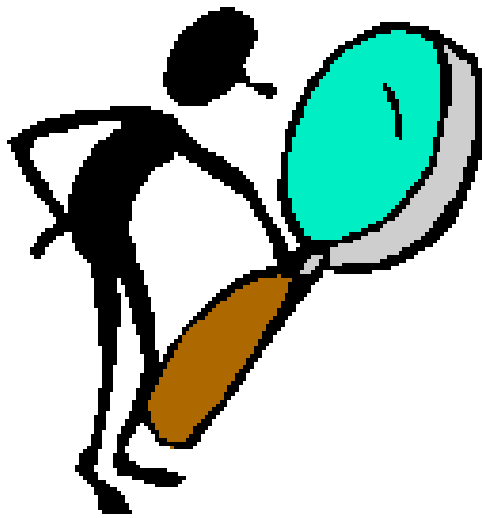
Fixing the System with

Root Cause Analysis



Copyright statement. This educational information is provided by the Public Education and Conferences Section of the Oregon Occupational Safety and Health Division (Oregon OSHA), Salem, Oregon, USA. Unless a copyright is indicated, information herein is in the public domain and may be copied and distributed without permission. Citation of Oregon OSHA as source of the information is appreciated. This document is originally published in Microsoft PowerPoint. Permission to use PowerPoint graphics must be obtained from Microsoft Inc. If a copyright is otherwise indicated on a photo, graphic, or other material, permission to copy these materials must be obtained from the original source.

Disclaimer. This information provides suggested methods for presenting various safety and health related topics. This material, or any other material used to inform employers of compliance requirements of Oregon OSHA standards through simplification of the regulations should not be considered a substitute for any provisions of the Oregon Safe Employment Act or for any standards issued by Oregon OSHA.

Get to the roots to fix the system

The hazardous conditions and unsafe behaviors we identify as contributing to the accident are called the **surface causes** of the accident. After we identify surface causes, we'll need to determine if inadequate safety system components contributed to the accident by allowing the hazardous conditions and unsafe behaviors to develop or occur. These system inadequacies are called the **root causes** of accidents. Let's take a closer look at these two very important concepts.

The surface causes of accidents

The surfaces causes of accidents are those **hazardous conditions** and **unsafe employee/manager behaviors and activities** that have directly caused or contributed in some way to the accident.

Hazardous conditions:

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

Hazardous conditions may exist in any of the following categories:

Materials	Machinery	Equipment	Environment	Chemicals
Tools	Workstations	Facilities	People	Workload
Time				

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

Unsafe behaviors:

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

Some example of unsafe employee/manager behaviors include:

Failing to comply with rules	Using unsafe methods	Taking shortcuts
Failing to report injuries	Failing to report hazards	Horseplay
Allowing unsafe behaviors	Failing to train	Failing to supervise
Scheduling too much work	Ignoring worker stress	Failing to correct

The direct cause of injury is not the cause of the accident

If we examine the surface cause categories above, we find that each may somehow produce a harmful level of energy that may be transferred to our body directly causing an injury. The harmful transfer of energy is the direct cause of injury. Let's take a look at three examples:

- If a harsh acid splashes on our face, we may suffer a chemical burn because our skin has been exposed to a chemical form of energy that destroys tissue. In this instance, the direct cause of the injury is harmful a chemical reaction. The related surface cause might be the acid (condition) or working without proper face protection (unsafe behavior).
- If our workload is to too strenuous, force requirements on our body may cause a muscle strain. Here, the direct cause of injury is a harmful level of kinetic energy (energy resulting from motion), causing injury muscle tissue. A related surface cause of the accident might be fatigue (hazardous condition) or improper lifting techniques (unsafe behavior).

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

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

Safety Engineering & Safety Management…two different roles

Safety "engineers" closely analyze all the surface cause categories and attempt to (1) eliminate the harmful energy, (2) reduce the harmful energy transfer, or (3) reduce exposure to harmful energy transfer. They do this by designing safety features directly into tools, machinery, equipment, facilities, etc.

On the other hand, safety “managers” identify and analyze the safety management system to evaluate the effectiveness of its subsystem components. They improve the system to eliminate or reduce the common or root causes producing the hazardous conditions and behaviors.

Workplace safety is most successful when engineering controls and management system improvement compliment each other.

The root causes of accidents

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

It's important to understand that root causes always pre-exist surface causes. Indeed, inadequately designed system components have the potential to feed and nurture hazardous conditions and unsafe behaviors. If root causes are left unchecked, surface causes will flourish!

Examples of safety system functions and the components common to all systems include:

Safety systems: Systems are developed to:

Promote Commitment/leadership	Increase employee involvement
Establish accountability	Identify and control hazards
Investigate incidents/accidents	Educate and train
Evaluate the safety program	

System components:

Policies	Programs	Plans	Processes
Procedures	Budgets	Reports	Rules

Safety managers 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.

