THIS IS THE NON-CREDIT VERSION
NO CERTIFICATE WILL BE ISSUED

Some links and content may not be active
Material is updated periodically

IF YOU WISH TO RECEIVE A CERTIFICATE, USE YOUR BROWSER BACK BUTTON OR RETURN TO THE EDUCATION PAGE

Conducting an Accident Investigation

Oregon OSHA Online Course 1110

This material is for training purposes only. Its purpose is to inform Oregon employers of best practices in occupational safety and health and general Oregon OSHA compliance requirements. This material is not a substitute for any provision of the Oregon Safety Employment Act or any standards issued by Oregon OSHA. For more information on this online course and other OR-OSHA online training, visit the *Online Course Catalog*. (http://www.cbs.state.or.us/osha/education.html)

This is a text only version. Some links and content may not be active.

Course Modules

INTRODUCTION

Workplace accidents occur each and every day all across the Country. Each Year the *Bureau of Labor Statistics* (www.bls.gov) publishes a statistical summary of injuries and illnesses (See summary below) that emphasizes this fact.

The failure of people, equipment, supplies, or surroundings to behave or react as expected causes most of the accidents. Accident investigations determine how and why these failures occur. By using the information gained through an investigation, a similar or perhaps more disastrous accident may be prevented. Conduct accident investigations with accident prevention in mind. Investigations are NOT to place blame.

This course introduces you to basic accident investigation procedures and describes accident analysis techniques. Throughout the course, you'll be taking what you've learned throughout the course to analyze a hypothetical accident!

What is an accident?

An accident is the final event in an unplanned process that results in injury or illness to an employee and possibly property damage.

An "event," occurs when one "actor" (one person/thing) performs an "action" (does something). In this definition, a person or thing will do something that result in a change of state (an injury). An accident may be the result of many factors (simultaneous, interconnected, cross-linked events) that have interacted in some dynamic way.

Why conduct an "investigation"?

Does your organization conduct accident investigations for the same reason as Oregon OSHA?

It shouldn't be. The answer to this question is key to the success of the entire program.To determine the purpose of a process, it's important to look at the "output" of that process.

The employer's role: Analyze to fix the system...It's fact finding not fault finding.

Unfortunately, some employers believe that the investigation process ends once blame as been established. The problem, here, is that once the purpose of the analysis process has been achieved, analysis stops. When employers investigate to place blame, no further analysis is conducted to fix the underlying safety management system weaknesses that contributed to the accident.

According to OSHA's Safety & Health Program Management Guidelines, para (c)(2)(iv), the employer's primary purpose for investigating accidents is primarily, "so that their causes and means for preventing repetitions are identified."

OSHA goes on to say this about the investigation process:

"Although a first look may suggest that "employee error" is a major factor, it is rarely sufficient to stop there. Even when an employee has disobeyed a required work practice, it is critical to ask, "Why?" A thorough analysis will generally reveal a number of deeper factors, which permitted or even encouraged an employee's action. Such factors may include a supervisor's allowing or pressuring the employee to take short cuts in the interest of production, inadequate equipment, or a work practice which is difficult for the employee to carry out safely. An effective analysis will identify actions to address each of the causal factors in an accident or "near miss" incident."

Bottom line: The output of the employer's accident investigation process should not end with merely identifying violations of employer safety rules. The final report should focus on identifying safety management system weaknesses. Following this policy will help make sure the accident analysis process is a "profit center" activity for the company. It will result in long-term returns that are substantially greater than the investment put into the process.

The most effective employer accident investigations address liability only after an honest evaluation by a qualified person concludes that all relevant elements of the safety management system are effectively designed and implemented.

A quick reprimand almost guarantees adequate evaluation was not conducted.

Are accidents always unplanned?

We like to think that accidents are unexpected or unplanned events, but sometimes, that's not necessarily so. Some accidents result from hazardous conditions and unsafe behaviors 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.

A competent person can examine workplace conditions, behaviors and underlying systems to predict closely what kind of accidents will occur in the workplace. Technically, we can't say an accident is always unplanned. Like any system, a safety management system is designed perfectly to produce what it produces. Consequently, written safety plans may be (unintentionally) designed such that they create circumstances that cause accidents.

In companies that decide to take the risk, it's likely their attitude about accidents is that, "accidents just happen; there's nothing we can do about them." Of course, that's an unacceptable notion in any effective safety culture. Employers with a healthful attitude about accidents consider them to be "inexcusable," and demand that hazards be corrected before they cause an accident.

Accidents and incidents

The procedures discussed in this course apply most directly to accidents, but they are also applicable to "near hit" incidents in general. If you aren’t investigating those then you are missing a huge opportunity to protect your employees.

Characteristics of effective incident/accident analysis program

The program will be guided by a written plan that identifies specific procedures and responsibilities. It's important to make sure procedures are clearly stated and easy to follow in a step-by-step fashion.
The plan clearly assigns responsibility for conducting accident investigations. It's up to the employer to determine who conducts accident investigations. Usually a supervisor, management/labor team, or safety committee member conducts the investigation.

Whoever conducts the investigation needs to understand his or her role as an accident investigator. Usually, two heads work better than one, especially when gathering and analyzing material facts about the accident. We recommend a team approach.

All accident investigators will be formally trained on accident investigation techniques and procedures. Investigators may attend accident investigation training presented by OR-OSHA, private educational institutions, or in-house training conducted by a qualified person.

Accident investigation must be perceived as separate from any potential disciplinary procedures resulting from the accident. The purpose of the accident investigation is to get at the facts, not find fault. The accident investigator must be able to state with all sincerity, that he or she is conducting the investigation only for the purpose of determining cause, not blame.

The accident investigation report will be in writing and will make sure that the surface causes and root causes of accidents are addressed. Most accident reports are ineffective precisely because they neglect to uncover the underlying reasons or factors that contribute to the accident. Only by digging deep, can you eliminate the hazardous conditions and work practices that, on the surface, caused the accident.

The accident investigation report will make recommendations to correct hazardous conditions and work practices, and those underlying system weaknesses that "caused" them into existence. In many instances, the surface causes for the accidents are corrected on the spot, and will be reported as such, but the investigator must make recommendations for long-term corrections in the safety and health system to make sure those surface causes do not reappear.

Follow-up on both current and/or revised procedures to make sure short and long-term corrective actions are completed.

There will be an annual review of accident reports. Safety committee members can evaluate accident reports for consistency and quality. They must make sure root causes are being addressed and corrected. To do this, information about the types of accidents, locations, trends, etc., should be gathered.

