons responsible for monitoring quality of the change. Indicate review official.)

Corrective Actions Taken:	**Responsible Individual:**	**Date Closed:**
_____	_____	_____
_____	_____	_____

System improvements made:	**Responsible Individual:**	**Date Closed:**
_____	_____	_____
_____	_____	_____

Person(s) monitoring status of follow-up actions: _____

Reviewed by _____ Title _____
Date _____ Department _____

SECTION VII: ATTACHMENTS: (Photos, sketches, interview notes, etc.)

The report is an open document until all actions are complete!

When the accident investigator completes the report, he or she will give it to someone who must do something with it. That's the job of the decision-maker. For accident investigation to be effective, management must consider the findings and develop an action plan for taking corrective action and making system improvements. Finally, periodic evaluation of the quality of accident investigation and report is critical to maintaining an effective program.

Reference Materials

Analysis usually stops when it's purpose has been achieved

You can tell what the purpose of a process is by looking at its output. OSHA does a good job investigating accidents to fulfill their mandate to primarily determine if rules have been violated. It's what OSHA does, and you can't fault them for carrying out the law.

A primary question OSHA must answer is if the employer failed to live up their their responsibility to the law. Did the employer violate any rules? Take a look at the OSHA compliance directive and investigation results (outputs) below to get a better idea about the purpose of OSHA's accident investigation process.

Employer are NOT OSHA investigators

Employers have no such mandate to investigate to determine rules violations. Actually, employers need to analyze their safety management system in greater depth required to meet the criteria of an OSHA investigation. To be most effective, employers should analyze accidents to first and primarily determine if system development and implementations weaknesses exist, not if rules were violated.

Excerpt - CPL 2.113 CPL 2.113 - Fatality Inspection Procedures

H. FATALITY/CATASTROPHE INVESTIGATIONS

2. Fatalities and catastrophes shall be thoroughly investigated…

… **to attempt to determine the cause of the events, whether a violation of OSHA safety or health standards related to the accident has occurred and any effect the standard violation has had on the occurrence of the accident.**

J. POTENTIAL CRIMINAL INVESTIGATIONS

1. Section 17(e) of the Act provides criminal penalties for an employer who is convicted of having willfully violated an OSHA standard, rule or order when the violation caused the death of an employee.
2. Early in investigations the Area Director shall make an initial determination whether there is potential for a criminal violation, based on the following criteria.
    a. A fatality has occurred.
    b. There is evidence that an OSHA standard has been violated and that the violation contributed to the death.
    c. There is reason to believe that the employer was aware of the requirement of the standard and knew it was in violation of the standard.

N. PRE-CITATION REVIEW

1. The Area Director or Assistant Area Director shall review all fatality/catastrophe investigation case files to ensure that the case has been properly developed in accordance with the Assistant Secretary's memo of March 24, 1995, "Enforcement Litigation Strategy", and in particular, Section III.B, titled "Case Selection and Development for Litigation."

You get a good idea about the intended purpose of a process is by looking at its output

Findings from an actual OSHA accident investigation report

OSHA investigators found that the employer violated safety standards related to employee training and emergency evacuation procedures. Specifically:

Some maintenance electricians in the melting plant were not adequately trained in the proper safe adjustment procedures for the electronic flow sensors installed in the cooling water system. The employer had installed electronic flow sensors approximately 18 months earlier, to replace mechanical switches with a history of malfunctions. Ten of the plant's 13 licensed electricians had received training on the new sensors, but the remaining three – including the individual who happened to respond when the furnace shut down during the night of the explosion – had not. **Proposed penalty: $5,000.**

Employees working in the melting department who are responsible for setting up or operating the remelt furnaces were not adequately trained for safe operation of the furnaces. While the employer's own safety and health procedures require that all employees newly assigned to a department receive very detailed safety training relating to the department and their specific duties, none of the melting plant personnel at the time of the explosion had ever received the training. **Proposed penalty: $5,000.**

Exits were not maintained free of obstructions or impediments to full instant use in the event of an emergency. When the explosion occurred, employees used designated evacuation routes to leave the facility. A gate in a cyclone fence that blocked one of those routes was locked, so that two employees had to climb the fence. **Proposed penalty: $1,500.**

“Fix The System” Incident/Accident Analysis Plan

1.0 General Policy

_____ considers employees to be our most valued asset and as such we will ensure that all incident and accidents are analyzed to correct the hazardous conditions, unsafe practices, and improve related system weaknesses that produced them. This incident/accident analysis plan has been developed to ensure our policy is effectively implemented.

_____ will ensure this plan is communicated, maintained and updated as appropriate.

2.0 Incident/Accident Reporting

2.1 Background. We can’t analyze incidents and accidents if they are not reported. A common reason that they go unreported is that the incident/accident analysis process is perceived to be a search for the “guilty party” rather than a search for the facts. We agree with current research that indicates most accidents are ultimately caused by missing or inadequate system weaknesses. Management will assume responsibility for improving these system weaknesses. When we handle incident/accident analysis as a search for facts, the all employees are more likely to work together to report incidents/accidents and to correct deficiencies, be they procedural, training, human error, managerial, or other. Consequently, our policy is to analyze accidents to primarily determine how we can fix the system. We will not investigate accidents to determine liability. A “no-fault” incident/accident analysis policy will help ensure we improve all aspects of our manufacturing process.

