



OSHAcademyTM
Occupational Safety & Health Training

Effective Accident Investigation

This course is absolutely necessary for anyone who is required to investigate accidents. It gives you the information needed to effectively analyze an accident event by uncovering the cause of injury, and the primary and contributing surface causes for the accident. You will also develop the skills needed to analyze and evaluate your safety management system (SMS) for root causes. You'll learn why the question of fault and possible discipline is often irrelevant and inappropriate when conducting an accident investigation.

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OSHAcademy Course 702 Study Guide

Effective Accident Investigation

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 702.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Contents

Course Introduction	1
National Census of Fatal Occupational Injuries in 2015	1
The Challenge.....	1
What is the Purpose of This Course?	1
Module 1: The Basics	2
What is an Accident?	2
Accidents and Incidents	2
Accident Types	3
Are Accidents Always Unplanned?	4
Old Theory - Worker Error	5
New Theory - Systems Approach	5
Why Conduct the Accident Investigation (AI).....	6
Why OSHA Conducts an Accident Investigation	6
Investigate and Analyze to Fix the System... Not the Blame	7
Bottom Line.....	8
Effective Accident Investigation Program.....	8
Module 2: Step 1 - Secure the Accident Scene	11
When should I start the investigation?.....	11
Things Disappear After an Accident.....	12
Material Evidence	12
Memory.....	12
Reporting Accidents to OSHA	12
Basic Requirements	13

Module 3: Step 2 - Document the Accident Scene 16

- Sample Kit 16
- Document the Scene 17
- Make Personal Observations 17
- Get Initial Statements 18
- Take Photos of the Accident Scene 19
- Take Videos of the Scene 19
 - More Tips 20
- Sketch the Accident Scene 21
 - Some Sketching Pointers 23
- Interview Records 24
- Final Words 25

Module 4: Step 3 – Conduct Interviews..... 26

- Digging Up the Facts 26
- Seven "Rights" of the Interview Process..... 26
- Cooperation is the Key..... 27
- Preparing for the Interview 27
- Effective Interviewing Techniques..... 29
- More Effective Interviewing Techniques 30
- Last Words 31

Module 5: Step 4 - Conduct Event Analysis 32

- Introduction 32
- Sorting it All Out..... 32
- Assessment vs. Analysis 32

Analysis Defined.....	32
Accident Analysis	32
Event Assessment and Analysis	33
Why Accidents Happen.....	33
Single Event Theory.....	33
The Domino Theory	34
Multiple Cause Theory	34
The Final Event in an Unplanned Process.....	35
Four Categories of Events	35
Developing the Sequence of Events	36
The Actor and the Action	37
Sample Sequence of Events	38
Make Sure You are Constructing Only One Event	39
Paint a Word Picture.....	39
Sample sequence of events	39
Make Sure You are Constructing Only One Event	40
Module 6: Step 5 – Conduct Cause Analysis.....	42
Introduction	42
Three Phases of Cause Analysis	42
Injury Analysis	42
Surface Cause Analysis.....	42
Root Cause Analysis	42
Injury Analysis	43
What is the Direct Cause of Injury?	43

Harmful Forms of Energy	44
Surface Cause Analysis.....	45
Hazardous Conditions	45
Unsafe or Inappropriate Behaviors.....	46
Analysis Tools	47
System Analysis.....	48
Hierarchy of Causes	50
Module 7: Step 6- Develop Solutions	51
Effective Recommendations.....	51
Why Decision-makers Don't Respond Quickly	51
Do it Right!	51
The Hierarchy of Control Strategies.....	52
Higher Priority Strategies that Control Hazards	52
Lower Priority Strategies.....	53
Recommend System Improvements.....	54
"GIGO" or "QIQO"?	55
Six Key Questions	55
Estimating Direct and Indirect Costs.....	59
Ratio Between Indirect and Direct Costs	59
Return on the Investment (ROI)	60
Provide Options	62
Module 8: Step 7 – Write the Report	64
Introduction	64
Perception is Reality	64

The Accident Report Form	64
Section I. Background	65
Section II. Description of the Accident	65
Section III. Findings	65
Section IV. Recommendations	66
Section V. Summary	67
Open Documents	67
Additional Resources	69

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Course Introduction

Workplace accidents occur each and every day all across the country. Each year the Bureau of Labor Statistics 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.

National Census of Fatal Occupational Injuries in 2015

The overall incidence rate of nonfatal occupational injury and illness cases requiring days away from work to recuperate was 104.0 cases per 10,000 full-time workers in 2015, down from 107.1 cases in 2014. In 2015, there were 1,153,490 days-away-from-work cases in private industry, state government, and local government - essentially unchanged from the number of cases reported in 2014. The median days away from work to recuperate - a key measure of severity of injuries and illnesses - was 8 days in 2015, 1 day fewer than reported in 2014.

The Challenge

The challenge to any accident investigator is to report the findings in a well-thought-out manner to ensure management will ultimately adopt recommendations for improving its safety management system, thus solving problems long-term. It's a common struggle trying to overcome long-held perceptions about safety and how accidents occur.

What is the Purpose of This Course?

This course introduces you to basic accident investigation procedures that have proven effective. We will also take a look at various accident analysis techniques. Throughout the course, you'll be taking what you've learned to analyze a hypothetical accident!

Module 1: The Basics

The best metaphor for how accidents are investigated is a simple maze. If a group of people are asked to solve the maze as quickly as possible and ask the "winners" how they did it, invariably the answer will be that they worked it from the Finish to the Start. Most mazes are designed to be difficult working from the Start to the Finish, but are simple working from the Finish to the Start. Like a maze, accident investigations look backwards. What was uncertain for the people working forward through the maze becomes clear for the investigator looking backwards.

(Source: DOE)

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. It is the final result or effect of a number of surface and root causes.

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

Accidents and Incidents

Workplace accidents are part of a broad group of events or occurrences leading to a physical or psychological injury. Workplace incidents adversely affect the completion of a task but do not result in an employee injury. For simplicity, the procedures discussed in this course apply most appropriately to accidents, but they are also applicable to all incidents in general. Think of it this way:

Accidents cause injuries, incidents do not.

Quiz Instructions

After each section, there is a quiz question. Make sure to read the material in each section to discover the correct answer to these questions. Circle the correct answer. When you are finished go online to take the final exam. This exam is open book, so you can use this study guide.

1. An accident is the _____ in an _____ process.

- a. end results, expected outcome
- b. final event, unplanned
- c. unexpected outcome, unexpected happening
- d. a planned, expected happening

Accident Types

An accident isn't just an event that you can lump into one big category. In reality, there are many different types of accidents. Let's take a look at a partial list.

- **Struck-by:** A person is forcefully struck by an object. The force of contact is provided by the object.
- **Struck-against:** A person forcefully strikes an object. The person provides the force or energy.
- **Contact-by:** Contact by a substance or material that, by its very nature, is harmful and causes injury.
- **Contact-with:** A person comes in contact with a harmful substance or material. The person initiates the contact.
- **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.
- **Caught-in:** A person or part of him/her is trapped, or otherwise caught in an opening or enclosure.
- **Caught-between:** A person is crushed, pinched or otherwise caught between a moving and a stationary object, or between two moving objects.
- **Fall-to-surface:** A person slips or trips and falls to the surface he/she is standing or walking on.
- **Fall-to-below:** A person slips or trips and falls to a level below the one he/she was walking or standing on.
- **Overexertion:** A person over-extends or strains himself/herself while performing work.

- **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.
- **Overexposure:** Over a period of time, a person is exposed to harmful energy (noise, heat), lack of energy (cold), or substances (toxic chemicals/atmospheres).

2. This type of accident is likely to occur if a worker carries a box that is too heavy.

- a. Overexertion
- b. Bodily reaction
- c. Fall-to-below
- d. Fall-to-surface

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 which decide to take the risk, it's likely its attitude about accidents is, "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 hazards be corrected before they cause an accident.

3. Companies that have healthful attitudes consider accidents ____.

- a. to be just the cost of doing business
- b. as unavoidable
- c. to be inexcusable
- d. as beyond their control

Old Theory - Worker Error

Old thinking about the causes of accidents assumes that the worker lacks common sense or 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 considers accidents as solely resulting from worker error: A lack of "common sense." Actually, common sense, is an invalid concept. In reality, no one has common sense. Rather, we each develop a unique and hopefully "good sense" based on individual experience and education.

- When we assume common sense is a valid concept, it allows us to more easily place blame for accidents squarely on the shoulders of the employee.
- The Common sense excuse for accidents infers the employee is "the problem." To prevent accidents, the employee must work more safely.
- Thinking that accidents are due to a lack of common sense results in short-term fixes that are inefficient, ineffective, and in the long run more expensive to implement and maintain.

4. Outdated causation theory assumes accident are caused solely by ____.

- a. a lack of training
- b. a lack of common sense
- c. worker error
- d. a lack of careful planning

New Theory - Systems Approach

The systems approach takes into account the dynamics of multiple variables that interact within the overall safety management system.

- It assumes accidents are due to defects in the safety management system.
- People are only one part of a complex system composed of many complicated processes.
- 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 blame, is the heart of the investigation.
- To prevent accidents, the system must work more safely.
- This line of thinking results in long-term fixes that are actually less expensive to implement and maintain.

5. In the systems approach, accidents are assumed to be caused by ____.

- a. a lack of common sense
- b. safety management system defects
- c. defects human behavior
- d. hazardous conditions inherent in the workplace

Why Conduct the Accident Investigation (AI)

Why should you conduct an accident "investigation"? The answer to this question is key to the success of the entire AI process. Here's an important principle to understand:

To determine the purpose of a process, look at the final "output" of that process.

What does that mean? It means that to understand what the purpose of the accident investigation process is, you've got to look at the findings in the final report. So, let's contrast the findings in an OSHA AI report with what should be the findings in your AI report.

Why OSHA Conducts an Accident Investigation

As you are surely aware, OSHA conducts many accident investigations each year. You can review accident summaries at the [OSHA Fatality and Catastrophe Investigation Summaries](#) webpage.

Remember, the findings in an investigation report is the **output** of the investigation process, so let's take a look at the sample given in OSHA Instruction CPL 2.113, Appendix C:

Findings of the Investigation Report

MEMORANDUM FOR: Regional Administrator
FROM: Area Director
SUBJECT: Notification of Results of Fatality Investigation

The following information supplements the OSHA-170, regarding investigation of the accident at _____ Company, Inc.