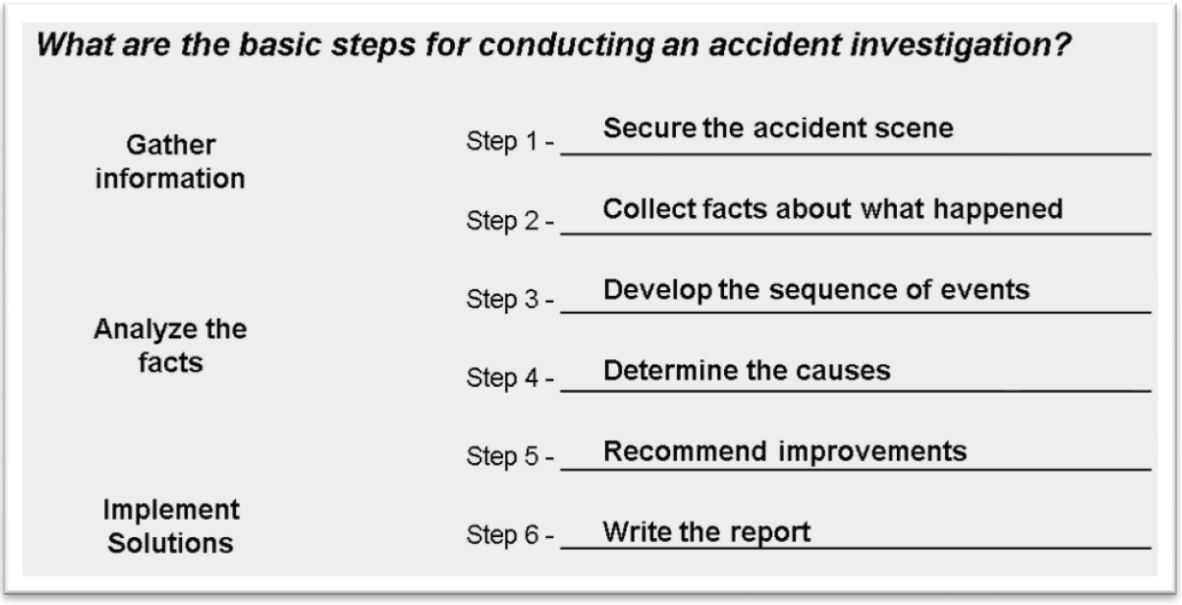
With all this in mind, let's move on to Module One to begin discussing the six-step process for conducting an effective accident investigation.

MODULE 1: INITIATING THE PROCESS

Introduction

In this first module our goals are to understand basic OROSHA law regarding employer responsibilities to conduct accident investigation. We'll also learn why it's important to begin the investigation early-on, when it's "safe" to investigate, and "how" to secure the accident scene once the investigation has been initiated. Finally, you'll learn what the law says about reporting accidents to OR-OSHA.

The incident/accident investigation process is composed of three principles and each principle is further reduced into 6 steps. This helps to ensure you are walking through the process in an orderly manner.



Before the accident occurs...lay the groundwork

When a serious accident occurs in the workplace, everyone will be too busy dealing with the emergency at hand to worry about putting together an investigation plan, so before the accident occurs... develop an effective written incident/accident analysis plan that will:

- Determine who should be notified of accident.
- Establish who is authorized to notify outside agencies (fire, police, etc.)
- Determine who is assigned to conduct investigations.
- Conduct required training for accident investigators.
- Determine who receives and acts on investigation reports.
- Establish timetables for conducting the investigation and follow-up actions such as hazard correction.

Step 1: <u>Secure the Accident Scene</u>

The first step in an effective accident investigation procedure is to secure the accident scene as soon as possible so you can begin collecting initial data. Sometimes, you may actually be able to begin the investigation, while the victim is being assisted by emergency responders. In this case, make sure you do not interfere in any way with them. The first responsibility is to make sure the victim is cared for. At this early point, you're primarily making initial observations for later analysis.

Most of the time, your investigation will not begin until emergency response is completed. In this situation, material evidence will most likely not be in its original location. Of course, this will make it more difficult for you to determine the original location of evidence, but effective interviews will help you to construct the scene. In either situation, you're not yet interested in what "caused" the accident, just gathering as much pertinent information as possible for later analysis.

Why is it important to start the investigation as soon as possible? Of course, it's not to establish blame, but rather to accurately determine the surface and root causes for the accident. The longer you wait to investigate, the more likely the accuracy of the evidence may suffer over time. Why?

Two things may change after an accident occurs:

Material evidence. Somehow, tools, equipment, and sometimes people just seem to move or disappear from the scene. Understandably, the employer is anxious to "clean up" the accident scene so people can get back to work. It's important that an effective procedure be developed to protect material evidence so that it does not get moved, or disappears.

Memory. Accidents are traumatic events. There are varying degrees of psychological trauma depending on how "close" an individual is to the accident or victim. There may be physical trauma to the victim and others whenever a serious accident occurs in the workplace. Everyone is affected somehow. As time passes after an accident conversations with others and individual emotions distort what people believe they saw and heard. After a while, the memory of everyone affected by the accident will be altered in some way. This type of distortion can have nothing but negative effects on your success as an accident investigator.

With the above in mind, it becomes rather obvious why we must try to get information as soon as possible. But what can we do to make sure evidence and memory do not disappear? Let's find out.

Securing the accident scene isn't difficult, but it's critically important to do it quickly. You may use tape, rope, cones, or even personnel to secure the accident scene. Securing the accident scene may not be rocket science, but it may be extremely important in preventing the loss or misplacement of material evidence.

If required, report the accident

If a very serious injury or fatality accident occurs, you may be required to report it to OROSHA. Let's look at the Standard for the specific requirements (http://orosha.org/pdf/rules/division_1/437-001-0700-21.pdf).

437-001-0700(21) Reporting Fatalities and Hospitalizations to Oregon OSHA. You must report the following to Oregon OSHA at 1-800-922-2689 or 503-378-3272 within the given time limits:
(a) Fatality - 8 hours
(b) Catastrophe - 8 hours
(c) Overnight Hospitalization - 24 hours

A fatality is pretty much self-explanatory. A catastrophe is considered two or more fatalities or three or more serious injuries. Think of an injury as serious if the victim is admitted to the hospital overnight for other than observation. Once the employer has knowledge that any of the above conditions have been met, the eight and 24-hour clock starts ticking.

MODULE 2: DOCUMENTING THE ACCIDENT SCENE

Introduction

In this module we will take a look at strategies for documenting the accident scene. We'll emphasize the team approach and discuss the advantages of using the various documentation methods including, personal observation, photo/videotaping, taking statements, drawing sketches and reviewing records.

Step 2: Collect Facts About What Happened

Once the accident scene has been roped off, it's important to begin immediately to gather evidence from many sources as possible during an investigation. One of the biggest challenges facing the investigator is to determine what is relevant to what happened, how it happened, and why it happened. Identifying items that answer these questions is the purpose of effective accident scene documentation.

As you'll learn, there are so many ways to document the scene that it may become quite difficult for one person to effectively complete all actions. The most effective strategy is to document as much as possible, even if you question relevancy. It's easy to discard clues or leads if they prove not useful to the investigation. It's not at all easy to dig up material evidence well into the investigation. All items found at the scene should be considered important and potentially relevant. Consequently, a team approach is probably the most efficient strategy when conducting accident investigations when very serious injuries or fatalities are involved.

Sample Accident Investigator's Kit

Another important policy is to have a ready-and-waiting accident investigator's kit. You won't be able to fulfill this purpose unless you come prepared so make sure an accident investigation kit is available for use. Some items we use are listed below:

- Camera
- Tape recorder
- Ground loop Impedance Tester
- Sound level meter
- Abney Level or clinometers
- Tape measure, 25 and 50 ft length
- Clipboard, paper, pencils, etc.
- Rain gear
- Rubber and caulked boots
- Plastic bags with ties
- Square, French curve template
- Personal Protective Equipment
- Eye protection
- Hand protection
- Clothing
- Respirators
- Hearing protection
- String
- Stakes
- Warning tape

Methods to document the accident scene

Make personal observations. With clipboard in hand, take notes on personal observations. Try to involve all the senses.

What do you see? What equipment, tools, materials, machines, structures appear to be broken, damaged, struck or otherwise involved in the event? Look for gouges, scratches, dents, smears.

If vehicles are involved, check for tracks and skid marks. Look for irregularities on surfaces. Are there any fluid spills, stains, contaminated materials or debris?

What about the environment? Were there any distractions, adverse conditions caused by weather?

Record the time of day, location, lighting conditions, etc. Note the terrain (flat, rough, etc.)

What is the activity occurring around the accident scene?

Who is there: Who is not? You'll need this information to take initial statements and interviews.