Three levels of cause analysis

As mentioned earlier in the course, accidents are processes that culminate in an injury or illness. An accident may be the result of many factors (simultaneous, interconnected, cross linked events) that have interacted in some dynamic way. In an effective accident investigation, the investigator will conduct three levels of of cause analysis:

Injury analysis. At this level of analysis, we do not attempt to determine what caused the accident, but rather we focus on trying to determine how harmful energy transfer caused the injury. Remember, the outcome of the accident process is an injury.

Event Analysis. Here we determine the surface cause(s) for the accident: Those hazardous conditions and unsafe behaviors described throughout all events that dynamically interact to produce the injury. All hazardous conditions and unsafe behaviors are clues pointing to possible system weaknesses. This level of investigation is also called "special cause" analysis because the analyst can point to a specific thing or behavior.

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

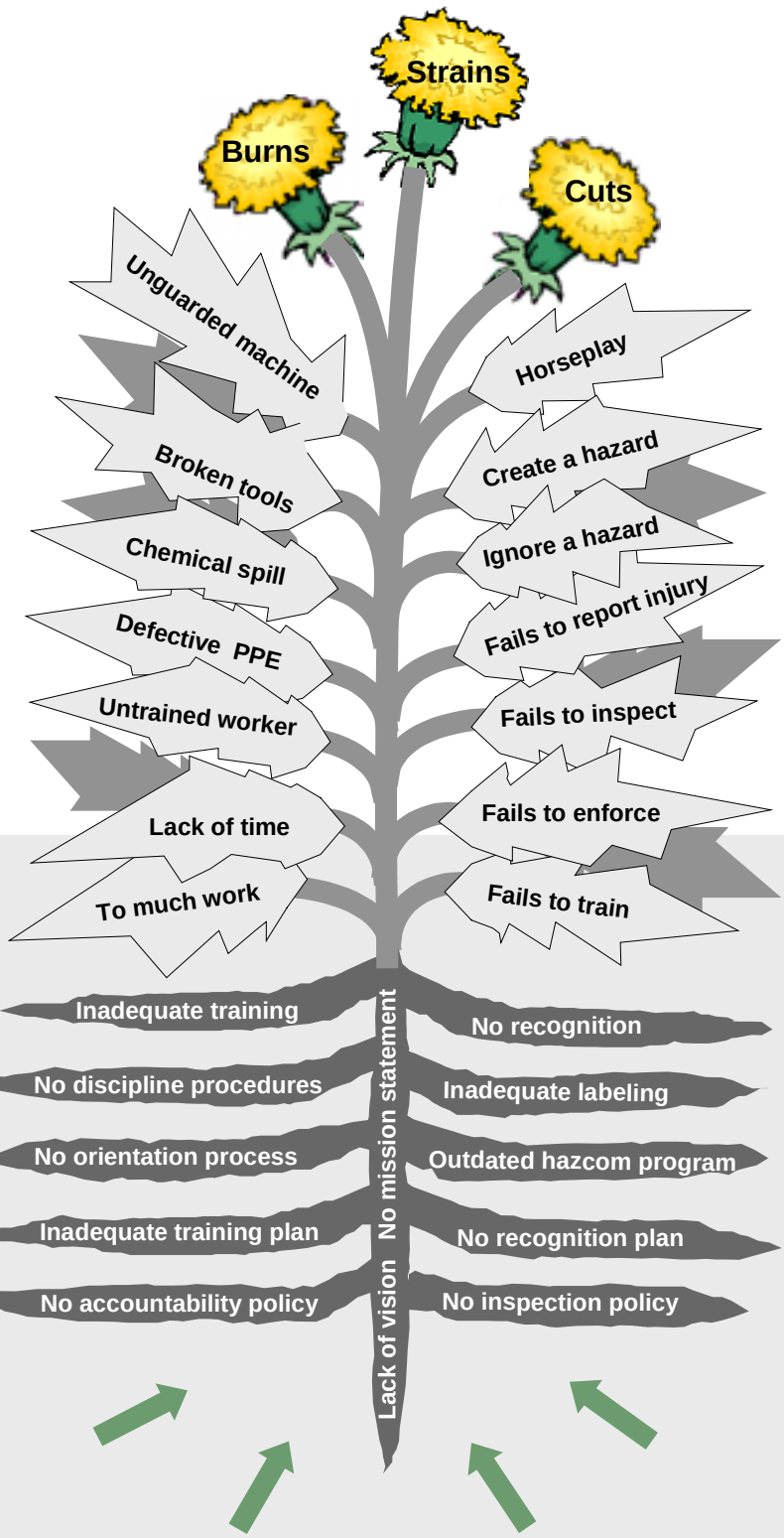
The biggest challenge to effective accident investigation is to transition from event analysis to systems analysis.