2.2 Policy. All employees will report immediately to their supervisor, any unusual or out of the ordinary condition or behavior at any level of the organization that has or could cause an injury or illness of any kind.

Supervisors will recognize employees immediately when an employee reports an injury or a hazard that could cause serious physical harm or fatality, or could result in production downtime. (See recognition program procedures)

2.3 _____ will ensure effective reporting procedures are developed so that we can quickly eliminate or reduce hazardous conditions, unsafe practices, and system weaknesses.

3.0 Preplanning.

Effective incident/accident analysis starts before the event occurs by establishing a well thought-out incident/accident analysis process. Preplanning is crucial to ensure accurate information is obtained before it is lost over time following the incident/accident as a result of cleanup efforts or possible blurring of people’s recollections.

4.0 Incident/Accident Analysis.

4.1 All supervisors are assigned the responsibility for analyzing incidents in their departments. All supervisors will be familiar with this plan and properly trained in analysis procedures.

4.2 Each department supervisor will immediately analyze all incidents (near hits) that might have resulted in serious injury or fatality. Supervisors will analyze incidents that might have resulted in minor injury or property damage within 4 hours from notification.

4.3 The supervisor will complete and submit a written incident/minor injury report through management levels to the plant superintendent. If within the capability/authority of the supervisor, corrective actions will begin immediately to eliminate or reduce the hazardous condition or unsafe work practice the might result in injury or illness.

5.0 Management Responsibilities

5.1 When our company has an incident/accident such as a fire, release, or explosion emergency, management will:

1. Provide medical and other safety/health help to personnel;
2. Bring the incident under control, and
3. Investigate the incident effectively to preserve information and evidence.

5.2 To preserve relevant information the analyst will:

1. Secure or barricade the scene;
2. immediately collect transient information;
3. Interview personnel.

6.0 Incident/accident Analysis Team

6.1 Background. It is important to establish incident/accident analysis teams **before** an event occurs so that the team can quickly move into action if called on. The makeup of the team is another important factor affecting the quality of the analysis. We will appoint competent employees who are trained, and have the knowledge and skills necessary to conduct an effective analysis. Doing so will show management's commitment to the process.

6.2 Incident/Accident Analysis Team Makeup

Although team membership may vary according to the type of incident, a typical team analyzing an incident/accident may include:

1. A third-line or higher supervisor from the section where the event occurred;
2. Personnel from an area not involved in the incident;
3. An engineering and/or maintenance supervisor;
4. The safety supervisor;
5. A first-line supervisor from the affected area;
6. Occupational health/environmental personnel;
7. Appropriate wage personnel (i.e., operators, mechanics, technicians); and,
8. Research and/or technical personnel.

Team member	Department	Shift	Phone
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____

6.3 The Incident/Accident Analysis Team Leader

The incident/Accident Analysis team leader will:

1. Control the scope of team activities by identifying which lines of analysis should be pursued, referred to another group for study, or deferred;
2. Call and preside over meetings;
3. Assign tasks and establish timetables;
4. Ensure that no potentially useful data source is overlooked; and,
5. Keep site management advised of the progress of the analysis process.

7.0 Determining the Facts

A thorough search for the facts is an important step in incident/accident analysis. During the fact-finding phase of the process, team members will:

1. Visit the scene before the physical evidence is disturbed;
2. Sample unknown spills, vapors, residues, etc., noting conditions which may have affected the sample; (Be sure you sample using proper safety and health procedures)
3. Prepare visual aids, such as photographs, field sketches, missile maps, and other graphical representations with the objective of providing data for the analysis.
4. Obtain on-the-spot information from eyewitnesses, if possible. Interview with those directly involved and others whose input might be useful should be scheduled soon thereafter. The interviews should be conducted privately and individually; so that the comments of one witness will not influence the responses of others.
5. Observe key mechanical equipment as it is disassembled. Include as-built drawings, operating logs, recorder charts, previous reports, procedures, equipment manuals, oral instruction, change of design records, design data, records indicating the previous training and performance of the employees involved, computer simulations, laboratory tests, etc.
7. Determine which incident-related items should be preserved. When a preliminary analysis reveals that an item may have failed to operate correctly, was damaged, etc., arrangements should be made to either preserve the item or carefully document any subsequent repairs or modifications.
8. Carefully document the sources of information contained in the incident report. This will be valuable should it subsequently be determined that further study of the incident or potential incident is necessary.

8.0 Determining the Cause

It is critical to establish the root cause(s) of an incident/accident so that effective recommendations are made to correct the hazardous conditions and unsafe work practices, and make system improvements to prevent the incident from recurring. The incident/accident analysis team will use appropriate methods to sort out the facts, inferences, and judgments they assemble. Even when the cause of an incident appears obvious, the investigation team will still conduct a formal analysis to make sure any oversight, or a premature/erroneous judgment is not made. Below is one method to develop cause and effect relationships.