Proposed Action: **(The output!) Issue citations for serious and other violations of machine guarding, open floor holes, hazard communication and recordkeeping with a penalty total of \$5475.** A 5(a)(1) letter outlining the hazards to be corrected which were not clearly addressed by 29 CFR 1928 Safety and Health Standards for agriculture and for which other OSHA Standards are not applicable will also be mailed to the company.

As you can see, the output was a recommendation to cite and fine the employer. The message in the above OSHA report is that, as required by the OSHA Act of 1970, OSHA conducts accident investigations to primarily determine if the employer violated OSHA standards. OSHA establishes employer liability, places blame, and administers "penalties" (punishment). This is OSHA's mandate: Establish liability and issue penalties as appropriate.

This is not your organization's mandate.

6. Where do you look to better understand the purpose of an accident investigation?

- a. The purpose statement
- b. The investigator's statement
- c. The OSHA requirements
- d. The investigation's final report

Investigate and Analyze to Fix the System... Not the Blame

Unfortunately, some employers believe that the investigation process ends once the blame has been established. Here's the problem with that belief:

Once the purpose of the analysis process has been achieved, analysis stops

When employers investigate to place blame, analysis stops and the employer does not continue an effective analysis process to fix root causes in the safety management system.

According to OSHA's Safety & Health Program Management Guidelines, 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 end product should identify the root causes: the safety management system weaknesses. In the most effective employer accident investigations, the question of liability (fault, blame) should be addressed only if an honest post-investigation evaluation concludes that no safety management system weaknesses contributed to the accident.

7. The end product of an accident investigation should identify the ____.

- a. surface causes
- b. root causes
- c. primary causes
- d. actual causes

Effective Accident Investigation Program

An effective accident investigation program will be guided by standard written procedures. It's important to make sure procedures are clearly stated and easy to follow in a step-by-step fashion. An effective program will include the following:

- A team of at least two investigators conduct the investigation. Two heads usually work better than one, especially when gathering and analyzing material facts about the accident.

- Accident investigators are properly trained on accident investigation techniques and procedures.
- The accident investigation is perceived as separate from potential disciplinary procedures resulting from the accident. The purpose of the accident investigation is to determine the facts, not the blame. Accident investigators must be able to objectively state that they are conducting the investigation only to determine what happened.
- The accident investigation report is written and makes sure 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.
- The accident investigation report makes recommendations to (1) correct hazardous conditions and unsafe work practices, and (2) improve underlying SMS weaknesses.
- Surface causes for the accidents are corrected on the spot or as soon as possible. Long-term improvements in the safety and health system (SMS) are completed in a timely manner to make sure related surface causes do not reappear.
- The accident investigation report will not place blame or include a recommendation for discipline. Discipline is a separate issue properly addressed by management/human resources only if contributing root causes have not been uncovered.
- Follow-up procedures to make sure short-term corrective actions and long-term SMS improvements are completed.
- An annual review of accident reports. Properly trained employees evaluate accident reports for consistency and quality. They verify that responsible persons correct surface/root causes are identified and that corrective actions/improvements completed.
- Safety personnel annually review and evaluate the investigation program.
- Information about the types of accidents, locations, trends, etc., is analyzed to improve investigations and prevent future accidents.

8. What is a characteristic of an effective accident investigation program?

- a. Surface causes are corrected on the spot
- b. They usually result in some form of discipline
- c. Only third-party investigators are used
- d. The focus is on determining liability

Module 2: Step 1 - Secure the Accident Scene

The first step in an effective accident investigation procedure is to secure the accident scene as soon as possible so that we can accurately gather facts. At this point, you are not yet interested in what "caused" the accident. Instead, you should focus on making the accident scene secure so that you can gather as much pertinent information as possible.

To secure the accident scene, simply use yellow caution tape, place warning cones, or post a guard to keep people away.

When should I start the investigation?

That's a good question, and the basic answer is that you should begin when it is safe to do so. As the accident investigator, you don't want to get in the way of emergency responders. It's also not safe to start if hazards have not been properly mitigated.

1. What is the first step in the accident investigation process?

- a. Report the accident to OSHA
- b. Secure and document the scene
- c. Develop the sequence of events
- d. Determine who is at fault

Reasons for Securing the Accident Scene

It's always important to know why we are doing something, isn't it? In this situation, we need to prevent material evidence from being removed or relocated in some way. This is especially true if the accident is a reportable (serious or fatal) injury that might trigger an OSHA accident investigation.

Remember, at the request of OSHA, the employer must mark for identification, materials, tools or equipment necessary to the proper investigation of an accident. It is important that material evidence does not somehow get lost or "walk off" the scene.

2. At the request of OSHA, the employer must ensure materials, tools, or equipment necessary to the proper investigation of an accident are ____.

- a. removed for labeling
- b. provided as needed
- c. marked for identification
- d. forwarded via registered mail

Things Disappear After an Accident

Material Evidence

Material evidence is anything that might be important in helping us find out what happened. Somehow, tools, equipment, and other items just seem to move. The employer is anxious to "clean up" the accident scene so that people can get back to work. It's important to develop a procedure to protect material evidence so that it does not get moved or disappear. If evidence disappears, I'm sure you can see why it might be difficult to uncover the surface causes for the accident. If you can't uncover the surface causes, it will be almost impossible to discover and correct the root causes. We'll talk more about surface and root causes later in the course.

Memory

Accidents are traumatic events that result in both physical and psychological trauma. Of course, there may be physical trauma to the victim and others. Varying degrees of psychological trauma may also result depending on how "close" an individual is to the accident or victim. Everyone is affected somehow. As the length of time after an accident increases, thoughts and emotions distort what people believe they saw and heard. Conversations with others further distort reality. After a while, the memory of everyone associated in any way with the accident will be altered in some way. With that in mind, it's important to get written statements and conduct interviews as soon as possible.

3. What happens to "the story" as the length of time after an accident increases?

- a. The accuracy of what employees saw increases as they discuss the accident
- b. Thoughts distort what witnesses believe they saw
- c. The guilty party is less likely to be identified
- d. Dwelling on the accident solidifies an employee's story

Reporting Accidents to OSHA

If your company is in the private sector, and a serious accident or fatality occurs, you may be required to report it to your [State](#) or Federal OSHA office.

Let's take a look at the OSHA Standard 29 CFR 1904.39, Reporting fatalities, hospitalizations, amputations, and losses of an eye as a result of work-related incidents to OSHA, for the specific requirements.

Basic Requirements

- Within eight (8) hours after the death of any employee as a result of a work-related accident, you must report the fatality to the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor.
- Within twenty-four (24) hours after the in-patient hospitalization of one or more employees or an employee's amputation or an employee's loss of an eye, as a result of a work-related accident, you must report the in-patient hospitalization, amputation, or loss of an eye to OSHA.
- You must report the event using one of the following methods:
 - By telephone or in person to the OSHA Area Office that is nearest to the site of the accident.
 - By telephone to the OSHA toll-free central telephone number, **1-800-321-OSHA (1-800-321-6742)**.
 - By electronic submission using the reporting application located on [OSHA's public website](#).
- You must give OSHA the following information for each fatality, in-patient hospitalization, amputation, or loss of an eye:
 - the establishment name;
 - the location of the work-related accident;
 - the time of the work-related accident;
 - the type of reportable event (i.e., fatality, in-patient hospitalization, amputation, or loss of an eye);
 - the number of employees who suffered a fatality, in-patient hospitalization, amputation, or loss of an eye;
 - the names of the employees who suffered a fatality, in-patient hospitalization, amputation, or loss of an eye;
 - your contact person and his or her phone number; and
 - a brief description of the work-related accident.

4. How soon after the work-related death of an employee should you report it to OSHA?

- a. 8 hours
- b. 12 hours
- c. 16 hours
- d. 24 hours

Do I have to report a motor vehicle accident?

No, you do not have to report the accident if it occurred on a public street or highway. **Yes**, if it occurred in a construction work zone.

Do I have to report an event that occurs on a commercial or public transportation system?

No, if it occurred on a commercial airplane, train, subway or bus accident. However, these injuries must be recorded on your OSHA injury and illness records, if you are required to keep such records.

Do I have to report a hospitalization or fatality due to a work-related heart attack at work?

Yes. Employers do have to report a heart attack if it resulted from a work-related incident. Your local OSHA Area Office will decide whether to investigate the incident, depending on the circumstances of the heart attack.

What if the fatality, in-patient hospitalization, amputation, or loss of an eye does not occur during or right after the work-related incident?

No, You must only report a fatality to OSHA if the fatality occurs within thirty (30) days of the work-related incident. For an in-patient hospitalization, amputation, or loss of an eye, you must only report the event to OSHA if it occurs within twenty-four (24) hours of the work-related incident. However, the fatality, in-patient hospitalization, amputation, or loss of an eye must be recorded on your OSHA injury and illness records, if you are required to keep such records.

What if I don't learn about a reportable fatality, in-patient hospitalization, amputation, or loss of an eye right away?

If you do not learn about a reportable fatality, in-patient hospitalization, amputation, or loss of an eye at the time it takes place, you must make the report to OSHA within the following time period after the fatality, in-patient hospitalization, amputation, or loss of an eye is reported to you or to any of your agent(s): Eight (8) hours for a fatality, and twenty-four (24) hours for an in-patient hospitalization, an amputation, or a loss of an eye.

How does OSHA define "in-patient hospitalization?"

OSHA defines inpatient hospitalization as a formal admission to the in-patient service of a hospital or clinic for care or treatment.

Do I have to report an in-patient hospitalization that involves only observation or diagnostic testing?

No, you do not have to report an in-patient hospitalization that involves only observation or diagnostic testing. You must only report to OSHA each inpatient hospitalization that involves care or treatment.

How does OSHA define "amputation?"

An amputation is the traumatic loss of a limb or other external body part. Amputations include a part, such as a limb or appendage, that has been severed, cut off, amputated (either completely or partially); fingertip amputations with or without bone loss; medical amputations resulting from irreparable damage; amputations of body parts that have since been reattached. Amputations do not include avulsions, enucleations, degloving, scalping, severed ears, or broken or chipped teeth.

5. Which of the following accidents must be reported to OSHA?

- a. A heart attack that occurs off work
- b. Motor vehicle accidents on public street or highway
- c. Accidents that occur on commercial or public transportation
- d. Fatality that occurs within 30 days of a work-related incident

Module 3: Step 2 - Document the Accident Scene

Be Prepared

Once the accident scene has been roped off, it's important to immediately begin gathering evidence from as many sources as possible during an investigation. One of the biggest challenges you'll face as an investigator is to determine what information is relevant. You want to gather data that will help you determine what happened, how it happened, and why it happened. Identifying items which answer these questions is the purpose of documenting the accident scene.