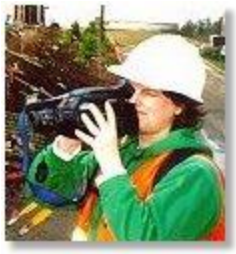
Measure distances and positions of anything and everything you believe to be of any value to the investigation.

Obtain initial statements

If you're fortunate there will be one or more eye-witnesses to the accident. Ask them for an initial statement giving a description of the accident. Also try to obtain other information from the witness including:

- Names of other possible witnesses for subsequent interviews.
- Names of company rescuers or emergency response service.
- Materials, equipment, articles that were moved or disturbed during the rescue.
- Take photos of the accident scene. Make sure you start with distance shots, and move in closer as you take the photos. Also make notes about the photos you took. Some important points to remember about taking photos include:
    - Take photos at different angles (from above, 360 deg. of scene, left, right, rear) to show the relationship of objects and minute and/or transient details such as ends of broken rope, defective tools, drugs, wet areas, containers.
    - Take panoramic photos to help present the entire scene, top to bottom - side to side.
    - Take notes on each photo. These will be included in the appendix of the report along with the photos. Identify the type of photo, date, time, location, subject, weather conditions, measurements, etc.
    - Place an item of known dimensions in the photo if hard-to-measure subjects are being photographed.
    - Identification of person taking photo.

You may indicate the locations photos were taken on sketches.



Videotape the scene

The earlier you can begin videotaping, the better. Once company or other emergency responders are attending to the victim, begin videotaping. The video recorder will pick up details and conversations that can add much valuable information to your investigation. Just remember...don't get in the way.

Some important points to remember when videotaping include:

- Have witness(es) accompany and describe what happened.
- If possible, reenact the event.
- Use a tripod when taping.
- To get the "lay of the land," stand back from a distance and zoom in to the scene.
- Scan slowly 360 degrees left and right to establish location.
- Narrate what is being taped, describe objects, size, direction, location, etc.
- If a vehicle was involved, tape direction of travel, going and coming.

Before you tape, make sure your video camera is operating properly, the battery is charged, etc.

Sketch the accident scene

Sketches are very important because they compliment the information in photos, and are good at indicating distances among the various elements of the accident scene which establishes "position evidence."

It is important to be as precise as possible when making sketches. The basic components of the sketch are:

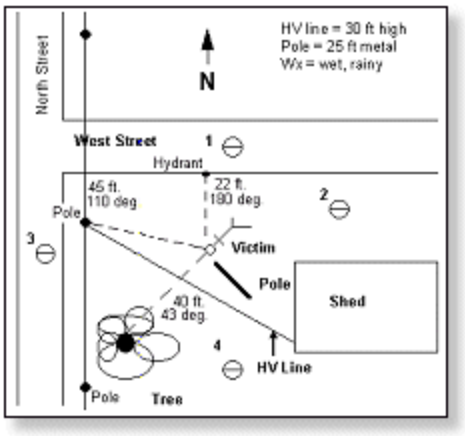
- Documentation. Date, time, location, identity of objects, victims, etc.
- Spatial relationships. Measurements.
- Location of photographs.
- Some sketching pointers:
- Make sketches large; preferably 8" x 10".
- Makes sketches clear. Include information pertinent to the investigation.
- Include measurements. Establish precise fixed identifiable reference points.
- Print legibly. All printing should be on the same plane.
- Indicate directions, i.e., N,E,S,W.
- Always tie measurements to a permanent point, e.g.. telephone pole, building.
- Mark where people were standing.

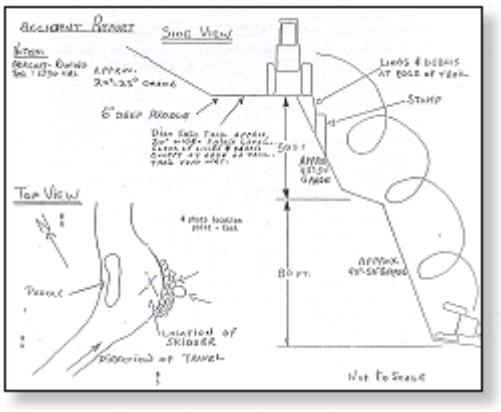
Use sketches when interviewing people.

Show where photos were taken.

Upgrade the quality of the sketch. Turn it into a precise diagram.

This sketch illustrates the Triangulation Method which makes it possible to later pinpoint the exact location of an object. In this accident, the victim contacted a high voltage line with a metal tree trimming pole. The position of the victim's head is measured from three points. Notice the small circles with horizontal lines through them. These circles indicate where photos were taken. Also, North is indicated and all major objects are identified.





Here's another sketch that helps to illustrate one of the major advantages of sketching. It shows motion through time. In this sketch you can see how the bulldozer rolled down the side of a hill.

Interview documents

That's right...you don't just review records, you "interview" them by asking questions. If you ask...they will answer. Some records you might want to interview are:

- Maintenance records - to determine the maintenance history of the tools, equipment or machinery involved in the accident.
- Training records - to determine the quantity and quality of the training received by the victim and others.
- Standard operating procedures - to determine the formally established steps in the procedures.
- Safety policies, plans, rules - to determine their presence and adequacy.
- Work schedules - to determine if the victim might have been fatigued or otherwise overworked.
- Disciplinary records - if discipline is considered justified, to determine if disciplinary actions have occurred previously.
- Medical records - if permission granted, or otherwise allowed, to determine potential physical/mental contributing factors.
- EMT reports - to determine quality of response procedures.
- OSHA Form 300 Log - to determine if similar accidents have occurred previously. See OROSHA Recordkeeping Rules for more information.
- Form 801, First Report of Injury - to collect additional information on accident events and background. See OROSHA Recordkeeping Rules for more information.
- Safety Committee Minutes - to determine the history of any discussion of related hazardous conditions, unsafe behaviors or program elements.
- Coroner's report - to determine direct cause of injury causing fatality.
- Police report - to determine facts when criminal negligence is in question. Note: When criminal negligence is suspected stop the investigation and coordinate all activities with legal advisors.

MODULE 3: CONDUCTING INTERVIEWS

Introduction

Once you have initially documented the accident scene, it becomes important to start digging for details through the interview process. Conducting interviews is perhaps the most difficult part of an investigation.

The purpose of the accident investigation interview is to obtain an accurate and comprehensive picture of what happened by obtaining all pertinent facts, interpretations, and opinions. Your job, as the interviewer is to construct a composite story using the various accounts of the accident and other evidence. The effective interviewer will have a firm understanding of the techniques for interviewing and the skills acquired through experience to apply those techniques.

This module will help you understand the difference between an initial interview and an investigative interview, how to set up an interview, and develop interview questions. The module will also discuss how to organize the interview and participants to be able to obtain accurate information.

Step 2: <u>Collecting the Facts Through Interviews (Cont'd)</u>

Your first task is to determine who needs to be interviewed. Questions will need to be designed around the interviewee. Consequently, each interview will be a very unique experience. Interviews should occur as soon as possible, but usually do not begin until things have settled down a bit. Some people you may want to consider for an interview include:

- The victim. To determine specific events leading up to and including the accident.
- Co-workers. To establish what actual vs. appropriate procedures have been used. Preferably ones who perform the same task.
- Direct supervisor. To get background information on the victim. He or she can provide procedural information about the task that was being performed.
- Manager. Can be the main source for information on related systems.
- Training department. To get information on quantity and quality of training the victim and others have received.
- Personnel department. To get information on the victim's and others' work history, discipline, appraisals.
- Maintenance personnel. To determine background on equipment/machinery maintenance.
- Emergency responders. To learn what they saw when they arrived and during the response.
- Medical personnel. To get medical information (as allowed by law.)
- Coroner. Can be a valuable source to determine type/extent of fatal injuries.
- Police. If they filed a report.
- Other interested persons. Anyone interested in the accident may be a valuable source of information.
- The victim's spouse and family. They may have insight into the victim's state of mind or other work issues.