1. Develop the chronology (sequence) of events which occurred before, during, and after the incident. The focus of the chronology should be solely on what happened and what actions were taken. List alternatives when the status cannot be definitely established because of missing or contradictory information.
2. List conditions or circumstances which deviated from normal, no matter how insignificant they may seem.
3. List all hypotheses of the causes of the incident based on these deviations.

9.0 Recommending Corrective Actions and System Improvements

Usually, making recommendations for corrective actions and system improvements follow in a rather straightforward manner from the cause(s) that were determined. A recommendation for corrective action and system improvement will contain three parts:

1. The recommendation itself, which describes the actions and improvements to be taken to prevent a recurrence of the incident.
2. The name of the person(s) or position(s) responsible for accomplishing actions and improvements.
3. The correction date(s).

10.0 Follow-up System

To make sure follow-up and closure of open recommendations, _____ will develop and implement a system to track open recommendations and document actions taken to close out those recommendations. Such a system will include a periodic status report to site management.

11.0 Communicating Results

11.1 To prevent recurring incidents we will take two additional steps:

1. Document findings; and
2. Review the results of the analysis with appropriate personnel.

11.2 Incident documentation will address the following topics:

1. Description of the incident (date, time, location, etc.);
2. Facts determined during the analysis (including chronology as appropriate);
3. Statement of causes; and
4. Recommendations for corrective and preventive action (including who is responsible and correction date).

12.0 Review and approval.

Appropriate operating, maintenance and other personnel will review all incident/accident analysis reports. Personnel at other facilities will also review the report to preclude a similar occurrence of the incident.

Plan reviewed by _____ Date _____

_____ Date _____

_____ Date _____

Plan approved by _____ Date _____

Sample Incident/Accident Analysis Team KIT

Essential

1. Camera, film, flash.
2. Tape measure - preferably 100 foot.
3. Clipboard and writing pad.
4. Graph paper.
5. Straight-edge ruler. Can be used as a scale reference in Photos.
6. Pens, pencils.
7. Accident investigation forms.
8. Flashlight.

Helpful

1. Accident investigator's checklist.
2. Magnifying Glass.
3. Sturdy gloves.
4. High visibility plastic tapes to mark off area.
5. First aid kit.
6. Cassette recorder and spare cassette tapes.
7. Identification tags.
8. Scotch tape.
9. Masking tape.
10. Specimen containers.
11. Compass.
12. Ten 4-inch spikes.
13. Hammer.
14. Paint stick (yellow/black).
15. Chalk (yellow/white)
16. Protractor.
17. Video camera with tape.
18. Investigator's template. (Traffic Institute, PO Box 1409, Evanston IL 60204, Stock # 1000)

SKETCHING TECHNIQUES

1. Make sketches large; preferably 8" x 10".

2. Makes sketches clear. Include information pertinent to the investigation.

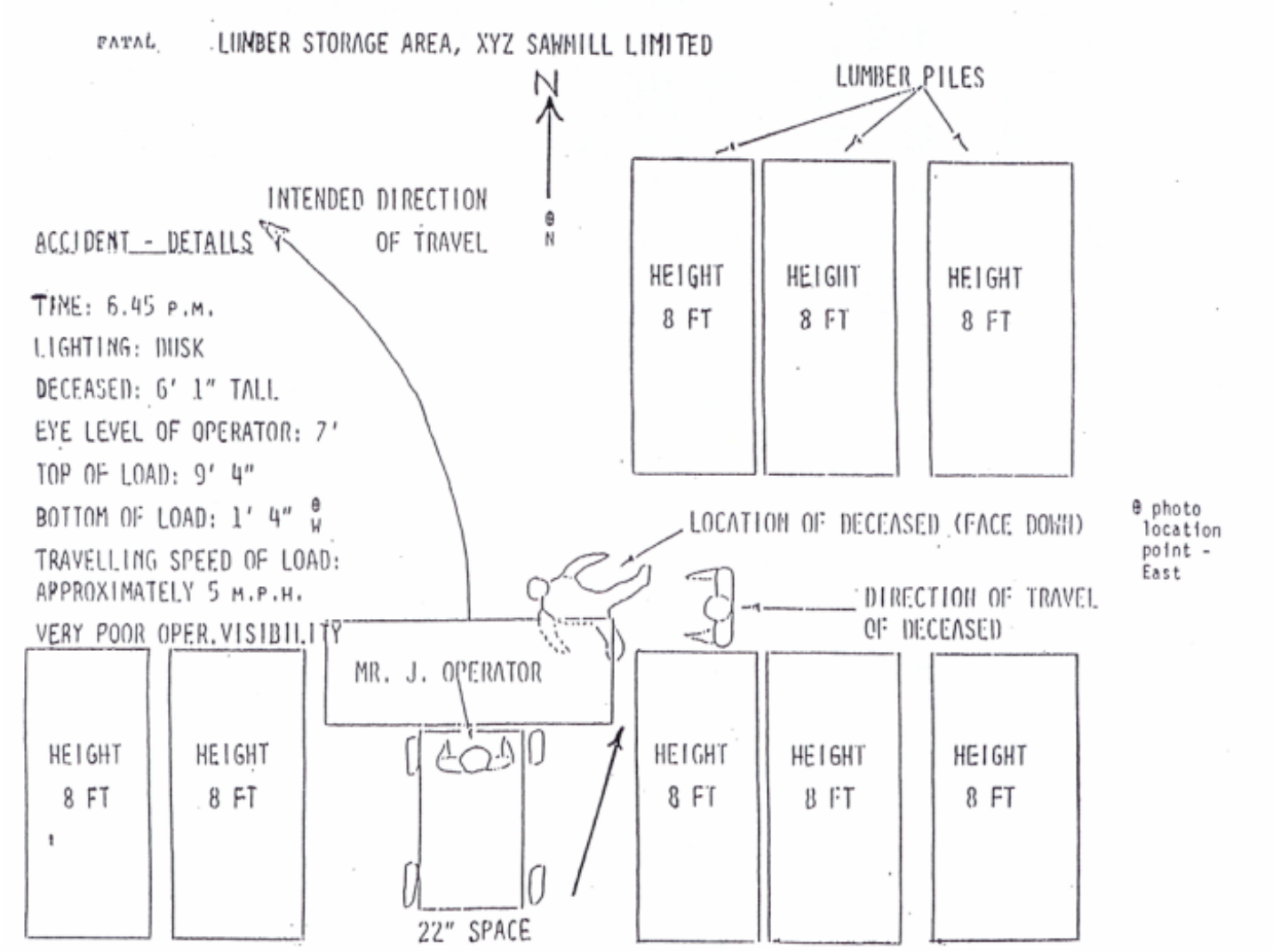
3. Include measurements.