You won't be able to document the scene effectively unless you come prepared, so make sure you have put together an accident investigation kit for use during the investigation.

Sample Kit

Essential Items:

1. Camera, film, and batteries
2. Tape measure—preferably 100 foot
3. Clipboard & writing paper
4. Graph paper
5. Straight-edge ruler. Can be used
6. Pens & pencils
7. Accident investigation forms
8. Flashlight with fresh batteries

Additional Helpful Items:

1. Accident investigators checklist
2. Sturdy gloves
3. High visibility plastic tape to mark off area
4. First aid kit
5. Audio or video recorder with extra memory or tapes

6. Identification tags
7. Tape, bags, and specimen containers to secure items
8. Compass for sketching the scene & identifying north
9. Paint stick or chalk (yellow/black) to mark the scene
10. Protractor to sketch the scene
11. Tarp (to keep the scene and/or investigators dry)
12. Investigators template (available online in varying styles)
13. Personal protective equipment appropriate to your business

As you'll learn, there are many ways to document the scene, so 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 don't think the information may not be relevant. It's easy to discard clues or leads later if they prove to not be useful to the investigation. It's not at all easy to dig up material evidence late into the investigation. All items found at the scene should be considered important and potentially relevant material evidence. Consequently, a team approach is probably the most efficient strategy to use when investigating serious accidents.

- 1. When documenting the scene, one of the biggest challenges facing the investigator is to determine ____.**
- a. who is to blame
 - b. what is relevant
 - c. who is in charge
 - d. when it happened

Document the Scene

Let's talk about the various methods you can use to document the accident scene.

Make Personal Observations

With clipboard in hand, take notes on personal observations. Try to involve all of your senses (sight, hearing, smell, etc.).

- What is present and what is not? What equipment, tools, materials, machines, or structures appear to be broken, damaged, struck or otherwise involved in the event? Look for gouges, scratches, dents, or 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? Is something missing that should be present, such as fall protection?
- 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 present and 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.

2. What should you document while making observations of the accident scene?

- a. What is present and what is not
- b. Personal assumptions
- c. Who you believe is to blame
- d. Feelings expressed

Get Initial Statements

If you are fortunate, there will be one or more eyewitnesses 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; and
- materials, equipment, and articles that may have been moved or disturbed during the rescue.

3. What should eye witnesses to an accident be asked to provide?

- a. What form of reprimand is needed
- b. Name and position of the supervisor
- c. Initial statement of what was seen and heard
- d. Who is to blame for the accident

Take Photos of the Accident Scene

When taking photos, make sure you start with distance shots, and gradually move in closer as you take the photos. Below are some important points to remember about taking photos.

- 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, or 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 objects are being photographed.
- Identify the person taking the photos.
- You may want to indicate the locations at which photos were taken on sketches.

4. Which of the following is NOT a best practice when documenting the accident scene with photos?

- a. Identify who took the photo
- b. Take only close-up photos
- c. Take photos with panoramic view
- d. Indicate direction of photos

Take Videos of the Scene

If you have the equipment or a smartphone, begin video recording the scene as soon as you can safely do so without impeding the work of emergency responders. The video will pick up details

and conversations that can add valuable information to your investigation. Be sure to check with your supervisor to see what your company policy is regarding video recording.

Some important points to remember when video recording the scene include:

- Get the lay of the land by standing back a distance and zooming into the scene
- Capture the entire scene 360 degrees to establish location by panning the camera slowly in a circle
- Narrate what is being filmed: describe objects, size, direction, location, etc.
- If a vehicle was involved, record the direction of travel both coming and going
- Discuss with your company management about capturing the witness descriptions on camera, staff may need to sign a waiver
- Review the video when possible to note any information you may have missed

More Tips

- Be careful with the zoom function; upon later review, it can be difficult to tell what is being captured if you're too close
- Shoot from a few different angles to capture different aspects of the scene
- If you're going to be recording for long stretches, consider using a tripod to reduce shaking and fatigue
- Transfer the digital video to your work computer for storage so it remains on file for further review
- Have plenty of storage devices like memory cards, discs, or tapes on hand along with an extra battery
- When recording, make sure the auto focus function has been turned on to increase the clarity of video

5. When should the accident investigation team begin making a video the accident scene?

- a. When OSHA is finished investigating
- b. As soon as they can safely do so
- c. Once emergency responders arrive
- d. Only after all response actions are complete

Sketch the Accident Scene

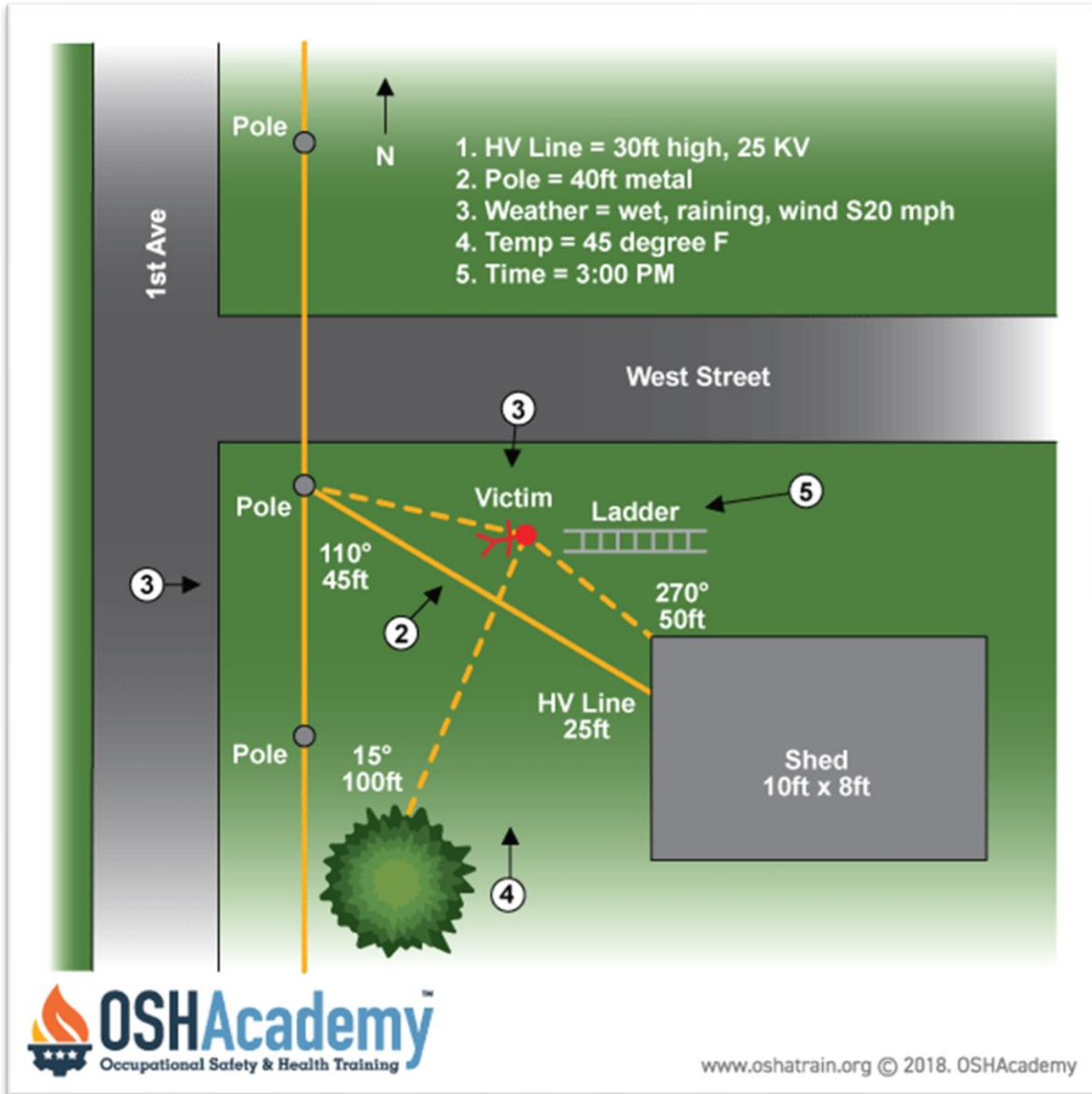
Sketches are very important because they compliment the information in photos, and are good at indicating distances between the various elements of the accident. This is important to do because it establishes "position evidence." It is important to be as precise as possible when making sketches. Below you will find the basic components of a sketch.

- Documentation. Date, time, location, identity of objects, victims, etc.
- Spatial relationships. Measurements.
- Location of photographs.

