



P A R T

# 1


## HISTORICAL PERSPECTIVE AND OVERVIEW



- 1 Safety and Health Movement, Then and Now 3
- 2 Accidents and Their Effects 18
- 3 Theories of Accident Causation 32
- 4 Roles and Professional Certifications for Safety and Health Professionals 51
- 5 Safety, Health, and Competition in the Global Marketplace 77



## ACCIDENT CAUSATION




Each year, work-related accidents cost almost \$50 billion in lost wages, medical expenses, insurance costs, and indirect costs.

The number injured in industrial place accidents in a typical year is 7,128,000.  
3 per 100 persons per year.

There is an accidental workplace death about every 51 minutes, and one injury every 19 seconds.

*Why do accidents happen?*  
To prevent accidents we must know why they happen.



## ACCIDENT CAUSATION



The most widely known theories of accident causation are:

- The domino theory.
- The human factors theory.
- The accident/incident theory.
- The epidemiological theory.
- The systems theory.
- The combination theory.
- The behavioral theory.

## DOMINO THEORY OF ACCIDENT CAUSATION



After studying 75,000 industrial accidents, Herbert W. Heinrich of Travelers Insurance concluded in the 1920s, that *88% of industrial accidents are caused by unsafe acts committed by fellow workers.*

Heinrich's study laid the foundation for his *Axioms of Industrial Safety*, and his now outdated domino theory of accident causation

Some of today's more widely accepted theories can be traced back to Heinrich's theory.

### Heinrich's 10 Axioms of Industrial Safety



1. Injuries result from a completed series of factors, one of which is the accident itself.
2. An accident can occur only as the result of an unsafe act by a person and/or a physical or mechanical hazard.
3. Most accidents are the result of unsafe behavior by people.
4. An unsafe act by a person or an unsafe condition does not always immediately result in an accident/injury.

### Heinrich's 10 Axioms of Industrial Safety



5. Reasons why people commit unsafe acts can serve as helpful guides in selecting corrective actions.
6. Severity of an accident is largely fortuitous, and the accident that caused it is largely preventable.
7. The best accident prevention techniques are analogous with the best quality and productivity techniques.

## Heinrich's 10 Axioms of Industrial Safety



8. Management should assume responsibility for safety because it is in the best position to get results.
9. The supervisor is the key person in the prevention of industrial accidents.
10. In addition to the direct costs of an accident (for example, compensation, liability claims, medical costs, and hospital expenses), there are also hidden or indirect costs.

Any accident prevention program that takes all ten axioms into account is more likely to be effective than a program that leaves out one or more.

## Heinrich's Domino Theory



According to Heinrich, there are five factors in the sequence of events leading up to an accident:

**Ancestry and social environment** - character traits that lead people to behave in an unsafe manner can be inherited, or acquired as a result of social environment.

**Fault of person** - negative traits, inherited or acquired, are why people behave in an unsafe manner and why hazardous conditions exist.

**Unsafe act/mechanical or physical hazard** - acts by people, and mechanical/physical hazards are the direct causes of accidents.

## Heinrich's Domino Theory



**Accident** - typically, injury accidents are caused by falling or being hit by moving objects.

**Injury** - typical injuries resulting from accidents include lacerations and fractures.

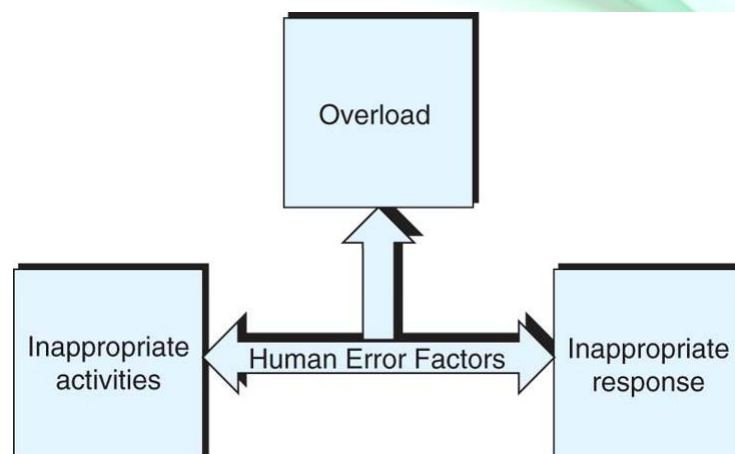
Injuries are caused by the action of preceding factors. Removal of the central factor (unsafe act/hazardous condition) negates the action of the preceding factors and prevents accidents and injuries.