4. Print legibly. All printing should be on the same plane.

5. Indicate directions, i.e. N,E,S,W.

6. Always tie measurements to a permanent point, e.g. telephone pole, building.

7. Use sketches when interviewing people. You can mark where they were standing. Also, it can be used to pinpoint where photos were taken.



FORMS OF ENERGY THAT DESCRIBE THE DIRECT CAUSE OF INJURY

1. MECHANICAL ENERGY - components that cut, crush, bend, shear, pinch, wrap, pull, and puncture as a result of rotating, transverse, or reciprocating motion.

2. ELECTRICAL ENERGY - low voltage electrical hazards (below 440 volts) and high voltage electrical hazards (above 440 volts).

3. CHEMICAL ENERGY - corrosive, toxic, flammable, or reactive (involving a release of energy ranging from "not violent" to "explosive" and "capable of detonation"). Toxics include poisonous plants, dangerous animals, biting insects and disease carrying bacteria, etc.

4. KINETIC (IMPACT) ENERGY - collision of objects in relative motion to each other including impact of a moving object against a stationary object, falling objects, flying objects, and flying particles.

5. POTENTIAL (STORED) ENERGY - sudden unexpected movement due to gravity, pressure, tension, or compression.

6. THERMAL ENERGY - extreme or excessive heat, extreme cold, sources of flame ignition, flame propagation, and heat related explosions.

7. ACOUSTIC ENERGY - excessive noise and vibration.

8. RADIANT ENERGY - relatively short wavelength energy forms within the electromagnetic spectrum including the potentially harmful characteristics of radar, infra-red, visible, microwave, ultra-violet, x-ray, and ionizing radiation.

9.ATMOSPHERIC/GEOLOGICAL/ OCEANOGRAPHIC ENERGY - atmospheric weather circumstances such as wind and storm conditions, geological structure characteristics such as underground pressure or the instability of the earth's surface, and oceanographic currents, wave action, etc.

Adapted from: Nelson & Associates, 3131 E. 29th Street, Suite E , Bryan, Texas 77802, Tel 409/774-7755, Fax 409/774-0559 -- www.hazardcontrol.com © Copyright 1997

ACCIDENT TYPES

STRUCK-BY. A person is forcefully struck by an object. The force of contact is provided by the object. Example -- a pedestrian is truck by a moving vehicle.

STRUCK-AGAINST. A person forcefully strikes an object. The person provides the force.
Example -- a person strikes a leg on a protruding beam.

CONTACT-BY. Contact by a substance or material that by its very nature is harmful and causes injury.
Example -- a person is contacted by steam escaping from a pipe.

CONTACT-WITH. A person comes in contact with a harmful material. The person initiates the contact. Example -- a person touches the hot surface of a boiler.

CAUGHT-ON. A person or part of his/her clothing or equipment is caught on an object that is either moving or stationary. This may cause the person to lose his/her balance and fall, be pulled into a machine, or suffer some other harm. Example -- a person snags a sleeve on the end of a hand rail.

CAUGHT-IN. A person or part of him/her is trapped, stuck, or otherwise caught in an opening or enclosure. Example -- a person's foot is caught in a hole in the floor.