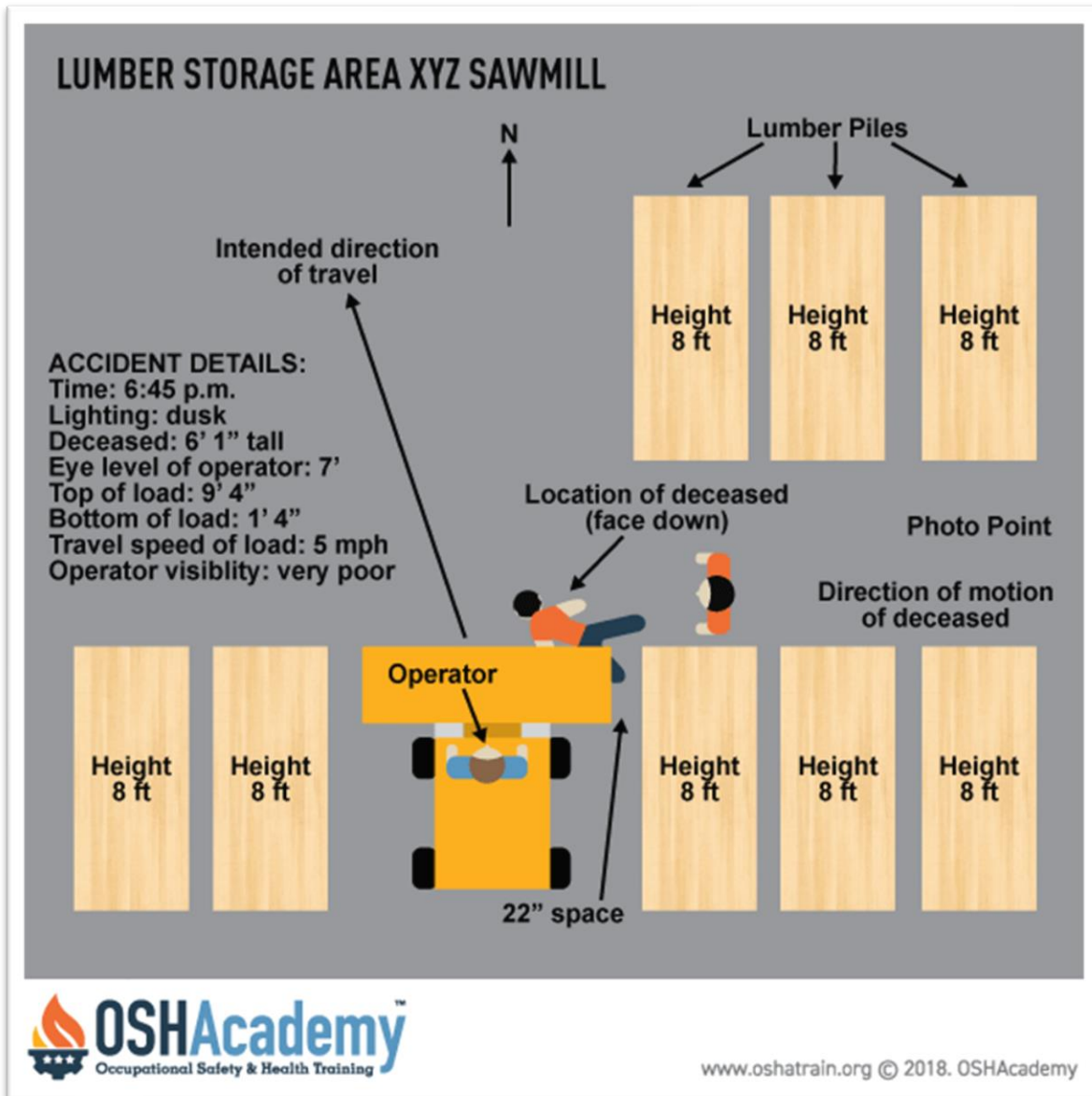
Sketches are also valuable because they reconstruct the accident in model form and effectively show movement through time. Sketches also help establish testimony if it becomes necessary to defend against a damage or injury claim. The sketch may also help establish a claim against a supplier or manufacturer.

You don't have to be a professional illustrator to make a decent sketch, but you must be accurate in your measurements. Take a look at the sketch below as a sample of a useful sketch.

The first 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.



The second sketch illustrates one of the major advantages of sketching. It shows motion through time. In this sketch, you can see the direction the deceased and the bulldozer were traveling shortly before the accident and at the time of the accident.



Some Sketching Pointers

- Make sketches large; preferably 8" x 10".
- Make 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: N,E,S,W.

- Always tie measurements to a permanent point, eg. telephone pole, building.
- Mark where people were standing.
- Use an arrow to show direction of motion.
- Use sketches when interviewing people.
- Show where photos were taken.

6. Which sketching method makes it possible to pinpoint the exact location of an object?

- a. Rectangular method
- b. Linear method
- c. Triangulation method
- d. Rule of squares method

Interview Records

That's right...you don't just review records, you "interview" them by asking them questions. If you ask...they will answer. Below are some of the records you may want to interview.

- Maintenance records
- Training records
- Standard operating procedures
- Safety policies, plans, and rules
- Work schedules
- Personnel records
- Disciplinary records
- Medical records (if permission granted, or otherwise allowed).
- EMT reports
- OSHA 300 Log
- OSHA Form 301, Injury and Illness Incident Report

- Safety committee minutes
- Coroner's report
- Police report

Final Words

Documenting the scene is important for so many reasons. Remember, the team approach works best because accuracy in reconstructing the accident is the final criteria. I think you'll agree that given all the time and money constraints, and complexity of the investigation process, two heads are better than one. Now let's take the quiz.

7. How should you review records during an accident investigation?

- a. Ask records questions like an interview
- b. Only review the victim's records
- c. Don't waste time on non-relevant records
- d. Don't make copies of records

Module 4: Step 3 – Conduct Interviews

Digging Up the Facts

After you have initially documented the accident scene, the next step is to start digging for additional details by conducting interviews.

This activity is perhaps the most difficult part of an investigation. This module will help you understand how to set up an interview and develop interview questions. The module will also discuss how to organize the interview and the participants to most effectively get accurate information.

1. What is the next step after you have initially documented the accident scene?

- a. Determine who is at fault
- b. Conduct witness interviews
- c. Report findings to the safety manager
- d. Determine what happened prior to the accident

Seven "Rights" of the Interview Process

The purpose of the accident investigation interview is to obtain an accurate and comprehensive picture of what happened. To do that, the interviewer must demonstrate personal leadership and skill in conducting the interview. Since leadership is all about doing the right thing, I came up with seven "rights" to help us remember what we should do to make sure the interview process is effective. So, here are those seven rights.

Be sure you ask the:

1. **Right people** the
2. **Right questions** at the
3. **Right time** in the
4. **Right place** in the
5. **Right way** for the
6. **Right reason** to uncover the
7. **Right facts**

2. During an accident investigation, what is the purpose of the interview process?

- a. Accurately determine the what happened
- b. Satisfy OSHA investigation requirements
- c. To quickly determine who is to blame
- d. To make sure you cannot be held accountable

Cooperation is the Key

Cooperation not intimidation **is the key** to a successful accident investigation interview. It's very counterproductive to give the impression in any way that can be interpreted by the interviewee as trying to establish blame. The purpose of the accident interview is to uncover additional information about the hazardous conditions, unsafe work practices, and related system weaknesses that contributed to the accident. Consequently, it's very important that effective techniques to establish trust and a cooperative atmosphere be used by the interviewer during the process.

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.

3. What is the key strategy for conducting accident investigation interviews?

- a. Appeal to feelings
- b. Intimidation
- c. Cooperation
- d. Disclose who is at fault

Preparing for the Interview

Your first task is to determine who to interview. You will need to design your questions around the interviewee. Consequently, each interview will be a very unique experience. Interviews should occur as soon as possible, but usually they do not happen until things have settled down just a bit. Below are some people you may want to consider interviewing.

- **The victim:** To determine the immediate events leading up to and including the accident.
- **Co-workers:** To establish what actual vs. appropriate procedures are being used.

- **Direct supervisor:** To get background information on the victim. He or she can provide procedural information about the task that was being performed, the training provided, workload, scheduling, and resources being provided.
- **Manager:** To get information on related operational and safety management programs/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 other employees' work history, discipline, appraisals.
- **Maintenance personnel:** To determine background on corrective and preventive maintenance.
- **Emergency responders:** To learn what they saw and did when responding to the accident.
- **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.

4. Who would you ask, during an accident investigation interview, to determine the actual vs. the appropriate manner in which a task is being performed?

- a. Training department
- b. Co-workers
- c. Manager
- d. Personnel department

Effective Interviewing Techniques

An important aspect of your job, as the interviewer, is to construct a composite story or "word picture" of what happened using the various accounts of the accident and other evidence. To do that, you will need to understand effective interview techniques and be able to skillfully apply those techniques.

It's important to remember that you are conducting an accident investigation, not a criminal investigation. These two interview processes may be similar, but each has a unique purpose. Each process requires different techniques to achieve the intended purpose. The last thing you want to do in an accident investigation is to come down hard (be accusatory) on an interviewee. So, let's look at some effective techniques that will assure you get to the facts — not find fault.

- Keep the purpose of the investigation in mind: To determine the cause of the accident so that similar accidents will not recur. The interview process is not conducted to determine liability, but to determine the facts so that any and all safety management system design and implementation weaknesses can be improved. Make sure the interviewee understands this point: "We don't want you or anyone else to get hurt like this again."
- Do not interview more than one person at a time. When others hear an interviewee's account of what happened, their own stories will probably change in some way.
- First, ask for background information like name, job, and phone number. Then, simply have the witness tell you what happened. Let them talk, and you just listen. Don't ask them "if" they can explain what happened, because they may respond with a simple "no," and that's that.
- 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.
- Put the person at ease. Explain the purpose and your role. Sincerely express concern regarding the accident and desire to prevent a similar occurrence.

- Tell the interviewee that the information they give is important. It's important to say it's "important".
- Be friendly, understanding, and open minded. Be calm and unhurried.

5. Which of the following is an ineffective interviewing technique during an accident investigation?

- a. Never going to the scene of the accident
- b. Ask for background information
- c. Have the witness tell you what happened
- d. Explain the purpose of the interview

More Effective Interviewing Techniques

- Don't ask leading questions; don't interrupt; and don't make expressions (facial, verbal of approval or disapproval).
- Do ask open-ended questions to clarify particular areas or get specifics. Try to avoid closed-ended questions that require a simple yes and no answer. Try to avoid asking "why-you" questions as these type 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? or "Tell me about the forklift inspection procedure."
- 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. Let the individual read your notes so that they can possibly fill in missing information and correct inaccuracies. Give the interviewee a copy of the notes. Have the interviewee initial that they have read and found the notes accurate.
- Don't use a tape recorder unless you get permission. Tell the interviewee that the purpose of the recorder is to make sure the information is accurate. Offer to give the interviewee a copy of the tape.
- If the interviewee wants to have someone witness the interview, that's fine. In most union environments, this is an employee right.

- Ask for the interviewee's opinion about what caused the accident and what can be done to make sure it doesn't happen again. Do not accept answers that accuse or place blame. Note: There is never enough information to establish blame at this phase of the investigation. Only after the investigation is complete and closed out will the need for discipline be discussed, and that's usually the responsibility of the supervisor and the Human Resource Department, not the accident investigator.
- Conclude the interview with a statement of appreciation for their contribution. Ask them to contact you if they think of anything else. If possible, relay the outcome of the investigation to each person who was interviewed. Again, do not discuss the possibility of disciplinary action.

Last Words

Understanding and applying the information above during the interview process will help establish a high level of trust and a cooperative relationship so that you can get to the facts. Remember, intimidation and placing blame has no place in the accident investigation process and besides, it just doesn't work.