Cooperation not intimidation is the key to a successful accident investigation interview. Gathering information is the focus of this interview process.

Effective Interviewing Techniques

What are effective ways to increase cooperation in the accident interview process? What communication strategies might increase the likelihood of an adversarial relationship in the interview? As you conduct interviews, gaining experience along the way, you'll further develop the "art" of interviewing by improving your ability to apply these techniques. Use incident investigations to gain this experience.

Keep the purpose of the investigation in mind: To determine the cause of the accident so that similar accidents will not recur. Make sure the interviewee understands this.

Approach the investigation with an open mind. It will be obvious if you have preconceptions about the individuals or the facts.

Go to the scene. Just because you are familiar with the location or the victim's job, don't assume that things are always the same. If you can't conduct a private interview at the location, find an office or meeting room that the interviewee considers a "neutral" location. Don't promise confidentiality.

Interview the people involved (victim, witnesses, people involved with the process, i.e., forklift driver, mechanic).

Put the person at ease. Explain the purpose and your role. Sincerely express concern regarding the accident and desire to prevent a similar occurrence.

Express to the individual that the information given is important. Be friendly, understanding, and open minded. Be calm and unhurried.

Direct an eyewitness to "explain what happened." If you don't ask them to explain, you may be left with a simple "no," and that's that.

Let the individual talk. Ask background information, name, job, etc. first. Ask the witness to tell you what happened; don't ask leading questions; don't interrupt; and don't make expressions (facial, verbal of approval or disapproval).

Ask open ended questions to clarify particular areas or get specifics. Try to avoid yes and no answer (closed ended) questions. Try to avoid asking "why" as these types of questions tend to make people respond defensively.

- Example: Do not ask: "Why did you drive the forklift with under-inflated tires? Rather, ask: What are forklift inspection procedures? What are forklift safety hazard reporting procedures?

Repeat the facts and sequence of events back to the person to avoid any misunderstandings.

Notes should be taken very carefully, and as casually as possible. Ask the interviewee to review the notes for technical accuracy. Reading the notes may help them remember other details. Give the interviewee a copy of the notes you take to help reduce any thought that you're trying to conceal information.

Don't use a tape recorder unless you get permission. Tell the interviewee that the purpose of the recorder is to ensure accuracy. Offer to give the interviewee a copy of the tape.

Ask for their suggestions as to how the accident/incident could have been avoided.

Conclude the interview by thanking them for their contribution. Ask them to contact you if they think of anything else. If possible, tell these people personally of the outcome of the investigation before it becomes public knowledge.

Last Words

Understanding and applying the information above during the interview process will help assure you establish a cooperative relationship so that you can obtain the facts. Intimidation and blaming will always result in an ineffective interview process.

MODULE 4: ANALYZING THE FACTS

Introduction

This module introduces you to the very important process of event analysis. We'll discuss the process of developing and analyzing the sequence of events occurring prior to, during, and immediately after an accident.

Sorting it all out...

We've collected a lot of factual data and it's strewn over the top of your desk. The task now is to turn that data into useful information. We've got to somehow take this data and make some sense of it. It's important to know that we are not just trying to take random facts to identify, or determine the presence of the conditions and behaviors that caused the accident. More importantly, we're conducting a structured "analysis" to determine the unique events that occurred prior to and including the injury event, and what kind of impact each event had on the accident.

Analysis defined

Webster defines analysis as the "separation of an intellectual or substantial whole into its parts for individual study."

When there is a workplace accident we need to separate or "break down" the accident process (the whole) into its component parts (events) for study to determine how they relate to the whole. Since the accident, itself, is the main event, its component "parts" may be thought of as the individual events leading up to and including the main event or the accident.

Step 3: Develop the Sequence of Events

Our challenge at this point in the investigation process is to accurately determine the sequence of events in the accident process so that we can more effectively analyze the accident process.

Once the steps in the process are developed, we can then study each event to determine related:

- Hazardous conditions. Things and states that directly caused the accident.
- Unsafe behaviors. Actions taken/not taken that contributed to the accident.
- System weaknesses. Underlying inadequate or missing programs, plans, policies, processes, and procedures that contributed to the accident.

The final event in an unplanned process

When we understand that the accident is actually the final event in an unplanned process, we'll naturally want to know what the initial event was. When the initial event occurs, it effects the actions of others, setting in motion a potentially very complicated process eventually ending in an injury or illness. The trick is to take the information gathered and arrange so that we can accurately determine what initial condition and/or action transformed the planned work process into an unplanned accident process.

For instance, if a supervisor ignores an unsafe behavior because doing so is not thought to be his or her responsibility, the failure to enforce behavior represents an event in the production process that may contribute to or increase the probability of an accident.

Each event in the unplanned accident process describes a unique:

- Actor. An individual or object that directly influenced the flow of the sequence of events. An actor may participate in the process or merely observe the process. An actor initiates a change by performing or failing to perform an action.

- Action. Something that is done by an actor. Actions may or may not be observable. An action may describe something that is done or not done. Failure to act should be thought of as an act in itself.

It's important to understand that when describing events, first indicate the actor, then tell what the actor does. Remember, the actor is the "doer," not the person or object being acted upon or otherwise having something done to them.

For instance, take a look at the statement below:

"Bob unhooked the lifeline from the harness."

In this example, "Bob" is the actor and "unhooking" is the action. First we describe the actor...Bob. Then we describe the action...unhooking. The lifeline and harness, although "objects", are not actors because they are not performing an action. Rather, something is being done to them. Also note that the statement is written in active tense.

Paint a word picture

It's important that the sequence of events clearly describe what occurred so that someone unfamiliar with an accident is able to "see it happen" as they read. If an event is hard to understand, it may be that the description is too vague or general.

The solution to this problem is to increase the detail by:

- Determine if anything else was said/done before or after the event you are currently assessing.
- Separate actors. Remember, an actor may be a person or a thing accomplishing a given action. If an event includes actions by more than one actor, break the event down into two events.

To get a good idea what the sequence of events looks like, review the example below that was prepared for an actual fatality investigation conducted by Oregon OROSHA a few years ago.

Sequence of Events

1. Employee #1 returned to work at 12:30 PM after lunch to continue laying irrigation pipes.

2. At approximately 12:45 PM employee #1 began dumping accumulated sand from an irrigation mainline pipe.

3. Employee #1 oriented the pipe vertically and it contacted a high voltage power line directly over the work area.

4. Employee #2 heard a ‘zap’ and turned to see the mainline pipe falling and employee #1 falling into an irrigation ditch.

5. Employee #2 ran to employee #1 and pulled him from the irrigation ditch, laid him on his back and ran about 600 ft to his truck and placed a call for help on his mobile phone.

6. Employee #2 than ran back to find employee #1 had fallen back into the ditch.

7. Employee #2 jumped back into the ditch and held employee #1 out of the water until help arrived.

8. Two other ranch employees arrived and assisted employee #2 in getting employee #1 out of the ditch.

9. Approximately one minute later, paramedics arrived and began to administer CPR on employee #1. They also used a heart defibrillation machine in an attempt to stabilize employee #1's heart beat.

10. At approximately 1:10 PM an ambulance arrived and transported employee #1 to the hospital where he was pronounced dead at 1:30 PM.

This example is rather brief and there may be other related events that indirectly contributed to the accident. However, it does give you sufficient descriptive detail to paint a mental picture of the actors and acts that occurred immediately prior to and including the accident.

Last Words

Now that we have the sequence of events, we can begin the "analysis" by examining each event for potential causes of the accident.