CAUGHT-BETWEEN. A person is crushed, pinched or otherwise caught between either a moving object and stationary object or between two moving objects. Example -- a person's finger is caught between a door and its casing.

FALL TO SURFACE. A person slips or trips and falls to the surface he/she is standing or walking on. Example -- a person trips on debris in the walkway and falls.

FALL-TO-BELOW. A person slips or trips and falls to a surface level below the one he/she was walking or standing on. Example -- a person trips on a stairway and falls to the floor below.

EXERTION. Someone over-exerts or strains him or herself while doing a job. Examples -- a person lifts a heavy object; repeatedly flexes the wrist to move materials, and; a person twists the torso to place materials on a table. Interaction with objects, materials, etc., is involved.

BODILY REACTION. Caused solely from stress imposed by free movement of the body or assumption of a strained or unnatural body position. A leading source of injury. Example - a person bends or twists to reach a valve and strains back.

EXPOSURE. Over a period of time, someone is exposed to harmful conditions. Example -- a person is exposed to levels of noise in excess of 90 dba for 8 hours.

THE TERMINOLOGY OF HAZARD CONTROL

Hazards take many forms: air contaminants, tasks involving repetitive motions, equipment with moving parts or openings that can catch body parts or clothing, microorganisms, extreme heat or cold, noise, toxic liquids, and more. The terms we use here to describe the principles of engineering control may sound strange when applied to some of these hazards. You may find that, in other discussions of hazard control, the terms are used somewhat differently. There should be agreement, however, about the concepts the terms describe.

ENGINEERING CONTROLS

These controls focus on the source of the hazard, unlike other types of controls that generally focus on the employee exposed to the hazard. The basic concept behind engineering controls is that, to the extent feasible, the work environment and the job itself should be designed to eliminate hazards or reduce exposure to hazards. While this approach is called engineering control, it does not necessarily mean that an engineer is required to design the control.

Engineering controls can be very simple in some cases. They are based on the following broad principles:

1. If feasible, design the facility, equipment, or process to remove the hazard and/or substitute something that is not hazardous or is less hazardous;

2. If removal is not feasible, enclose the hazard to prevent exposure in normal operations; and

3. Where complete enclosure is not feasible, establish barriers or local ventilation to reduce exposure to the hazard in normal operations.

Elimination of Hazards through Design

Designing facilities, equipment, or processes so that the hazard is no longer even potentially present is obviously the best worker protection. Some examples of this are:

• Redesigning, changing, or substituting equipment to remove the source of excessive temperatures, noise, or pressure;

• Redesigning a process to use less toxic chemicals;

• Redesigning a work station to relieve physical stress and remove ergonomic hazards; or

• Designing general ventilation with sufficient fresh outdoor air to improve indoor air quality and generally to provide a safe, healthful atmosphere.

Enclosure of Hazards

When you cannot remove a hazard and cannot replace it with a less hazardous alternative, the next best control is enclosure. Enclosing a hazard usually means that there is no hazard exposure to workers during normal operations. There still will be potential exposure to workers during maintenance operations or if the enclosure system breaks down. For those situations, additional controls such as safe work practices or personal protective equipment (PPE) may be necessary to control exposure.

Some examples of enclosure designs are:

• Complete enclosure of moving parts of machinery;

• Complete containment of toxic liquids or gases from the beginning of the process using or producing them to detoxification, safe packing for shipment, or safe disposal of toxic waste products;

• Glove box operations to enclose work with dangerous microorganisms, radioisotopes, or toxic substances; and

• Complete containment of noise, heat, or pressure-producing processes with materials especially designed for those purposes.

Barriers or Local Ventilation

When the potential hazard cannot be removed, replaced, or enclosed, the next best approach is a barrier to exposure or, in the case of air contaminants, local exhaust ventilation to remove the contaminant from the workplace. This engineered control involves potential exposure to the worker even in normal operations. Consequently, it should be used only in conjunction with other types of controls, such as safe work practices designed specifically for the site condition and/or PPE.

Examples include:

• Ventilation hoods in laboratory work;

• Machine guarding, including electronic barriers;

• Isolation of a process in an area away from workers, except for maintenance work;

• Baffles used as noise-absorbing barriers; and

• Nuclear radiation or heat shields.

MANAGEMENT CONTROLS

Many of your organization's general workplace rules have a bearing on safety and health. It is accurate to think of these rules as hazard controls. In addition to the general workplace rules that apply to everyone, specific work practices may be needed to safeguard your employees in a variety of situations. For example, even when a hazard is enclosed, exposure can occur when maintenance is necessary, when the enclosure system suffers a partial or complete breakdown, or when enclosure does not fully control the hazard.

Improving work practices

By following established safe work practices for accomplishing a task safely (and using PPE in many cases), your employees can further reduce their exposure to hazard.

The safety and health rules that you develop and make part of your overall workplace rules are an important component of your hazard prevention and control program. These rules play a major part in identifying acceptable and unacceptable behavior. For example, you may have rules outlawing horseplay or violent behavior on company property, or requiring your employees to wear personal protective equipment.