*See "Domino Theory in Practice" on textbook page 36.*

## HUMAN FACTORS THEORY OF CAUSATION



Attributes accidents to a chain of events, ultimately caused by human error.



## Overload



**Overload** - imbalance between a person's capacity at any given time & the load that person is carrying in a given state.

*Capacity* is a product of natural ability, training, state of mind, fatigue, stress & physical condition.

*Load* consists of tasks for which a person is responsible, and...

- Added environmental burdens (noise, distractions, etc.)
- Internal factors (personal problems, emotional stress/worry)
- Situational factors (level of risk, unclear instructions, etc.)

## Inappropriate Response and Incompatibility



**Inappropriate responses** in a given situation can lead to accidents...

Detecting a hazardous condition, and not to correcting it.

Removes a machine safeguard to increase output.

Disregarding an established safety procedure.

## Inappropriate Response and Incompatibility



**Workstation incompatibility** - incompatibility of a person's workstation with regard to size, force, reach, feel & similar factors can lead to accidents and injuries.

### Safety Fact

#### Pregnancy and Work

Strenuous physical work and pregnancy can be a dangerous combination. Too much strenuous labor can result in a miscarriage. The types of work to be avoided by pregnant employees include the following:

- Standing for more than three hours per day
- Operating machinery that vibrates
- Lifting heavy loads
- Working in extremes of hot or cold

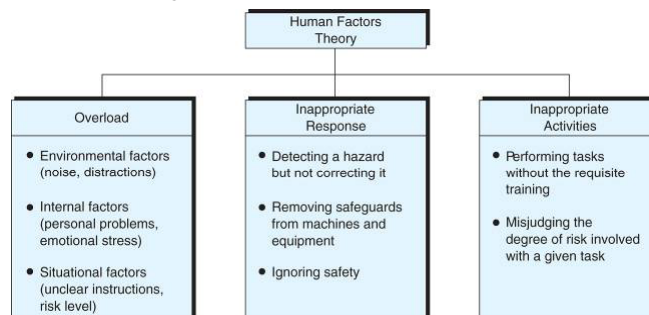
Shift work and workstations that require awkward postures can also put pregnant employees at risk. The third trimester is the most risk-intensive time during pregnancy.

## Inappropriate Activities



**Human error** - can be the result of inappropriate activities—such as when a person undertakes a task that he/she doesn't know how to do.

Such inappropriate activities can lead to accidents/injuries.



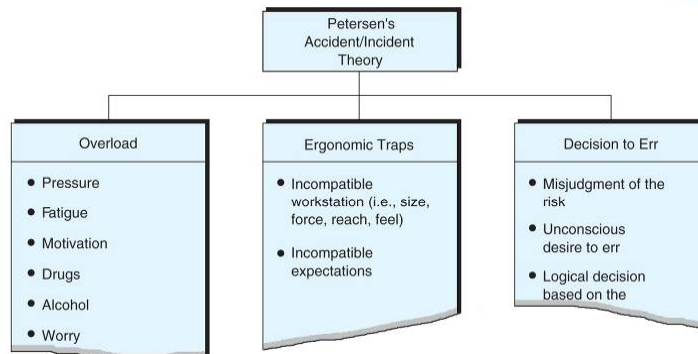
See "Human Factors Theory in Practice" on textbook page 36.

## ACCIDENT/INCIDENT THEORY OF CAUSATION



An extension of the human factors theory was developed by Dan Petersen, introducing...

**Ergonomic traps; Decision to err; Systems failures.**



See the entire chart on page 37 of your textbook.

## ACCIDENT/INCIDENT THEORY OF CAUSATION



Following are just some of the different ways that systems can fail, according to Petersen's theory:

**Management does not establish a comprehensive safety policy.**

**Responsibility and authority with regard to safety are not clearly defined.**

**Safety procedures such as measurement, inspection, correction, and investigation are ignored or given insufficient attention.**

**Employees do not receive proper orientation.**

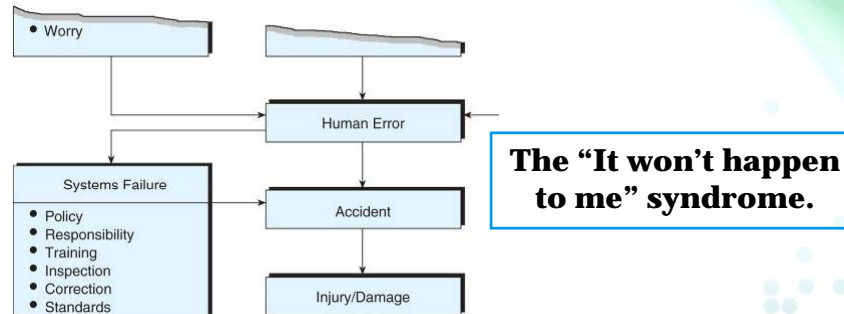
**Employees are not given sufficient safety training.**



## ACCIDENT/INCIDENT THEORY OF CAUSATION



- Decision to err may be conscious, based on logic or it may be unconscious.
  - Overload, ergonomic traps, deadlines, budget factors & peer pressure can lead to unsafe behavior.