6. What is the best type of question to ask during the accident investigation interview?

- a. Open-ended question
- b. Yes-no question
- c. Leading question
- d. Closed-end question

Module 5: Step 4 - Conduct Event Analysis

Introduction

This module introduces you to the concepts of assessment and analysis as they relate to the accident investigation process. We'll review some theories of accident causation and discuss the process of developing and analyzing the sequence of events occurring prior to, during, and immediately after an accident.

Sorting it All Out

So far, you have collected a lot of factual data and it's strewn all over your desk. The task now is to turn that data into useful information. You've got to somehow take this data and make some sense of it.

Assessment vs. Analysis

It's important to know that you're not gathering all of this information just to conduct an assessment of what was and was not present immediately prior to the accident. You're actually conducting an analysis to determine specifically how surface causes (behaviors and conditions), and the underlying root causes (system weaknesses) contributed to the accident. To better understand this, let's take a closer look at what the process of "analysis" is.

- 1. To determine how surface and root causes contributed to the accident, conduct _____.**
- a. an assessment
 - b. an analysis
 - c. an evaluation
 - d. a review

Analysis Defined

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

Accident Analysis

When an accident occurs, we need to separate or "break down" the "whole" accident process into its component "parts" for study to determine how they relate to the whole accident.

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.

Event Assessment and Analysis

Once the individual events have been determined, the investigator must assess each event to identify the presence or absence of conditions and behaviors that led to the current event.

Next, the investigator will carefully analyze the conditions and behaviors in each event to determine if they somehow contributed to the accident.

Then, we move on to the next event and complete the same assessment and analysis process.

2. Which of the following processes identifies the presence or absence of conditions and behaviors each event?

- a. Assessment
- b. Analysis
- c. Evaluation
- d. Review

Why Accidents Happen

Over the past century, safety professionals have tried to more effectively explain how and why accidents occur. During the early years the initial 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 as the result of complicated interactions taking place among conditions, behaviors and systems. With this in mind, 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 employee. An accident investigator who has adopted this explanation for accidents will never look beyond perceived personal employee flaws to discover the underlying system weaknesses that may have contributed to the accident.

3. Which of the following accident theories makes it easy to blame the employee for the accident?

- a. The domino theory
- b. The multiple cause theory
- c. The single event theory
- d. The behavioral based theory

The Domino Theory

This explanation describes an accident as a series of related occurrences which lead to a final event which results 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 who has adopted this approach will assume that by eliminating any one of those actions or events, the chain will be broken and the future accident 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.

4. Which theory describes an accident as a series of related occurrences which lead to a final event which results in injury or illness?

- a. Single event theory
- b. Domino theory
- c. Multiple event theory
- d. Common sense theory

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 actions that somehow interact to cause the accident. Unlike the domino theory, the investigator realizes 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.

The Final Event in an Unplanned Process

When we understand that the accident, itself, is actually the final event in a complex series of events, we'll naturally want to know what the initiating events were. When the initiating events occur, they effect, in one way or another, the workplace conditions and actions of others, setting in motion a potentially very complicated process that eventually ends in an injury or illness. The trick is to take the information gathered and arrange it so that we can accurately determine what initial conditions and/or actions transformed the planned work process into an unintended accident process.

5. Which theory states that eliminating one accident event does not necessarily prevent future accidents?

- a. Single event theory
- b. Domino theory
- c. System theory
- d. Multiple cause theory

Four Categories of Events

In this step, take the information you have gathered to determine the events prior to, during, and after the near miss/injury accident. It is important to note that a serious injury accident can easily be the result of 20 or more events. Events can occur anytime, anywhere, any place, and to anyone. It is possible that pertinent events may have occurred many weeks or months before the accident.

There are four categories of events:

1. **Actual Events.** These are events that you are able to determine actually occurred i.e., an event that is witnessed by one or more persons (two or more is best) and they can verify it actually happened. You would want to interview all witnesses to the event.
 - Example - Bob and Bobbie saw Bill turn off the chipper power switch and then walk over and reach into the chipper in an attempt to remove some jammed wood.
2. **Assumed Events.** These are events that must have happened but have not yet been verified. Flag these somehow to remind you that more investigation is needed. Assumed events are harder to establish. In any step-by-step process, you can't get to step 3 without first doing the first two steps. If a worker is injured at step 3, you may assume he accomplished steps 1 and 2 unless, it is established that he bypassed the first two steps. If

completing steps 1 and 2 will prevent an injury at step 3, you may assume the worker did not do steps 1 or 2.

- Example - If Bill's hand was crushed while clearing a piece of wood that was stuck in a large chipper, we may assume he did not perform lockout/tagout, or we may assume that he performed lockout/tagout incorrectly. Only further investigation and analysis will uncover what actually happened.

3. **Non-Events.** If an event was supposed to happen, but did not, that is a non-event. Although non-events describe an event that did not occur, they should be captured because they may help discover conditions and behaviors relevant to the investigation.

- Example - Bill did not try to start the chipper to verify lockout/tagout was successfully performed. He failed to perform the verification step of the lockout/tagout procedure.

4. **Simultaneous Events.** In some accidents scenarios two or more events occur at precisely the same time resulting in a hazardous condition or set of unsafe behaviors that cause an injury.

- Example - Ralph wondered why the chipper was off and turned it back on at the same instant in time that Robert reached into the chipper to remove the jammed wood.

6. Which category of events have happened but have not yet been verified?

- a. Actual event
- b. Non-event
- c. Simultaneous event
- d. Assumed event

Developing the Sequence of Events

Our challenge at this point in the investigation process is to accurately determine the sequence of events leading up to the accident so that we can more effectively understand why the accident event, itself, happened. Once the sequence of events is developed, we can then study each event in the sequence to determine the related causal factors below.

- **Hazardous conditions:** Objects and physical states that directly caused or contributed to the accident.

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

(Hold on... we'll study more about these three elements in the next module.)

In the multiple-cause approach to accident investigation, many events may occur, each somehow contributing to the final event. 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 safe behavior represents an event in the production process that may contribute to or increase the probability of a future accident.

7. Once the sequence of events is developed, investigators must then do which of the following?

- a. Determine fault
- b. Determine causal factors
- c. Call OSHA
- d. Fire the employee who caused the accident

The Actor and the Action

Each event in the unplanned accident process is composed of two components: an actor and an action.

1. **Actor:** The actor is 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.
2. **Action:** An action is "the something" that is done by an actor. Actions may or may not be observable. An action may describe a behavior that is accomplished or not accomplished. Failure to act should be thought of as an act, just as much as an act that is accomplished.

It's important to understand that when describing an event in writing, first identify the actor and then tell what the actor did. 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 event statement below:

"Bob unhooked the lifeline from the harness."

In this example, "Bob" is the actor and "unhooked" describes the action. First, we describe the actor — Bob. Next, 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.

8. What is the term used to describe the person or object that directly influenced the flow or sequence of events leading to an accident?

- a. Actor
- b. Action
- c. Manager
- d. Employee

Sample Sequence of Events

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

3. Employee #1 returned to work at 12:30 PM after lunch to continue laying irrigation pipes.
4. At approximately 12:45 PM employee #1 began dumping accumulated sand from an irrigation mainline pipe.
5. Employee #1 oriented the pipe vertically and it contacted a high voltage power line directly over the work area.
6. Employee #2 heard a 'zap' and turned to see the mainline pipe falling and employee #1 falling into an irrigation ditch.
7. 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.
8. Employee #2 then ran back to find employee #1 had fallen back into the ditch.
9. Employee #2 jumped back into the ditch and held employee #1 out of the water until help arrived.
10. Two other ranch employees arrived and assisted employee #2 in getting employee #1 out of the ditch.

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

Make Sure You are Constructing Only One Event

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. We can use two strategies to increase detail:

1. Look around. Determine if anything else was said/done before or after the event you' re currently assessing.
2. Separate the 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. If the event contains the conjunction, "and," the event is likely to be a combination of two events. If you look at the sample sequence of the events from 5.9 and 5.10, I'm sure you can spot a few combined events.

9. If the event contains the conjunction, " _____," the event is likely to be a combination of two events.

- a. if
- b. or
- c. and
- d. when

Paint a Word Picture

It's important that the sequence of events clearly describe what occurred so that someone who is unfamiliar with an accident is able to "see it happen" as they read the narrative.

Sample sequence of events

Here is another example that shows how a sequence of events can be developed using cards. Describe each event and then arrange the events on your desk or a wall in the proper sequence.

Event - 11 Feb 2 - 9:30am Bob gets the six-foot step ladder from the storage in the warehouse.	Event - 10 Feb 2 - 9:35am Bob carries the ladder to the overhead light in the warehouse that needs replacement.	Event - 9 Feb 2 - 9:36am Bob notices oil on his workshoes and wipes it off with a rag.	Event - 8 Feb 2 - 9:37am Ralph tells Bob to hurry up because the filter on the air conditioning needs to be replaced.	Event - 7 Feb 2 - 9:37am Bob grabs the fluorescent light with his left hand and climbs up the step ladder.
Event - 6 Feb 2 - 9:37am Bob lays the fluorescent light across the top platform of the ladder.	Event - 5 Feb 2 - 9:37am Bob positions his feet on the fourth (second from the top) rung of the ladder.	Event - 4 Feb 2 - 9:38am As Bob reaches to remove the defective fluorescent light, the replacement bulb begins to roll off of the ladder platform.	Event - 3 Feb 2 - 9:38am Bob is startled and quickly reaches to catch the moving bulb before it falls to the floor.	Event - 2 Feb 2 - 9:38am The right side of the fourth rung of the ladder separates from the leg of the ladder.
Event - 1 Feb 2 - 9:38am Bob's right foot slips through the space between the fourth and fifth rung of the ladder.	Event 0 Feb 2 - 9:38am Bob's left leg buckles and he falls back, striking his back and head against the ladder.	Event + 1 Feb 2 - 9:38am Ralph and Betty see Bob falling and rush to help him before the ladder falls.	Event + 2 Feb 2 - 9:38am Ralph tells Betty to hold the ladder and carefully lifts Bob and helps him out of the ladder.	

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Make Sure You are Constructing Only One Event

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. We can use two strategies to increase detail:

1. Look around. Determine if anything else was said/done before or after the event you're currently assessing.
2. Separate the 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. If the event contains the conjunction, "and," the event is likely to be a combination of two events. If you look at the sample sequence of the events from 5.9 and 5.10, I'm sure you can spot a few combined events.