Safety and health rules are most effective when they are written, posted, given to all affected employees, and discussed with them. Many employers emphasize the link between safety and health rules and the consequences of breaking them by reviewing the rules with their employees. They then ask the employees to sign a statement at the bottom of the list: "I have read the rules, I understand them, and I have received an explanation of the consequences of breaking them." Employer and employee both keep a copy of this signed statement.

Some employers ask their employees to help develop the workplace rules and then to help revise them as needed. When employees play a role in formulating the rules, they are more likely to understand and follow them.

Safe Work Practices

Some of these practices are very general in their applicability. They include housekeeping activities such as:

- Removal of tripping, blocking, and slipping hazards;
- Removal of accumulated toxic dust on surfaces; and
- Wetting down surfaces to keep toxic dust out of the air.

Other safe work practices apply to specific jobs in the workplace and involve specific procedures for accomplishing a job. To develop these procedures, you conduct a job hazard analysis. This process is clearly described with examples and illustrations in OSHA Publication 307l (Revised 1992), "Job Hazard Analysis,“ and summarized here in Chapter VII.

OSHA recommends that you keep the written analysis of a job separate from the written procedures your workers will follow to accomplish the job safely. A good job hazard analysis is more detailed than a good work instruction sheet. Each document suffers from being combined with the other.You may decide that a training program is needed, using the job hazard analysis as the basis for training your workers in the new procedures. A training program may be essential if your employees are working with highly toxic substances or in dangerous situations.

Drawbacks to Controlling Hazards with Safe Work Practices

While safe work practices are a necessity and can work very well, they are only as good as the management systems that support them. This is because they are susceptible to human error. The controls first must be designed from a base of solid hazard analysis. They then must be accompanied by good worker training, reinforcement, and consistent and reasonable enforcement. Safe work practices should be used in conjunction with, and not as a substitute for, more effective or reliable engineering controls.

Safe Work Practices Training

Anticipate resistance when teaching new job practices and procedures to workers. If your employees have done a job long enough without special precautions, they are likely to feel unconcerned about hazards. It is essential that they understand why special work practices are needed. Therefore, training begins with a discussion of hazards. Your workers must be assisted in understanding that, for an accident or injury to occur, two things must be present: a hazard and an employee.

Remove the hazard and there will be no injury.

Train the employee to follow proper work practices, and those safe work practices can significantly help the employee to avoid harm. Just presenting training may not be sufficient. An employer has a responsibility to ensure that worker training has achieved its objective and that workers understand the hazards and know how to protect themselves. A supervisor easily can perform informal testing to check the results of training. This means stopping at an employee's work station and asking for an explanation of the hazards involved in the work and the employee's means of protection. If the training has been presented well and has been understood, each trained worker should be able to give a clear, comprehensive response.

Positive Reinforcement

Each supervisor should provide frequent reinforcement of work practices training. The informal testing described above serves not only to gauge training effectiveness, but also to reinforce the desired behavior. Some worksites also provide special recognition for the use of safe work practices. Some supervisors periodically hand out "Thank you for working safely" cards that can be redeemed for a free cup of coffee or soft drink. Other supervisors periodically observe individual workers at their tasks and give oral and/or written feedback on what was done safely.

OSHA recommends award systems that recognize positive activities rather than absence of injuries. Award programs with prizes for hours worked without injury can put heavy pressure on workers not to report injuries.

Enforcement

Workers must realize that safe work practices are a requirement of employment and that unsafe practices will not be tolerated. It is necessary, therefore, that the employer have a disciplinary system that is implemented fairly and consistently. If no such system exists in your workplace, you would be wise to have employees assist in designing one. We discuss disciplinary systems in greater detail below.

Improving work schedules

While workplace rules and safe work practices can legitimately be considered forms of administrative control, we use this term here to connote other measures aimed at reducing employee exposure to hazard, generally by manipulating the work schedule. Such measures include lengthened rest breaks, additional relief workers, exercise breaks to vary body motions, and rotation of workers through different jobs to reduce or "even out" exposure to hazards or to allow them to work part of the day without respirators or other burdensome PPE. Administrative controls normally are used in conjunction with other controls that more directly prevent or control exposure to hazard.

Administrative controls are often employed to reduce ergonomic hazards. For example, employees in a meatpacking plant might rotate among several tasks to reduce accumulated stress on particular muscles and tendons. Administrative controls have also been used in situations of extreme temperatures, and to counteract the dangers of some widely used chemicals. However, such controls are not appropriate in dealing with carcinogens or chronic chemical hazards such as lead.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

When exposure to hazards cannot be engineered completely out of normal operations or maintenance work, and when safe work practices and other forms of administrative control cannot provide sufficient additional protection, a supplementary method of control is the use of protective clothing and/or equipment. These are collectively called personal protective equipment, or PPE. PPE may also be appropriate for controlling hazards while engineering and work practice controls are being installed. The term PPE covers such items as face shields (whether worn by dentists or welders), steel-toed shoes and boots, safety glasses and goggles, hard hats, back supports, leather aprons, metal-mesh gloves, forearm guards, respirators, and "space suits."