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

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

Fix the system…not the blame

The Accident Weed



Direct Cause of Injury

- Harmful Energy Transfer
- Kinetic, thermal, chemical, etc.

Primary Surface Causes

- Directly cause of the injury event
- Unique hazardous condition(s)
- Individual unsafe behavior(s)
- Controllable or uncontrollable factors
- Events occur close to the injury event
- Failure to perform safety practices, procedures, processes
- Involves the victim, others

Secondary Surface Causes

- Indirectly cause the injury event
- Specific hazardous condition(s)
- Individual unsafe behavior(s)
- Controllable and uncontrollable factors
- Events occur distant from the injury event
- Failure to perform safety practices, procedures, processes
- Co-workers, supervisors, anytime, anywhere

Implementation Root Causes

- Common conditions and behaviors
- Inadequate implementation of safety policies, programs, plans
- Inadequate design of processes, procedures
- Pre-exist surface causes
- Controllable
- Middle management, anytime, anywhere

System Design Root Causes

- Inadequate design of safety system policies, programs, plans
- Pre-exist all other causes
- Controllable
- CEO, top management, anytime, anywhere

External Environmental Causes

- Government regulation
- Physical resources
- Human resources
- Capital
- Society

Team Exercise: *"Getting to the roots by asking why, why, why, why"*

Purpose: Now that you have reconstructed the specific events prior to, during, and after the accident, it's time to analyze for cause by asking a series of "Whys."

Instructions.

1. Analyze the injury event to identify and describe the direct cause of injury. See examples below.

a. Describe the injury and it's cause.

- Laceration to right forearm resulting from contact with rotating saw blade.
- Contusion from head striking against/impacting concrete floor.
- Burn injury to right lower leg from contact by battery acid.
- Impact following a fall from platform to lower level caused dislocation of right shoulder.

b. Identify the accident type.

Struck-by	Struck-against	Contact-by	Contact-with
Caught-on	Caught-in	Caught-between	Fall-to-surface
Fall-to-below.	Over-exertion	Bodily reaction	Exposure.

Write the direct cause for the injury below.

_____

_____

_____

_____

List the accident type.

_____

Team Exercise: *"Getting to the roots by asking why, why, why, why"*

2. Analyze at least two events occurring just prior to the injury event to identify surface causes for the accident.

a. Determine the primary surface causes. Look for specific hazardous conditions and employee behaviors that caused the injury.

- Event x. Unguarded saw blade. (condition or behavior?)
- Event x. Working at elevation without proper fall protection. (condition or behavior?)
- Event x. Employee unaware of hazards of working with batteries. (condition or behavior?)

Condition(s)_____

_____

_____

Behavior(s) _____

_____

_____

a. Determine secondary surface causes. These are also specific conditions and behaviors.

- Supervisor not performing weekly area safety inspection. (condition or behavior?)
- Fall protection equipment missing. (condition or behavior?)
- Responsible person not training on how to hook up harness. (condition or behavior?)

Condition(s)_____

_____

_____

_____

Behavior(s) _____

_____

_____

_____

Team Exercise: *"Getting to the roots by asking why, why, why, why"*

3. **Analyze each surface cause to identify potential root cause(s)** that contributed to or produced the accident.

a. Determine system implementation weaknesses. Look for the common behaviors that represent inadequate implementation of safety programs and processes. It's important to understand that poor implementation of one program area may be the result of poor implementation in another safety management program area:

Top management commitment Accountability
Employee involvement Hazard identification & control
Incident & Accident Investigation Education & Training
Safety system evaluation

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

Implementation Root Causes _____

_____

_____

_____

_____

a. Determine system design weaknesses. Then ask why to determine the inadequate/missing policies and plans that caused them. These are common conditions.

- Inspection policy does not clearly specify responsibility by name or position.
- No fall protection training plan or process in place.
- Procedures for administering corrective actions absent from the accountability plan.