MODULE 5: DETERMINING SURFACE AND ROOT CAUSES

Introduction

Did you know that most accidents in the workplace result from a combination of unsafe work behaviors and hazardous conditions? According to the latest research, they represent the cause for about 98% of all workplace accidents. "Acts of God" account for the remaining 2%. All these statistics imply that safety management system weaknesses account for fully 98% of all workplace accidents. To effectively fulfill our responsibilities as an accident investigator, we must not close the investigation until these root causes have been identified.

It's a common struggle trying to overcome long-held perceptions about safety and how accidents occur. Management perceptions and subsequent actions reflect both traditional and progressive approaches. Let's take a look at old and new thinking.

Old Theory - Worker Error

Old thinking about the causes of accidents assumes that the worker makes a choice to work in an unsafe manner. It implies that there are no outside forces acting upon the worker influencing his actions and that there are simple reasons for the accident.

Old thinking also considers accidents as solely resulting from worker error: A lack of "common sense." The employee is the focus of "the problem." To prevent accidents, the employee must work more safely. This thinking results in blaming and short-term fixes: Inefficient, ineffective, and in the long run more expensive to implement and maintain.

New Theory - Systems Approach

The systems approach takes into account the dynamics of systems that interact within the overall safety program. It concludes that accidents are considered defects in the system. People are only one part of a complex system composed of many complicated processes (more than we realize). Accidents are the result of multiple causes or defects in the system.

It becomes the investigator's job to uncover the root causes (defects) in the system. Fixing the system, not the employee, is the heart of the investigation. To prevent accidents, the system must work more safely. This thinking results in long-term fixes: Less expensive to implement and maintain.

Why accidents happen

Over the past century, safety professionals have tried to more effectively explain how and why accidents occur. As you will see below, their explanations were at first rather simplistic.

Theorists gradually realized that it was not sufficient to explain away workplace accidents as simple cause-effect events. They developed new theories that better explained the complicated interaction among conditions, behaviors and systems that result in an accident.

Let's take a look at some of these theories.

Single Event Theory - "Common sense" leads us to this explanation. An accident is thought to be the result of a single, one-time easily identifiable, unusual, unexpected occurrence that results in injury or illness. Some still believe this explanation to be adequate.

It's convenient to simply blame the victim when an accident occurs. For instance, if a worker cuts her hand on a sharp edge of a work surface, her lack of attentiveness may be explained as the cause of the accident. ALL responsibility for the accident is placed squarely on the shoulders of the employees. An accident investigator who has adopted this explanation for accidents will not produce quality investigation reports that result in long-term corrective actions.

The Domino Theory - This explanation describes an accident as a series of related occurrences which lead to a final event that result in injury or illness. Like dominoes, stacked in a row, the first domino falling sets off a chain reaction of related events that result in an injury or illness.

The accident investigator will assume that by eliminating any one of those actions or events, the chain will be broken and future accidents prevented. In the example above, the investigator may recommend removing the sharp edge of the work surface (an engineering control) to prevent any future injuries. This explanation still ignores important underlying system weaknesses or root causes for accidents.

Multiple Cause Theory - This explanation takes us beyond the rather simplistic assumptions of the single event and domino theories. Once again, accidents are not assumed to be simple events. They are the result of a series of random related or unrelated acts/events that somehow interact to cause the accident.

Unlike the domino theory, the investigator will realize that eliminating one of the events does not assure prevention of future accidents. Removing the sharp edge of a work surface does not guarantee a similar injury will be prevented at the same or other workstation. Many other factors may have contributed to an injury. An accident investigation will not only recommend corrective actions to remove the sharp surface, it will also address the underlying system weaknesses that caused it.

Time to analyze for cause

We've gathered information and used it to develop an accurate sequence of events. We've got a good mental picture of what happened. Now it's time to conduct an analysis of each event to determine causes.

This module will introduce us to the following concepts:

- Injury analysis
- Event analysis
- Systems analysis
- Direct cause of injury
- Surface cause of the accident
- Root cause of the accident
- Three levels of cause analysis

As mentioned earlier in the course, accidents are processes that culminate in an injury or illness. An accident may be the result of many factors (simultaneous, interconnected, crosslinked events) that have interacted in some dynamic way.

In an effective accident investigation, the investigator will conduct three levels of cause analysis:

- Injury analysis. At this level of analysis, we do not attempt to determine what caused the accident, but rather we focus on trying to determine how harmful energy transfer caused the injury. Remember, the outcome of the accident process is an injury.
- Event Analysis - Here we determine the surface cause(s) for the accident: Those hazardous conditions and unsafe behaviors described throughout all events that dynamically interact to produce the injury. All hazardous conditions and unsafe behaviors are clues pointing to possible system weaknesses. This level

of investigation is also called "special cause" analysis because the analyst can point to a specific thing or behavior.

- Systems analysis - At this level we're analyzing the root causes contributing to the accident. We can usually trace surface causes to inadequate safety policies, programs, plans, processes, or procedures. Root causes always pre-exist surface causes and may function through poor component design to allow, promote, encourage, or even require systems that result in hazardous conditions and unsafe behaviors. This level of investigation is also called "common cause" analysis because we point to a system component that may contribute to common conditions and behaviors throughout the company.

The direct cause of injury

Whenever an injury occurs, a harmful level of energy is somehow transferred to our body. We should describe the nature of that energy transfer and refer to it as the direct cause of the injury. Here are the various forms of energy that can be harmful:

1. ACOUSTIC ENERGY - Excessive noise and vibration.

2. CHEMICAL ENERGY - Corrosive, toxic, flammable, or reactive substances. Involves a release of energy, ranging from "not violent" to "explosive" and "capable of detonation".

3. ELECTRICAL ENERGY - Low voltage (below 440 volts) and high voltage (above 440 volts).

4. KINETIC (IMPACT) ENERGY - Energy from "things in motion" and "impact," and are associated with the collision of objects in relative motion to each other. Includes impact between moving objects, moving object against a stationary object, falling objects, flying objects, and flying particles. Also involves movement resulting from hazards of high pressure pneumatic, hydraulic systems.

5. MECHANICAL ENERGY - Cut, crush, bend, shear, pinch, wrap, pull, and puncture. Such hazards are associated with components that move in circular, transverse (single direction), or reciprocating motion.

6. POTENTIAL (STORED) ENERGY - Involves "stored energy." Includes objects that are under pressure, tension, or compression; or objects that attract or repulse one another. Susceptible to sudden unexpected movement. Includes gravity - potential falling objects, potential falls of persons. Includes forces transferred biomechanically to the human body during lifting.

7. RADIANT ENERGY HAZARDS - Relatively short wavelength energy forms within the electromagnetic spectrum. Includes infra-red, visible, microwave, ultra-violet, x-ray, and ionizing radiation.

8. THERMAL ENERGY - Excessive heat, extreme cold, sources of flame ignition, flame propagation, and heat related explosions.

Let's take a look at some examples describing the direct cause of injury:

If a harsh acid splashes on our face, we may suffer a chemical burn because our skin has been exposed to a chemical form of energy that destroys tissue.

In this instance, the direct cause of the injury is harmful a chemical reaction. The related surface cause might be the acid (condition) or working without proper face protection (unsafe behavior).

If our workload is too strenuous, force requirements on our body may cause a muscle strain. Here, the direct cause of injury is a harmful level of kinetic energy (energy resulting from motion), causing injury muscle tissue.

A related surface cause of the accident might be fatigue (hazardous condition) or improper lifting techniques (unsafe behavior).

The important point to remember here is that the "direct cause of injury" is not the same as the surface cause of the accident.

To summarize:

The direct cause of injury is the harmful transfer of energy. The direct result is injury.

The surface cause of the accident describes a condition or behavior. The result of the condition and/or behavior is the direct cause of injury...a harmful transfer of energy.