Legal Requirements

One section of the OSHA standards (29 CFR 1910, Subpart I) specifically addresses PPE. Many other OSHA standards require certain types of PPE. If respirators are ever worn for any reason at your worksite, you must have a written respirator program, perform fit testing, train supervisors and workers in proper respirator use, and meet other requirements of the standard (29 CFR 1910.134). For further information about respirators, see OSHA Publication 3079 (Revised 1993), "Respiratory Protection." A useful general source of information is OSHA Publication 3077 (Revised 1994), "Personal Protective Equipment.“

If you are not sure what is required or what types of PPE might be best for your employees, you can call or write the nearest State or Federal OSHA office for guidance. Small business employers may contact the OSHA-funded, State-run consultation service in their State.

PPE Drawbacks

The limitations and drawbacks of safe work practices (see page VIII-5) also apply to PPE. Employees need training in why the PPE is necessary and how to use and maintain it. It also is important to understand that PPE are designed for specific functions and are not suitable in all situations. For example, no one type of glove or apron will protect against all solvents. To pick the appropriate glove or apron, you should refer to recommendations on the material safety data sheets of the chemicals you are using.

Your employees need positive reinforcement and fair, consistent enforcement of the rules governing PPE use. (See discussion below.) Some employees may resist wearing PPE according to the rules, because some PPE is uncomfortable and puts additional stress on employees, making it unpleasant or difficult for them to work safely. This is a significant drawback, particularly where heat stress is already a factor in the work environment.

An ill-fitting or improperly selected respirator is particularly hazardous, since respirators are used only where other feasible controls have failed to eliminate a hazard.

MEEE Document Analysis

This document covers the four areas that should be reviewed in determining the root cause of hazards, accidents and incidents. It is not uncommon to find factors in each of the four areas: Management, Employee, Equipment and Environment.

Management Checklist

Yes	No	
____	____	Did supervisor detect, anticipate, or report an unsafe or hazardous condition?
____	____	Did supervisor recognize deviations from the normal job procedure?
____	____	Did the supervisor and employees participate in job review sessions especially for those jobs performed on an infrequent basis?
____	____	Were supervisors made aware of their responsibilities for the safety of their work areas and employees?
____	____	Were supervisors properly trained in the principles of accident prevention?
____	____	Was there any history of personnel problems or any conflicts with or between supervisor and employees or between employees themselves?
____	____	Did the supervisor conduct regular safety meetings with his or her employees?
____	____	Were the topics discussed and actions taken during the safety meetings recorded in the minutes?
____	____	Were the proper resources (e.g., equipment, tools, materials, etc.) required to perform the job or task readily available and in proper condition?
____	____	Did the supervisors ensure employees were trained and proficient before assigning them to their jobs?
____	____	Did management properly research the background and experience level of employees before extending an offer of employment?

Question #	Comments:
_____	_____
_____	_____
_____	_____
_____	_____

ACCIDENT ANALYSIS

Employee Checklist

Yes	No	
____	____	Did a written or well-established procedure exist for employees to follow?
____	____	Did job procedures or standards properly identify the potential hazards of job performance?
____	____	Were employees familiar with job procedures?
____	____	Was there any deviation from the established job procedures?
____	____	Did any mental or physical conditions prevent the employee(s) from properly performing their jobs?
____	____	Were there any tasks in the job considered more demanding or difficult than usual (e.g., strenuous activities, excessive concentration required, etc.)?
____	____	Was the proper personal protective equipment specified for the job or task?
____	____	Were employees trained in the proper use of any personal protective equipment?
____	____	Did the employees use the prescribed personal protective equipment?
____	____	Were employees trained and familiar with the proper emergency procedures, including the use of any special emergency equipment?
____	____	Was there any indication of misuse or abuse of equipment and/or materials at the accident site?
____	____	Is there any history or record of misconduct or poor performance for any employee involved in this accident?
____	____	If applicable, are all employee certification and training records current and up-to-date?
		Was there any shortage of personnel on the day of the accident?

Question #	Comments:
_____	_____
_____	_____
_____	_____
_____	_____

ACCIDENT ANALYSIS

Equipment Checklist

Yes	No	
____	____	Were there any detects m equipment (including materials and tools) that contributed to a hazard or created an unsafe condition?
____	____	Were the hazardous or unsafe conditions recognized by management, employees, or both?
____	____	Were the recognized hazardous conditions properly reported?
____	____	Are existing equipment inspection procedures adequately detecting hazardous or unsafe conditions?
____	____	Were the proper equipment and tools being used for the job?
____	____	Were the correct/prescribed tools and equipment readily available at the job site?
____	____	Did employees know how to obtain the proper equipment and tools?
____	____	Did equipment design contribute to operator error?
____	____	Was all necessary emergency equipment readily available?
____	____	Did emergency equipment function properly?
____	____	Is there any history of equipment failure for the same or similar reasons?
____	____	Has the manufacturer issued warnings, Safe-Alerts, or other such information pertaining to this equipment?
____	____	Were all equipment guards and warnings functioning properly at the time of the accident?