10. It's important that the sequence of events _____.

- a. are labeled using letters only
- b. are arranged and then described
- c. never number more than 15
- d. paints a word picture

Module 6: Step 5 – Conduct Cause Analysis

Introduction

You've completed the initial of the accident analysis by gathering information and using it to break the accident down into an accurate sequence of events. You have a good mental picture of what happened. Now it's time to continue the analysis process by completing each of the following three phases of analysis to determine what caused those events. This module will introduce us to the three phases of analysis below:

- **Injury Analysis** to determine the direct cause of injury
- **Event Analysis** to determine the surface causes of the accident
- **System Analysis** to determine the root causes of the accident

1. _____ determines the surface causes of the accident.

- a. Injury analysis
- b. Event analysis
- c. Cause analysis
- d. System analysis

Three Phases 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.

Surface Cause Analysis

Here you determine the hazardous conditions and unsafe behaviors described in the sequence of events that dynamically interact to produce the accident. The hazardous conditions and unsafe behaviors uncovered are the surface causes for the accident and give clues that point to possible system weaknesses.

Root Cause Analysis

At this level, you're analyzing the weaknesses in the safety management system that contributed to the accident. You can usually uncover weaknesses related 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 (in quality terms) because you're identifying a system component that may contribute to common conditions and behaviors that exist or occur throughout the company.

I think the greatest challenge to effective accident investigation is to transition from even analysis to systems analysis.

One last important point to make is that most accident processes are far more complex than you might originally think. Some experts believe at least 10 or more factors come together to cause a serious injury accident. Other experts state that an average of 27 factors directly and indirectly contribute to a serious accident.

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

2. During _____, you are analyzing the root causes contributing to the accident.

- a. system analysis
- b. injury analysis
- c. event analysis
- d. cause analysis

Injury Analysis

What is the Direct Cause of Injury?

In a comprehensive accident report, you'll be asked to determine the direct cause of the worker's injury. It's important to understand the nature of cause that resulted in the injury so that you can write a clearly describe what directly caused the injury in terms of a "cause and effect" relationship. Here's the cause-effect relationship: the harmful transfer of energy is always the cause of an injury which is the effect. Let's take a look at some examples that illustrate this important principle.

- If Bob falls off a ladder and hits the ground so hard that it fractures his lower leg, the direct cause of injury is the transfer of excessive kinetic energy (the cause) that breaks the leg bone (the effect).
- A harsh acid splashes on Brenda's face causing a serious burn. The direct cause of Brenda's injury is the harmful chemical reaction (the cause) as energy is transferred from the acid to her skin causing the burn (the effect).

As you can see, in each example above, we identify some form of harmful energy transfer that results in an injury. And, simply put, that's how you describe the direct cause of an injury. If you don't describe the type of energy transfer involved and resulting injury, you're not writing an adequate statement.

3. The direct cause of an injury will always identify _____.

- a. the unsafe behavior
- b. the hazardous condition
- c. the type of energy transfer involved
- d. the resulting accident scenario

As mentioned in the previous section, injuries are always caused by the harmful transfer of energy to the employee's body. The severity of the injury depends on the magnitude of the harmful energy. Below are the various forms of energy that can be harmful.

Harmful Forms of Energy

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 or persons, 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** - 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.

4. Which form of harmful energy involves stored energy?

- a. Kinetic energy
- b. Potential energy
- c. Acoustic energy
- d. Thermal energy

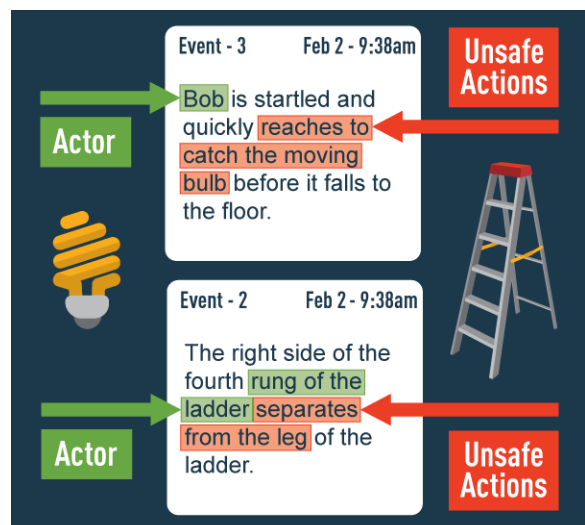
Surface Cause Analysis

The surface causes of accidents are those unique hazardous conditions and unsafe or inappropriate behaviors that occur during the sequence of events that have caused or contributed in some way to the accident.

Let's look at some characteristics and examples of hazardous conditions:

Hazardous Conditions

- Are unique things or objects that are somehow defective or unsafe
- Are "states of being" such as employee fatigue



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- May also be unique defects in processes, procedures or practices
- Proper guards prevent hazardous conditions.
- May exist at any level of the organization
- Are the result of deeper root causes

Hazardous conditions may exist in any of the categories below.

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

5. _____ are unique hazardous conditions within the sequence of events that have directly caused or contributed to the accident.

- a. Potential causes
- b. Indirect causes
- c. Surface causes
- d. Actual causes

Unsafe or Inappropriate Behaviors

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

- Actions we take or don't take that increase risk of injury or illness
- May also be thought to be unique performance errors in a process, procedure or practice
- May exist at any level of the organization

- Are the result of deeper root causes

Below are some examples of unsafe or inappropriate employee/manager behaviors.

<ul style="list-style-type: none">• Failing to comply with rules• Using unsafe methods• Taking shortcuts• Horseplay• Failing to report injuries• Failing to report hazards	<ul style="list-style-type: none">• Allowing unsafe behaviors• Failing to train• Failing to supervise• Failing to correct• Scheduling too much work• Ignoring worker stress
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6. Which of the following is true regarding unsafe behaviors in the workplace?

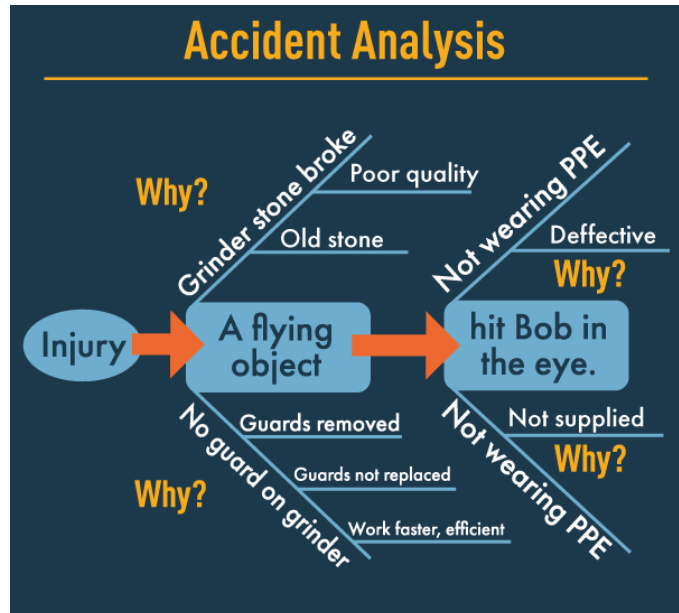
- a. They are the result of a lack of common sense
- b. They always happen because employees do not care
- c. They are not the result of root causes
- d. They may exist at any level of the organization

Analysis Tools

We recommend using both the "5-Why Analysis" and "Fishbone Diagram" to help you conduct an event analysis to uncover surface causes. Follow the steps below to conduct a Fishbone Diagram:

1. Get a sheet of paper.
2. At the top of the sheet write "Accident Analysis". Doing this reminds you that you are breaking down the process into a number of events.
3. At the left side of the sheet, centered, write "The Injury".
4. Extend a horizontal line out from the right of the box.
5. Describe the injury event on the horizontal line.

6. Identify and circle the actors and actions described in the event statement.
7. Start asking why questions (at least five) about the condition of actors and actions to uncover hazardous conditions or unsafe behaviors.
8. Draw lines either angling up or down from the circled actors and actions and write the answers to your questions.
9. Repeat these steps with each of the new level of answers.



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The diagram you'll produce using this procedure should look something like the diagram to the right. In fact, it will probably look more complex. Each level of questioning will get you closer to the root cause(s) that contributed to the hazardous conditions or unsafe behaviors. Ultimately, you'll start identifying inadequate policies, programs, plans, processes, procedures and practices (the 6Ps): you're getting to the real root causes!

7. When analyzing an accident, how many "why" questions should you ask about the condition of the actors?

- a. 2
- b. 3
- c. None
- d. At least five

System Analysis

Now let's switch gears. Instead of talking about unique conditions and behaviors, let's take a look at analyzing the surface causes to determine possible safety management system weaknesses. There are many "general" conditions and behaviors (variables) inherent in the safety management system. Oh yes... to me the safety management system is "organic". By that I mean it is dynamic, ever-changing and behaves as though it were alive. Think about it. If that's a little too metaphysical for you... read on.

The **root causes** for accidents are the **underlying safety management system weaknesses**, which consist of thousands of variables, any number of which can somehow contribute to the surface causes of accidents. These weaknesses can take two forms.

- **System Design Root Causes:** Inadequate design of one or more components of the safety management system. The design of safety management system policies, plans, programs, processes, procedures and practices (remember this as the 6-Pa's) is very important to make sure appropriate conditions, activities, behaviors, and practices occur consistently throughout the workplace. Ultimately, most surface causes will lead to system design flaws.
- **System Implementation Root Causes:** Inadequate implementation of one or more components of the safety management system. After each safety management system component is designed, it must be effectively implemented. You may design an effective safety plan, yet suffer failure because it wasn't implemented properly. If you effectively implement a poorly written safety plan, you'll get the same results. In either instance, you'll eventually need to improve one or more policies, plans, programs, processes, procedures or practices.

Safety managers should work with safety engineers to eliminate or reduce exposure to hazards through effectively improving safety system components. Because systems design work common throughout the workplace, eliminating any single root cause may simultaneously eliminate many hazardous conditions and unsafe behaviors.

Since root causes reside within safety management systems, upper management -- those who formulate systems, are most likely going to be involved in making the necessary improvements. When analyzing for system weaknesses, it may be beneficial to coordinate closely with those who will be responsible for implementing system improvements.

Take a look at the [Accident Weed](#), an excellent analogy that helps us understand the relationship between surface and root causes for accidents.