System Design Root Causes _____

_____

_____

_____

_____

_____

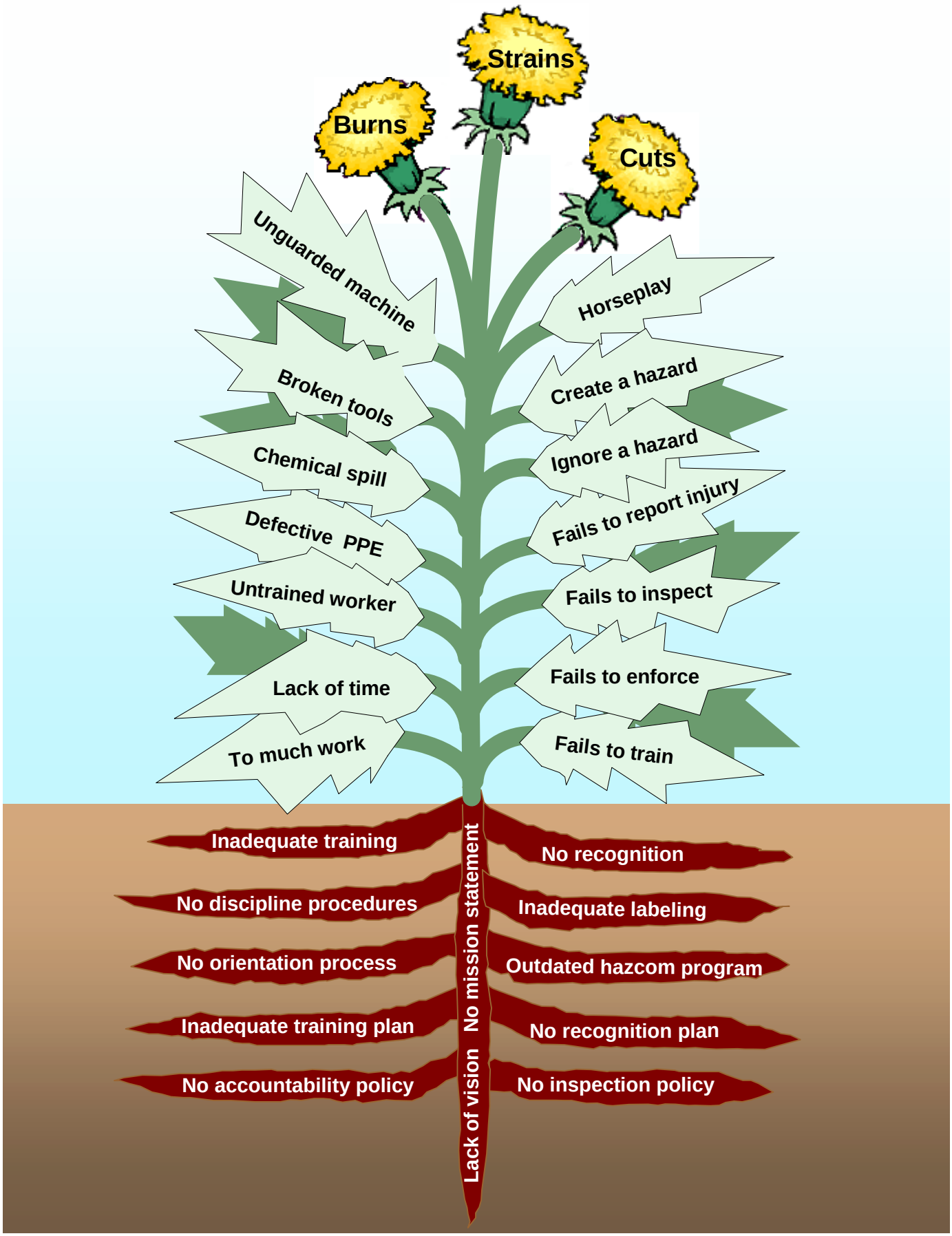
_____

Determine the causes

Direct Cause of injury- A harmful **transfer of energy** that produces injury or illness.

Surface Causes of accident - Specific hazardous conditions or **unsafe behaviors** that result in an accident.

Root Causes of the accident - Common behaviors and conditions that ultimately result in an accident.


Strains
Burns
Cuts
Unguarded machine
Broken tools
Chemical spill
Defective PPE
Untrained worker
Lack of time
To much work
Horseplay
Create a hazard
Ignore a hazard
Fails to report injury
Fails to inspect
Fails to enforce
Fails to train
Inadequate training
No discipline procedures
No orientation process
Inadequate training plan
No accountability policy
No mission statement
Lack of vision
No recognition
Inadequate labeling
Outdated hazcom program
No recognition plan
No inspection policy

Team Exercise: "Getting to the roots by asking why, why, why, why"

1. Analyze the injury event to identify and describe the direct cause of injury.

a. Describe the injury and it's cause.

b. Identify the accident type.

Team Exercise: "Getting to the roots by asking why, why, why, why"

2. Analyze at least two events occurring just prior to the injury event to identify surface causes for the accident.

a. Determine the primary surface causes.

b. Determine secondary surface causes.

Team Exercise: "Getting to the roots by asking why, why, why, why"

3. Analyze each surface cause to identify potential root cause(s) that contribute to or produced the accident.

a. Determine system implementation weaknesses.

b. Determine system design weaknesses.