The surface causes of accidents

Surfaces causes are those specific hazardous conditions and unsafe or inappropriate behaviors that directly cause or contribute in some way to an accident.

Hazardous conditions:

- are basically things or objects that cause injury or illness
    - may also be thought to be defects in a process
    - may exist at any level of the organization

Hazardous conditions may exist in any of the following categories:

- Materials
- Machinery
- Equipment
- Tools
- Chemicals
- Environment
- Workstations
- Facilities
- People
- Workload

It's important to know that most hazardous conditions in the workplace are the result of specific unsafe behaviors that produced them.

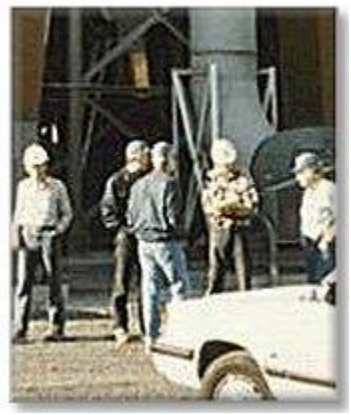
Unsafe behaviors:

- actions we take or don't take that increase risk of injury or illness
- may also be thought to be errors in a process
- may occur at any level of the organization

Some example of unsafe employee/manager behaviors include:

- Failing to comply with rules
- Using unsafe methods
- Taking shortcuts
- Horseplay

- Failing to report injuries
- Failing to report hazards
- Allowing unsafe behaviors
- Failing to train
- Failing to supervise
- Failing to correct
- Scheduling too much work
- Ignoring worker stress



System Analysis to determine the root causes of accidents

Once you start identifying inadequate policies, programs, plans, processes, and procedures in the diagram above...you're getting to the real root causes!

The root causes for accidents are the underlying safety system weaknesses that have somehow contributed to the existence of hazardous conditions and unsafe behaviors that represent surfaces causes of accidents.

These weaknesses can take two forms:

1. Design root causes. Inadequate planning and design of the system. The development of formal (written) safety management system policies, plans, processes, procedures is very important to make sure appropriate conditions, activities, behaviors, and practices occur.

2. Implementation root causes. Inadequate implementation of the system. Failure to effectively carry out the safety management system is critical to the success of the system. You can develop a wonderfully designed system, yet if it's not implemented correctly, it won't work.

It's important to understand that root causes always pre-exist surface causes.

Indeed, inadequately designed and implemented system components have the potential to feed and nurture hazardous conditions and unsafe behaviors. If root causes are left unchecked, surface causes will flourish!

Examples of safety management system functions

Systems are developed to:
- Promote Commitment/leadership
- Increase employee involvement
- Establish accountability
- Identify and control hazards
- Investigate incidents/accidents
- Educate and train
- Evaluate the safety program

System components:
- Policies
- Programs
- Plans

- Processes
- Procedures
- Budgets
- Reports
- Rules

The formal group within your company that's best suited to evaluate for system weaknesses is your safety committee.

Last Words

Only by thoroughly conducting all three levels of analysis can we design system improvements that effectively eliminate hazardous conditions and unsafe behaviors at all levels of the organization. The accident investigation can not serve as a proactive safety process unless system improvements effectively prevent future accidents.

MODULE 6: DEVELOPING RECOMMENDATIONS

Introduction

An accident investigation is generally thought to be a reactive safety process because it is initiated only after an accident has occurred. However, if we propose recommendations that include effective control strategies and system improvements, we transform the investigation into a valuable proactive process that ensures similar accidents do not recur.

In this module we'll explore tips and tactics for making effective recommendations that "sell" safety improvements.

Step 5: Recommend Improvements

What is an effective recommendation?

To make sure recommendations are effective, we need to address effective control strategies that will eliminate or reduce the specific surface causes of the accident. We must also propose system improvements to missing or inadequate safety system components that contributed to the accident. Let's continue this discussion by taking a look at control strategies.

The Hierarchy of Controls

Hazard control strategies (http://www.cdc.gov/niosh/topics/engcontrols/) may be quite effective in eliminating hazards or reducing exposure. Effective corrective actions will include one or more of the following hazard control strategies:

1. **Engineering controls**. Sometimes the cause of an accident is corrected most effectively by removing or reducing the hazard, itself.

This may be done in a number of ways, including:
Redesign the hazard out. Example - Fabricate a mesh guard to protect against exposure to moving parts.

Replace the unsafe item with a safe item. Example - Replace a poor quality grinder stone with a high quality grinder stone.

Enclose the hazard. Example - Place a hood over a source of noisy printer.

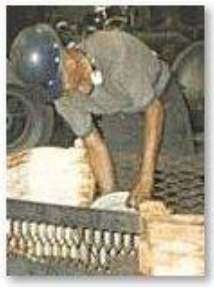
Substitute an unsafe item with different item. Example - Substitute a toxic chemical with a non-toxic chemical

Engineering out the hazard is our top priority

Why is this control strategy our top priority? Engineering controls remove the hazard itself. We're somehow changing a thing/condition in the workplace. It has the potential to completely remove a hazard, and as we all know...we can't be exposed to a hazard if it does not exist. No hazard...no exposure...no accident.

It's important to note that the intent of OROSHA law is that the employer attempts to engineer the hazard out if feasible. For instance, if a machine is producing a noise level of 120 decibels, OROSHA expects the employer to first attempt to reduce the noise level to acceptable levels using an engineering control such as enclosure.

2. **Administrative controls**. Safety managers employ these control strategies to eliminate or reduce the frequency and duration of exposure to hazards.



This is accomplished through:

- Managing work practices - Effective design and implementation of safe work procedures and practices.

- Managing work schedules - These strategies include job rotation, breaks, shift work, etc.

As you might have guessed, these control strategies are less effective in the long term than engineering controls because they do not remove the hazards, themselves. Rather, they attempt to reduce exposure to hazards by controlling human behavior - attempting to change "things we do or don't do."

As long as employees "behave" or comply with the changed procedures or schedules, management controls work. However, it's "normal" for us to want to work in the most efficient manner. Sometimes safe work procedures are not perceived as most efficient...so we may not use them.

Managers must diligently oversee and maintain management control strategies or those controls may become ineffective.

"Any system that depends on human reliability is inherently unreliable."
Block, Murphy's Law - Book Two

3. **Personal protective equipment (PPE)**. Some jobs require PPE by law. This control strategy is used in conjunction with the other control strategies. It should not be used to replace them.
When engineering and/or administrative controls don't adequately eliminate or reduce the hazard(s) of a task, PPE may be needed in addition to those strategies. PPE places a barrier between workers and the hazard. Remember, PPE does not eliminate or reduce the hazard itself, it merely sets up a barrier between you and the hazard. And, to be successful, it is highly dependent on safe behaviors.

The Hierarchy of Controls, when used separately or in combination, may be quite effective in eliminating or greatly reducing the probability of a similar accident recurring. However, to make sure long term risk reduction is achieved throughout the entire company, system improvements must be made.

Recommend system improvements

Missing or inadequate safety system components represent root causes for workplace accidents. Surface causes represent symptoms indicating system weaknesses. Therefore, every effort should be made to improve system components to ensure long term workplace safety. As we learned in the last module, the most successful accident investigator is actually a systems analyst: Not an easy task.

Making system improvements might include some of the following:

- Including "safety" in a mission statement.
- Improving safety policy so that it clearly establishes responsibility and accountability.
- Changing a work process so that checklists are used that include safety checks.

- Revising purchasing policy to include safety considerations as well as cost.
- Changing the safety inspection process to include all supervisors and employees.
- Proactive recommendations

To speed up the process and to improve the approval rate, we must learn to anticipate the concerns and questions that supervisors have when deciding what actions to take. The more pertinent the information included in the recommendation, the greater the likelihood for approval. To make sure you do provide good information, ask some important proactive questions.