8. The _____ for accidents are the underlying safety management system weaknesses.

- a. root causes
- b. actual causes
- c. surface causes
- d. indirect causes

Hierarchy of Causes

Most accidents in the workplace result from a hierarchy of causes:

- **System weaknesses** which are the root causes that contribute to unsafe behaviors and hazardous conditions for most workplace accidents;
- **Unsafe behaviors** which are the surfaces causes for the majority of workplace accidents;
- **Hazardous conditions** which are the surfaces causes for only a small percentage of workplace accidents; and
- **Uncontrollable (unknowable) causes**, which account the least number of workplace accidents.

This hierarchy implies that, ultimately, management system weaknesses contribute in some way to the vast majority of all workplace accidents. When you conduct accident investigations, assume contributing system weaknesses exist because it's true for most accidents. This fact also implies that it is usually inappropriate to discipline employees when they have accidents.

To effectively fulfill your responsibilities as an accident investigator, you must not close the investigation until you identify the root causes or prove they don't exist.

9. Ultimately, the majority of of workplace accidents are due to ____.

- a. lack of training
- b. lack of management involvement
- c. safety management system weaknesses
- d. employees who just don't care

Module 7: Step 6- Develop Solutions

Effective Recommendations

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 immediate corrective actions and system improvements, we may transform the investigation into a valuable "proactive" process that helps to prevent future injuries. In this module we'll explore tips and tactics for making effective recommendations that "sell" safety improvements.

Once you have developed engineering and administrative controls to eliminate or reduce injuries, the challenge becomes convincing management to make changes. Management will most likely understand the importance of taking corrective action and readily agree to your ideas. However, if management doesn't quite understand the benefits, success becomes less likely. Your ability to present effective recommendations becomes all that more important. This module will help you learn how to put together "an offer they can't refuse," by emphasizing the long-term bottom-line benefits of the corrective action you are recommending.

Why Decision-makers Don't Respond Quickly

When recommendations are not acted upon, it is usually because the decision-maker does not have enough information to make a judgment. To speed up the process and to improve the approval rate, you must learn to anticipate the questions the decision-maker will ask in order to sign off on the requested change. This being the case, the more pertinent the information included in the presentation, the higher the odds are for approval.

1. When making recommendations, we need to propose immediate _____ actions and long-term _____ improvements.

- a. disciplinary, worker
- b. corrective, system
- c. retrieval, behavioral
- d. system, worker

Do it Right!

It's important to divide your recommendations into the categories below:

1. **Immediate or short-term corrective actions** to eliminate or reduce the hazardous conditions and/or unsafe behaviors related to the accident.

2. **Long-term system improvements** to create or revise existing safety policies, programs, plans, processes, procedures and practices identified as missing or inadequate in the investigation.

2. Which of these is considered an immediate corrective action?

- a. Placing a guard on a table saw
- b. Writing a new safety policy
- c. Establishing a proactive incentive program
- d. Revising an accident investigation form

The Hierarchy of Control Strategies

Let's discuss the six hazard control strategies that we've grouped into the two categories described in module 7.2. As a safety professional, you need to be familiar with these basic strategies. You can be sure they'll be on the exam.

Higher Priority Strategies that Control Hazards

1. **Elimination:** Totally eliminate the hazard. Why is this control strategy our top priority and considered by OSHA to be most effective? This control strategy has the potential to completely remove the hazard. We're somehow changing a thing/condition in the workplace. And as we all know...

No hazard, no exposure = no accident.

2. **Substitution:** Substitute the hazard with a less hazardous condition, process or method. Some basic examples are substituting a toxic chemical with a non-toxic chemical or replacing an old poorly-designed machine with a new model.
3. **Engineering controls:** See if any of the strategies below are used in your workplace.
 - **Design:** Example - Design a tool so that it reduces the likelihood of a strain or sprain.
 - **Redesign:** Example - Change the design of a machine so that dangerous moving parts or electrical circuits are out of reach.
 - **Enclosure:** Examples - Place a hood over a noisy printer. Place a machine guard around a dangerous moving part.

It's important to note that OSHA expects the employer to first try to eliminate, substitute or engineer the hazard so that it can no longer cause a serious injury. For instance, if a machine is producing unacceptable noise, OSHA would expect the employer to first eliminate or reduce the noise level to acceptable levels using one or more of these three strategies. In this instance, an engineering control such as enclosure might work.

3. Replacing a toxic chemical with a non-toxic chemical is an example of which hazard control strategy?

- a. Elimination
- b. Engineering controls
- c. Substitution
- d. Personal protective equipment

Lower Priority Strategies

The final three control strategies are less effective than elimination, substitution, and engineering controls in the long term because they do not remove the hazard, itself. Rather, they merely attempt to reduce exposure to hazards by controlling behavior - attempting to change "things we do or don't do."

- 4. **Warnings:** Signs and labels that tell employees to "Keep Out," "May cause eye irritation" etc., are used to warn employees about hazards. However, it's important to know that employees will not necessarily pay attention to "posted" warning signs. Unless compliance is enforced, employees are more likely to ignore warning signs. To illustrate, think about this concept the next time you're driving a vehicle. Do you drive at the posted speed limit, or the enforced speed limit?
- 5. **Administrative controls:** This control strategy also attempts to reduce exposure by limiting the duration of exposure to a hazard. To do this, the employer may employ job rotation and schedule work/breaks. This is also accomplished through improving work procedures and practices. Example - Develop and use a safe work procedure for preventative maintenance on air conditioning equipment.
- 6. **Personal protective equipment (PPE):** Some jobs require PPE by law. PPE places a barrier between workers and the hazard. This control strategy is used in conjunction with the other control strategies. It should not be used to replace them. When other controls do not adequately eliminate or reduce hazards, PPE may be needed in addition to those strategies. 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 the employee's behavior.

As long as employees "behave" or comply with the warning signs, administrative controls and wear PPE when required, these control strategies will work. However, human beings are natural risk-takers, and it's "normal" for us to want to work in the most efficient manner. Sometimes safe work procedures are not perceived as efficient, so we may not want to use them.

Therefore, managers must regularly supervise employees to make sure they comply with warning signs, procedures and PPE requirements. Think about the "Murphy's Law" principle below. It certainly applies to safety. Here's an important principle to remember:

“Any system that relies on human behavior is inherently unreliable.”

The Hierarchy of Controls, when used separately or in combination, may be quite effective in eliminating or greatly reducing the probability of a future similar accident. However, to make sure long term risk reduction is achieved throughout the entire company, safety management system improvements must be made, so let's discuss this important topic.

4. _____ attempts to reduce exposure by limiting the duration of exposure to a hazard.

- a. Substitution
- b. Administrative controls
- c. Engineering controls
- d. Personal protective equipment

Recommend System Improvements

The surface causes for accidents actually represent the symptoms of underlying safety management system weaknesses. This cause-effect relationship is so important to understand that I'll say it again: the behaviors and conditions that caused the accident are, themselves, usually the effects of deeper root causes. This is a fact.

Consequently, your first assumption, as an accident investigator, should be that root causes have contributed to an accident, and your job is to find them. Your first basic assumption should never be that an accident is simply the result of surface causes. Once in a while, you'll find that an accident was solely the result of a "personal failure," but that won't be often: in fact, it will be rare in most organizations.

Therefore, make every effort to improve safety management system components to ensure long term workplace safety in your company. As we learned in the last module, the most successful accident investigator is actually a systems analyst. Making safety management system improvements might include some of the following examples:

- 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;
- including hands-on practice as part of the safety training program;
- revising purchasing policy to include safety considerations as well as cost; and
- changing the safety inspection process to include all supervisors and employees.

5. The behaviors and conditions that caused the accident are, themselves, usually the effects of _____.

- a. employee carelessness
- b. lack of supervisor involvement
- c. deeper root causes
- d. a lack of common sense

"GIGO" or "QIQO"?

Here's another idea to think about. When managers do not respond to a recommendation, it may be that they do not have enough useful information to take action. You've probably heard of the GIGO principle -- "If you put garbage in, you'll get garbage out." That also works on the flip side. Quality in - Quality out or "QIQO". Useful information presented to management is more likely to result in decisions that take effective action to make long-lasting positive improvement.

Six Key Questions

To help make sure your recommendations include quality short-term corrective actions and long-term safety management system improvements, answer the following six primary questions. Doing this will help you be able to answer any questions management may have at the time you present your recommendations, and it will help you justify taking action by appealing to management's need to fulfill their obligations.

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

1. 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 design or implementation of safety management programs, policies, plans, processes, procedures and general practices that allowed the conditions and behaviors to exist?

6. How does the "garbage in, garbage out" (GIGO) principle apply to safety system improvements?

- a. Get in and get out (GIGO) before you get fired
- b. Management GIGO is associated with negative entropy
- c. You're more likely to get top management support by eliminating GIGO
- d. If you give management good information, you'll get good results

2. What is the history of the problem?

- Have similar accidents occurred previously? If so, you should be able to claim that the probability for similar accidents is highly likely to occur.
- What are previous direct and indirect costs for similar accidents?
- How have similar accidents affected production and morale?
- Describe how it has affected direct, budgeted or insured costs related to past injuries or illnesses.
- How has it affected indirect, unbudgeted or uninsured costs related to loss of efficiency and/or productivity and employee morale?

3. 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 who 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?

7. When developing recommendations, what is an important question to ask about the history of a safety problem?

- a. What are possible objectives of the decision-maker?
- b. What are the hazard controls that will work to solve the problem?
- c. Who has been disciplined for safety infractions?
- d. How have similar problems affected direct and indirect safety costs?

5. Why is the decision-maker doing safety?

It's important to know what is motivating the decision-maker. Is the decision-maker doing safety to fulfill one or more of the following imperatives?

- **Fulfill the legal obligation?** You may need to emphasize possible penalties if corrections are not made. Common in a fear-driven culture.
- **Fulfill the fiscal obligation?** You may want to emphasize the costs/benefits. Common in an achievement-driven culture.
- **Fulfill the social obligation?** You may want to emphasize improved morale, public relations. Common in a humane corporate culture.

Employer motivation will determine the nature of the objections to the recommendations you submit. What are possible objections the decision-maker might raise? Whatever they might be, it's important you understand their motivations so that you are better prepared with responses that satisfy the decision-maker's needs.

- List the possible decision-maker objections.
- List the arguments that are most likely to be successful against those objections.
- As a last resort: Review employer obligations under administrative law.

8. Which of the following obligations emphasizes possible penalties if corrections are not made?

- a. Legal obligation
- b. Social obligation
- c. Fiscal obligation
- d. Managerial obligation

6.What will be the cost/benefits of corrective actions and system improvements?