Question #	Comments:
_____	_____
_____	_____
_____	_____
_____	_____

ACCIDENT ANALYSIS

Environment Checklist

Yes	No	
____	____	Did the location of the employees, equipment, and/or materials contribute to the accident?
____	____	Were there any hazardous environmental conditions that may have contributed to the accident?
____	____	Were the hazardous environmental conditions in the work area recognized by employees or supervision?
____	____	Were any actions taken by employees, supervisors, or both to eliminate or control environmental hazards?
____	____	Were employees trained to deal with any hazardous environmental conditions that could arise?
____	____	Were employees not assigned to a work area present at the time of the accident?
____	____	Was sufficient space provided to accomplish the job?
____	____	Was there adequate lighting to properly perform all the assigned tasks associated with the job?
____	____	Did unacceptable noise levels exist at the time of the accident?
____	____	Was there any known leak of hazardous materials such as chemicals, solvents or air contaminants?
____	____	Were there any physical environmental hazards, such as excessive vibration, temperature extremes, inadequate air circulation, or ventilation problems?
____	____	If applicable, were there any hazardous environmental conditions, such as inclement weather, that may have contributed to the accident?
____	____	Is the layout of the work area sufficient to preclude or minimize the possibility of distractions from a passerby or from other workers in the area?
____	____	Is there a history of environmental problems in this area?

Question #	Comments:
_____	_____
_____	_____
_____	_____
_____	_____

Accident/Incident Investigation

When do you conduct an investigation?

All incidents, whether a near miss or an actual injury-related event, should be investigated. Near miss reporting and investigation allow you to identify and control hazards before they cause a more serious incident. Accident/incident investigations are a tool for uncovering hazards that either were missed earlier or have managed to slip out of the controls planned for them. It is useful only when done with the aim of discovering every contributing factor to the accident/incident to "foolproof" the condition and/or activity and prevent future occurrences. In other words, your objective is to identify root causes, not to primarily set blame.

Definitions

ACCIDENT - The National Safety Council defines an accident as an undesired event that results in personal injury or property damage.

INCIDENT - An incident is an unplanned, undesired event that adversely affects completion of a task.

NEAR MISS - Near misses describe incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.

Who should investigate?

The usual investigator for all incidents is the supervisor in charge of the involved area and/or activity. Accident investigations represent a good way to involve employees in safety and health. Employee involvement will not only give you additional expertise and insight, but in the eyes of the workers, will lend credibility to the results. Employee involvement also benefits the involved employees by educating them on potential hazards, and the experience usually makes them believers in the importance of safety, thus strengthening the safety culture of the organization. The safety department or the person in charge of safety and health should participate in the investigation or review the investigative findings and recommendations. Many companies use a team or a subcommittee or the joint employee-management committee to investigate incidents involving serious injury or extensive property damage.

Training for incident investigation

No one should investigate incidents without appropriate accident investigation training. Many safety and health consultants and professional organizations provide this type of training. Before committing resources to training, you might want to check the course contents against the information found in the National Safety Council's pamphlet, "Accident Investigation ... A New Approach."

The investigative report should answer six key questions

Six key questions should be answered: who, what, when, where, why, and how. Fact should be distinguished from opinion, and both should be presented carefully and clearly. The report should include thorough interviews with everyone with any knowledge of the incident. A good investigation is likely to reveal several contributing factors, and it probably will recommend several preventive actions.

You will want to avoid the trap of laying sole blame on the injured employee. Even if injured workers openly blame themselves for making a mistake or not following prescribed procedures, the accident investigator must not be satisfied that all contributing causes have been identified. The error made by the employee may not be even the most important contributing cause. The employee who has not followed prescribed procedures may have been encouraged directly or indirectly by a supervisor or production quotas to "cut corners." The prescribed procedures may not be practical, or even safe, in the eyes of the employee(s). Sometimes where elaborate and difficult procedures are required, engineering redesign might be a better answer. In such cases, management errors -- not employee error -- may be the most important contributing causes.

All supervisors and others who investigate incidents should be held accountable for describing causes carefully and clearly. When reviewing accident investigation reports, the safety department or in-house safety expert should be on the lookout for catch-phrases, for example, "Employee did not plan job properly." While such a statement may suggest an underlying problem with this worker, it is not conducive to identifying all possible causes, preventions, and controls. Certainly, it is too late to plan a job when the employee is about to do it. Further, it is unlikely that safe work will always result when each employee is expected to plan procedures alone.

Implications of accident investigations

Recommended preventive actions should make it very difficult, if not impossible, for the incident to recur. The investigative report should list all the ways to "foolproof" the condition or activity. Considerations of cost or engineering should not enter at this stage. The primary purpose of accident investigations is to prevent future occurrences. Beyond this immediate purpose, the information obtained through the investigation should be used to update and revise the inventory of hazards, and/or the program for hazard prevention and control. For example, the Job Safety Analysis should be revised and employees retrained to the extent that it fully reflects the recommendations made by an incident report. Implications from the root causes of the accident need to be analyzed for their impact on all other operations and procedures.