Answer Six Key Questions

Answer the following six questions to help develop and justify recommendations.

1. Pinpoint the problem - What exactly is the problem?

What are the specific hazardous conditions and unsafe work practices that caused the problem? What are system components - the inadequate or missing policies, processes, rules that allowed the conditions and practices to exist?

2. What is the history of the problem?

Have similar accidents occurred previously? If so, probability for similar accidents is highly likely to certain. What are previous direct and indirect costs for similar accidents? How have similar accidents affected production and morale?

3. Pinpoint the specific solution - What are the solutions that would correct the problem?

What are the specific engineering, administrative and PPE controls that, when applied, will eliminate or at least reduce exposure to the hazardous conditions? What are the specific system improvements needed to ensure a long term fix?

4. Who is the decision maker?

Who is the person that can approve, authorize, and act on the corrective measures? What are the possible objections that he/she might have? What are the arguments that will be most effective in overcoming objections?

5. Why is that person doing safety?

It's important to know what is motivating the decision-maker. Is the manager doing safety to:

Fulfill the legal obligation? You may need to emphasize possible penalties if corrections are not made.

Fulfill the fiscal obligation? You may want to emphasize the costs/benefits.

Fulfill the moral obligation? You may want to emphasize improved morale, public relations.

6. What will be the cost/benefits if the recommendation is approved and the predictable cost/ benefits if not?

What are the estimated costs and benefits of taking corrective action, as contrasted with the possible

costs and harm that might occur if the hazardous conditions and unsafe work practices remain? What are the employer obligations under administrative law? What is the "message" sent to the workforce as a result of action or inaction?

The maintenance supervisor may be able to help you determine these estimates. Also, detail the costs associated with any training that might be required.

A simple cost-benefit analysis

A simple cost-benefit analysis assumes that there is a reasonable expectation that a disabling injury is likely in the near future (five years) when employees are exposed (place themselves within a danger zone) to a workplace hazard.

The object is to contrast the relatively high cost/low benefit if the hazard is not eliminated, with the low cost/high benefit if the hazard is eliminated.

The analysis answers the following questions:

- What are the potential costs to the company if the hazard is not eliminated?
- What are the potential costs to the company if the hazard is eliminated?
- How soon will the corrective action pay for itself?
- What is our return on investment (ROI) if corrective actions are taken?

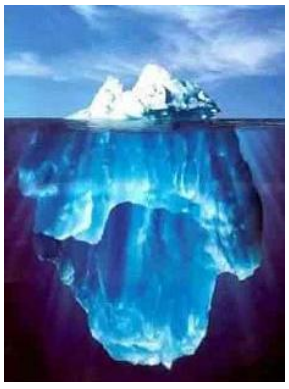
Example: If, during a safety inspection, you notice that an elevated platform area in a warehouse does not have a proper guardrail. You note that several workers work on the platform each day, and a well-used walkway passes directly under the platform. To construct a cost-benefit analysis for this situation you would answer the above questions as follows:

Average direct dollar costs for different types of accidents

To be effective, recommendations should be supported by a bottom-line cost/benefit analysis that contrasts the relative high costs of accidents against the much lower costs associated with corrective actions. Doing a cost benefit analysis is even more important when recommending corrective actions before an accident occurs.

According to the National Safety Council, which considers all industries nationally, the estimated 2000 average direct and indirect costs of a lost time injury is about $28,000, and a fatality averages $980,000. In Oregon, the direct cost to close a serious injury claim is around $20,000 and $300,000 to close a fatality claim.

Indirect costs, according to the NSC figures above average 1.6x direct costs. However, it's important to understand that indirect costs may amount to much more than this multiple with any single claim. Indirect costs can be as much as 2x to 50x direct costs...or more.



Two things to remember when estimating indirect costs:

The lower the direct cost, the higher the ratio between the direct and indirect costs. For instance, if someone suffers only minor injury requiring a few hundred dollars to close the claim, the indirect/direct costs ratio may be much higher than the NSC average.

- Capital intensive operations, where large sums have been invested in facilities, realize higher and average indirect/direct cost ratios. For example, if someone is seriously or fatally injured on a oil-drilling rig, resulting in operations shutting down for a day or so, many thousands of dollars in lost production will result. In high capital intensive work processes, the expected ratio between direct and indirect costs may be 5x to 50x.

- Labor intensive operations, where more investment is made in labor than capital assets, realize lower indirect/direct cost ratios. Someone may suffer a serious injury, but operations are not as likely to be significantly impacted. In labor intensive operations the expected ratio between direct and indirect costs may be 2x to 10x.

You can use these figures to demonstrate the benefits of taking corrective action.

What are the estimated costs to the company if the hazard is eliminated?

Costs: $1,500 needed to purchase and repair guardrail.

How soon will the corrective action pay for itself?

If a disabling injury occurs within the next 5 years, using National Safety Council figures we can estimate a direct/indirect cost to the company of approximately $28,000. Given the cost to purchase and repair the guard rail of $1,500. The corrective action will pay for itself in just 3.3 months ($1,500/($28,000/60 months)).

What is our return on investment (ROI) if corrective actions are taken? The ROI over the five year period will be $25,500 or 1,800 percent!

Last Words

Finally, it's important to provide alternatives to make it more likely that corrective actions will be taken. Your options might follow the logic below:

First option -- If we had all the money we needed, what could we do? Eliminate the hazard with primarily engineering controls. Additional administrative controls if required.

Second option -- If we have limited funds, what would we do. Eliminate the hazard with using work practice and/or administrative controls. Engineering controls if required.

Third option -- If we don't have any money, what can we do? Reduce exposure to the hazard with work practice/administrative controls and/or PPE.

It's important to remember that your employer should first try to engineer out the hazard if feasible before using administrative controls or PPE. Of course, some tasks require the use of PPE in accordance with Material Safety Data Sheet (MSDS) requirements.

MODULE 7: WRITING THE REPORT

Introduction

Now that you have accurately assessed and analyzed the facts related to the accident, you must report your findings to those who have authority, accountability, and can take action (We call this the "A Person"). In this module, we'll cover the procedure for effectively reporting the facts.

Perception is reality...

Never forget that your primary objective, as an accident investigator, is to uncover the causal factors that contributed to the accident. It's not your job to place blame. Your challenge is to be as objective and accurate as possible.

Your findings, and how you present them, will shape perceptions and subsequent corrective actions.

If your report arrives at conclusions such as..."Bob should have used common sense," or "Bobbie forgot to use PPE," how effective will it be? Of course, it won't be effective at all.

If your report concludes with statements such as this, it will be virtually impossible to take corrective actions that permanently eliminate the causes. It's likely that similar accidents will repeatedly occur.

Bottom line: If the accident investigation doesn't fix the system, it's most likely been a waste of time and effort.

So the challenge is to report your findings in a well-thought-out manner so that management will more likely adopt recommendations for improving its safety processes, thus solving problems long-term.

The Accident Report Form

The primary reason accident investigations fail to help eliminate similar accidents, is that report forms are poorly designed. In many cases the form design actually makes it possible to identify and correct only surface causes: root causes are often ignored.

Let's take a look at one format that is designed to give emphasis to root causes. You can also take a look at the sample below. This is a report format similar to that used by OR-OSHA accident investigators in conducting workplace accident investigations:

Section I. Background

This section contains background information that answers questions about who the victim is, and the time, date, location of the accident, as well as other necessary details. Most forms do quite well detailing background information.

Section II. Description of the accident

This section presents a descriptive narrative of the events leading up to, including and immediately after the accident. It's important that the narrative paint a vivid "word picture" so that someone unfamiliar with the accident can clearly see what happened. The format you choose is important. You may want to eliminate or keep event numbers.