- What are the costs that might result if/when OSHA inspects? Answer this question to address the legal obligation your employer has.
- What is the estimated investment required to take corrective action, and how does that contrast with the possible costs if corrective actions are not taken? Answer this question to address the fiscal obligation your employer has.
- What is the "message" sent to the workforce and the community as a result of action or inaction? Answer this question to address the social obligation your employer has.

It's important to have the answers to all of these questions ready for the decision maker.

The maintenance supervisor may be able to help you estimate the investment required for recommended corrective actions.

More ideas to consider:

- These options must also eliminate or reduce the hazards and the exposures;
- Try to include at least three (real world) but only one or two for this exercise;
- Briefly list low/high cost solutions that eliminate the problem now/soon;
- Briefly list low/high cost solutions that reduce the problem now/soon;
- Briefly list the advantages and disadvantages of each solution.

9. Why would you discuss the consequences of rejecting your recommendation if OSHA subsequently inspects?

- To emphasize the employer's social obligation
- To emphasize the employer's financial obligation
- To emphasize the employer's legal obligation
- To emphasize the employer's moral obligation

Estimating Direct and Indirect Costs

What is the ratio between indirect (uninsured) and direct (insured) costs in your scenario?

The indirect costs for accidents will usually be greater than the direct costs. Indirect costs can range from 1 to 20 times greater than the direct costs, depending on the severity of the injury. For every \$1 spent in direct costs, you'll pay an additional \$1 to \$20 in indirect costs. For every one dollar spent in direct costs, you'll pay \$1.50 in indirect costs. To determine the ratio between the indirect and direct costs, use the following equation:

INDIRECT & DIRECT COSTS RATIO

$$\frac{\text{Indirect Costs}}{\text{Direct Costs}} = \boxed{} \text{ to } 1$$



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In this case, if the indirect (uninsured) cost totals \$60,000 and the direct (insured) cost is \$40,000, total accident costs will be \$100,000. The ratio of total costs to direct costs will be \$100,000/\$40,000 = 2.5:1. This ratio can be much higher. In fact, the average is about 4:1.

Ratio Between Indirect and Direct Costs

This ratio is a little more dramatic than contrasting the indirect costs with direct costs. It helps emphasize the fact that direct costs are actually just the tip of the iceberg. To determine this

ratio, use the following equation:

ACCIDENT TO DIRECT COSTS RATIO

$$\frac{\text{Direct Costs + Indirect Costs}}{\text{Direct Costs}} = \boxed{} \text{ to } 1$$



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In this case, if the indirect (uninsured) cost totals \$60,000 and the direct (insured) cost is \$40,000, total accident costs will be \$100,000. The ratio of total costs to direct costs will be \$100,000/\$40,000 = 2.5:1. This ratio can be much higher. In fact, the average is about 4:1.

10. The indirect costs for accidents will usually be _____ the direct costs.

- a. less than
- b. greater than
- c. equal to
- d. about the same as

Return on the Investment (ROI)

So, how much will the employer save in the future by approving your recommendation now? To answer that question we need to determine the return on the investment (ROI). The ROI answers the question, "If the investment prevents a future accident, how much money will we ultimately save in terms of additional sales that we would otherwise have to generate to cover the total costs of the accident?"

To determine ROI, you will usually be given a simple formula. You'll be told that for every dollar invested in safety, you'll save between \$2 and \$6 in the future. That's probably true, but it is a simplistic response that does not accurately tell the employer what the real savings are: To do

that, you need to know how hard the company works to pay for the costs of accidents. The biggest factor in determining ROI is your company's profit margin (at least in the private sector). That's why we include the company's profit margin in our formula for determining ROI. Let's look at the step-by-step process for determining ROI.

Reference the graphic below. To determine the ROI in terms of business volume (sales), it's necessary to:

1. Estimate the total additional sales required to cover the accident costs: If the company in our scenario has a 10% profit margin, it must commit a staggering 10X the future total accident costs (\$100,000), or \$1 million in additional sales to cover the total accident costs.
2. Estimate the savings in additional sales if the recommendation is approved: Subtract the amount of the recommended investment (\$10,000) from the total additional sales (\$1 million) required to cover a future similar accident to determine total savings in business volume (\$990,000).

3. Estimate the return on investment (ROI): A recommended investment of \$10,000 and a savings of \$990,000 in additional sales will give you an ROI as a percentage of $(\$990,000/\$10,000) \times 100 = 9,900\%$!

RETURN ON INVESTMENT (ROI)

$$\left(\frac{\$100,000 \text{ Future Accident Costs}}{10\% \text{ Profit Margin}} \right) = \text{Additional sales to cover accident costs}$$


=

Additional sales to cover
accident costs

Investment Savings

$$\$1,000,000 - \$10,000 = \$990,000$$

$$\frac{\$990,000}{\$10,000} \times 100 = 9,900\% \text{ ROI}$$



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11. Your company has a 10% profit margin. If the total cost of an accident is \$100,000, and your recommended investment is \$10,000, what is estimated return on the company's investment (ROI)?

- a. 100,000%
- b. 10,000%
- c. 1,000%
- d. 100%

Provide Options

Another good recommendation strategy is to provide the decision-maker with alternative corrective actions. This will increase the probability that the decision-maker will choose one of the alternatives. Your options might follow the logic below:

1. **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.
2. **Second option** -- If we have limited funds, what would we do. Eliminate the hazard with primarily administrative controls. Engineering controls if required.
3. **Third option** -- If we don't have any money, what can we do? Reduce exposure to the hazard with administrative controls and/or PPE.

Well, how was that? Pretty tough... but the whole idea is to help you get through the rough parts now, so that you will be able to develop and present an effective recommendation to top management the first time! It is time to take the review quiz, so let's go.

12. What is a good strategy to help ensure the decision-maker approves a safety recommendation?

- a. Massage the statistics
- b. Send copies to OSHA
- c. Provide alternative solutions
- d. Require acceptance quickly

Module 8: Step 7 – Write the Report

Introduction

Now that you have accurately assessed and analyzed the facts related to the accident and developed effective corrective actions and system improvements, you must report your findings to those who have the authority to take action. 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 surface causes and the contributing root causes. It is not be your job to conduct the investigation to establish who is to blame: that's playing the OSHA game if you do. In fact, if your analysis of the facts surrounding the accident has uncovered root-cause system weaknesses, justification for employee discipline does not exist because management has not fulfilled its OSHA-required responsibilities. 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," it won't be effective at all. If your report concludes with accusatory statements, it will be unlikely result in system improvements that permanently eliminate the surface causes. It's also likely that similar accidents will occur. Bottom line: If the accident investigation doesn't help to fix the system, it has most likely been a waste of time and effort. Okay, we'll get off our soapbox. Let's look at the report.

Here is a series of [Accident Reports](#) with assessments of surface and root causes.

1. If you discovered contributing root causes (system weaknesses) in an accident investigation, _____.

- a. discipline is justified
- b. discipline is not justified
- c. the investigation has been a waste of time
- d. the investigation has been too thorough

The Accident Report Form

One of the reasons an accident investigation might fail to help eliminate similar accidents, is that the report form is poorly designed. Some poorly designed forms actually make it quite difficult to get beyond identification of only surface causes: root causes are often ignored.

Let's look at one format that is designed to emphasize root cause analysis. Take a look at a [sample accident report](#). This is a report format similar to that used by OSHA accident investigators in conducting workplace accident investigations, but it goes further. This form includes the identification of safety management system weaknesses and recommended improvements. You may want to print this form while we discuss the various sections.

2. What may be the result if accident report forms are poorly designed?

- a. Failure to prevent similar accidents
- b. Persons at fault are not identified
- c. Disciplinary procedures will not be addressed
- d. Failure to address the lack of common sense

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. Make sure you obtain all of this information for possible later reference.

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.

Take a look at a sample [Section II Description of the accident](#).

3. Why is it important to paint a word picture when describing what happened in an accident?

- a. To meet OSHA reporting requirements
- b. To help prevent a possible OSHA inspection
- c. To clarify what happened
- d. To lower potential workers' compensation costs

Section III. Findings

The findings section describes the hazardous conditions, unsafe behaviors **and** the system weaknesses your analysis has uncovered. Each description of a surface or root cause will also

include justification for the finding. The justification will explain how you came to your conclusion.

Unfortunately, the **most common** failure found in accident reports is that they address only surface causes. Consequently, similar accidents recur. These report forms may have a format that "forces" the investigator to list only surface causes for accidents. The form does not "report" the system weaknesses associated with each surface cause. Consequently, the investigator believes the job is done without ferreting out the system weaknesses representing the root causes.

Other forms may actually require the investigator to indicate the status of employee negligence. Now, how can the accident investigator assure an interviewee or any other employee that the purpose of the analysis process is to "fix the system — not the blame," when the report form shouts "negligent"?

To complete this section, just state the facts: The hazardous conditions, unsafe behaviors, practices, and inadequate or missing programs, policies, plans, processes and procedures that produced them. Be sure to write complete descriptive sentences. Not short cryptic phrases. For example look at the descriptive surface cause and a root cause statements below:

- Hazardous condition: A high voltage power line was located directly over the work area.
- Missing Policy. Policies regarding safe working procedures and practices related to work around high voltage lines do not exist.

4. What is the most common failure found in accident reports?

- a. Placing blame
- b. Addressing only surface causes
- c. Issuing fines
- d. Results in reprimands

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 costs involved with implementing corrective actions. Let's take a closer look at effective recommendation writing. Review this sample [Section IV. Recommendations](#).

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.

Open Documents

The accident investigation report should be considered an open document until all actions have been completed. These include, but are not limited to:

- Background Information
- Accident Description
- Investigation Findings
 - Surface causes
 - Root causes
- Recommendations
 - Corrective actions
 - System improvements
- Report Summary
- Report Submitted
 - Safety committee
 - Decision-maker
- Improvements Completed
 - Corrective actions
 - System improvements

5. The accident investigation report should be considered an open document until which of the following has occurred?

- a. OSHA has been contacted
- b. Surface causes have been identified
- c. All actions have been completed
- d. Fines have been issued

Additional Resources

- [OSHA eTool Matrix](#), OSHA
- [OSHA Safety Pays](#), OSHA
- [Foundation for a Safe Workplace](#), Oregon OSHA
- [ANSI/AIHA Z10-2012](#), American National Standards Institute
- [Accident Investigation Stories](#), Washington State Department L&I