See the example below.

Section II: Description of the Accident

Event -3. Employee #1 returned to work at 12:30 PM after lunch to continue laying irrigation pipes.

Event -2. At approximately 12:45 PM employee #1 began dumping accumulated sand from an irrigation mainline pipe.

Event -1. Employee #1 oriented the pipe vertically and it contacted a high voltage power line directly over the work area.

Event 0. Employee #2 heard a 'zap' and turned to see the mainline pipe falling and employee #1 falling into an irrigation ditch.

Event +1. Employee #2 ran to employee #1 and pulled him from the irrigation ditch, laid him on his back and ran about 600 ft to his truck and placed a call for help on his mobile phone.

Event +2. Employee #2 than ran back to find employee #1 had fallen back into the ditch.

Event +3. Employee #2 jumped back into the ditch and held employee #1 out of the water until help arrived.

Event +4. Two other ranch employees arrived and assisted employee #2 in getting employee #1 out of the ditch.

Event +5. Approximately one minute later, paramedics arrived and began to administer CPR on employee #1. They also used a heart defibrillation machine in an attempt to stabilize employee #1's heart beat.

Event +6. At approximately 1:10 PM an ambulance arrived and transported employee #1 to the hospital where he was pronounced dead at 1:30 PM

Section III. Findings

The findings section describes the hazardous conditions, unsafe behaviors and system weaknesses your investigation has uncovered. Each description of surface and root cause will also include justification for the finding. The justification will explain how you came to your conclusion.

Some report forms used today "force" the investigator to list only surface causes for accidents. Consequently, the investigator believes the job is done without ferreting out the root causes. Other forms offer very little space to write findings.

The form does not "report" the root causes uncovered associated with each surface cause. It is not the object of this section to find fault or place blame. Just state the facts: The hazardous conditions, unsafe procedures, inadequate or missing policies, training, accountability, etc.

Be sure to write complete descriptive sentences. Not short cryptic phrases.

Sample primary surface cause finding statements:

The findings describe the hazardous conditions and unsafe behaviors that directly caused injury. They exist or occur immediately prior to the injury event.

Hazardous condition: “The bolts for the machine guard on the chipper were missing and the grating cut open.”

Unsafe behaviors: “The injured employee fed limbs into the unguarded chipper, exposing himself to the hazardous condition.”

Sample secondary surface cause finding statements:

These findings describe those conditions and behaviors produced by individuals at some point prior to the injury event. These conditions, activities, practices and behaviors can exist at any time, in any place, and be produced by any person in the organization.

Hazardous condition: “Tools to repair the machine guard were broken and unusable.”

Unsafe behaviors:

- “An employee (could not be determined who) failed to replace bolts on the guard.”
- “An employee defeated the guard by cutting through the guard grating producing a large hole.”
- “The injured employee had not been trained in chipper operation or machine guarding principles.”

Sample safety program implementation root cause finding statements:

These findings describe management failures to implement programs, processes, plans, procedures within the safety management system. These failures result in secondary surface causes; those conditions and behaviors common to work groups or the entire organization.

Inadequate process:

- “Employees are not being properly trained in safe work procedures around high voltage lines.”
- “None of the employees exposed to high voltage have been trained.”
- “Supervisors are unfamiliar with rules and have not received training in this subject.”

Inappropriate behaviors:

- “Supervisors are generally allowing unsafe work practices associated with high voltage lines.”

Sample safety program design root cause finding statements:

These findings describe one or more inadequate safety management system policies, programs, and processes in any of the seven element areas: commitment, accountability, involvement, identification/control, incident/accident analysis, education/training, and evaluation. These "deep root causes" result in inadequate implementation of the safety management system.

Conditions: “Safety training policy statement does not exist.” “Safety training plan does not include policies and practices for employees working around high voltage line systems.” “The safety training plan does not include supervisor or manager level training on this subject.”

Section IV. Recommendations

If root causes are not addressed properly in Section III of the report, it is doubtful recommendations in this section will include improving system inadequacies.

Effective recommendations will describe ways to eliminate or reduce both surface and root causes. They will also detail estimated investments involved with implementing corrective actions and system improvements.

Let's take a closer look at effective recommendation writing.

Sample recommendations that correct primary surface causes:

These recommendations describe how to correct those unique hazardous condition(s) and unsafe behaviors that directly resulted in injury. These recommendations will impact only the unique condition or behavior.

To correct a condition. Repair and/or replace the machine guard. Benefit: This hazardous condition is eliminated. Estimated investment: $200.00

To correct a behavior. Educate and train the injured employee on hazard reporting procedures. Benefit: The injured employee will understand and gain the skills necessary to prevent a similar accident. Estimated investment: $30.00

Sample recommendations that correct secondary surface causes:

These recommendations describe how to correct those common hazardous conditions and unsafe or inappropriate behaviors that eventually "set up" or produced the unique conditions and behaviors of the injury event. Correcting secondary surface causes is accomplished by improving the implementation of the safety management system. These recommendations will have a general positive impact throughout the work group or organization.

Implement an effective education and training process covering machine guarding principles for all maintenance and affected employees Benefit: Affected employees will understand and be skilled in identifying and correcting machine guard hazards. Estimated investment: $500.00

Implement improved employee orientation that includes education and training on hazard reporting procedures. Benefit: New employees will understand and gain skills in appropriate hazard reporting procedures. Estimated investment: $100

Conduct supervisor/manager training on new policies. Management will better understand and gain skills in their responsibilities in response to hazard reports. Estimated investment: $200

Sample recommendations that correct implementation and design root causes**:**

Solving implementation weaknesses is accomplished by improving system design. These recommendations address improvements to written safety management system and specific program policies and plans that correct inadequate implementation of processes and procedures.

Recommendations may include improvements in more than one of the seven safety management system element areas discussed earlier. In most instances, safety committees and/or safety coordinators will be involved in this process. Draft policies, plans, procedures are developed and forwarded to upper management for approval.

Review and improve the safety training plan to ensure it includes machine guarding, lockout/tagout, and hazard reporting procedures. Benefit: Ensures the safety training plan addresses affected employee responsibilities regarding machine guarding, and other related safety programs. Estimated investment: $1500.00

Develop company safety policy and safe work plan addressing work near high voltage lines. Benefit: Ensures safe work policies and procedures regarding work around high voltage lines are detailed and properly implemented. Estimated investment: $1,000

Include supervisor/manager education and training in accountability principles and application. Benefit: Ensures management is effectively educated and trained in their accountabilities to the employer and employees, and how to administer corrective actions. Estimated investment: $500

Include supervisor/manager education and training in recognition principles and application. Benefit: Ensures management is effectively educated and trained in methods to motivate hazard reporting and discretionary behaviors such as suggesting and involvement. Estimated investment: $500

Section V. Summary

This section contains a brief review of the causes of the accident and recommendations for corrective actions. In your review, it's important to include language that contrasts the costs of the accident with the benefits derived from investing in corrective actions. Including bottom-line information will ensure that your recommendation will be understood and appreciated by management.

Section VI. Review and Follow-Up Actions

This section describes the actions taken to repair equipment/machinery, conduct training, revise policies, etc. It also describes the persons responsible for carrying out corrective actions and system improvements.

Section VII. Attachment

This section describes and contains all of the photos, sketches, interview notes, etc. material to the investigation. Of course the more comprehensive the investigation, the more supporting documentation will be included here.

Last Words

There you have it...all there is to know about the accident analysis process, and how to report it. Well, not quire all there is to know...but you've worked hard on these seven modules and now have the basic understanding about effective accident investigation procedures. Only experience will transform knowledge into expertise. Good luck in that effort.