See “Accident/Incident Theory in Practice” on textbook page 37.

## EPIDEMIOLOGICAL THEORY OF CAUSATION

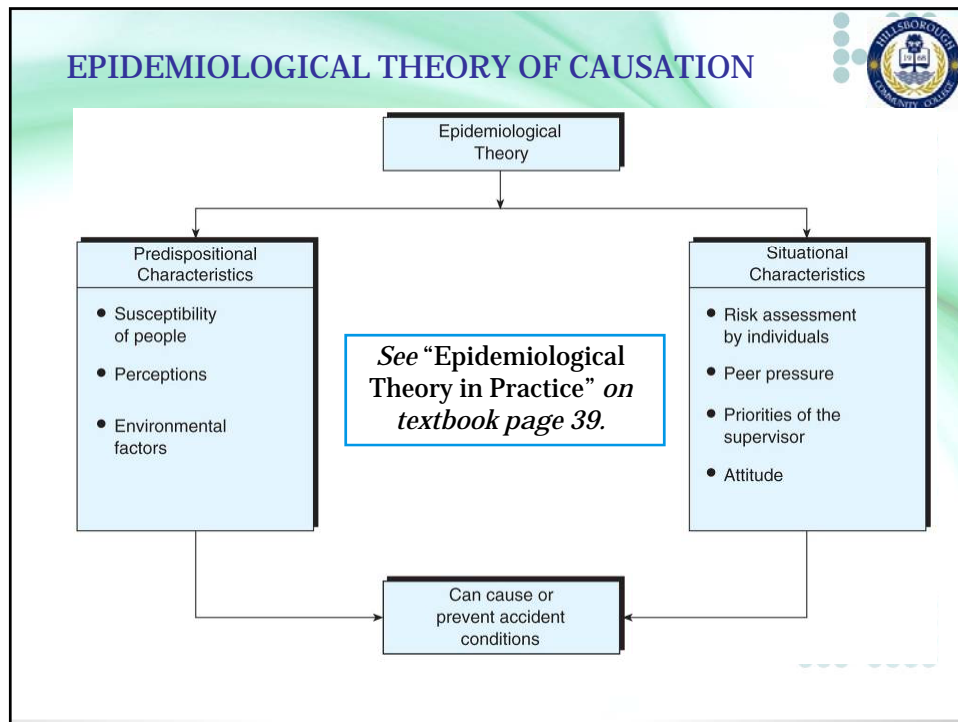


Current safety theories/programs trend to a broad perspective encompassing **industrial hygiene**.

Concerns environmental factors that can lead to sickness, disease, or other forms of impaired health.

Epidemiology is the study of causal relationships between environmental factors and disease.

The *epidemiological theory* holds uses those models to study relationships between environmental factors & accidents or diseases.



## SYSTEMS THEORY OF ACCIDENT CAUSATION

**A system is a group of regularly interacting & interrelated components that form a unified whole.**

**The systems theory of accident causation views a situation in which an accident may occur as a system comprised of the following components:**  
 Person (host); Machine (agency); Environment.

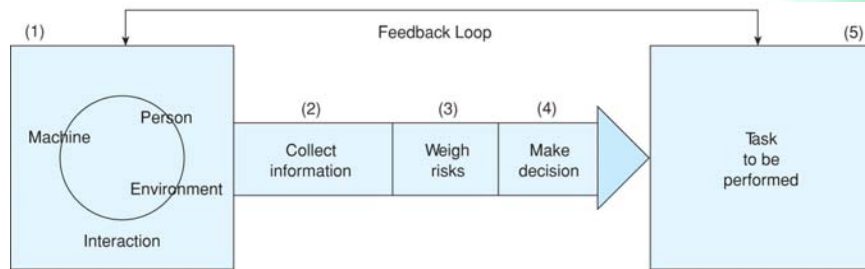
**Likelihood of an accident occurring is determined by how these components interact.**  
 Changes in the patterns of interaction can increase or reduce the probability of an accident.

## SYSTEMS THEORY OF ACCIDENT CAUSATION



- As a person interacts with a machine within an environment, three activities take place:

After collecting information by observing & noting current circumstances, a person weighs risks & decides whether to perform the task.



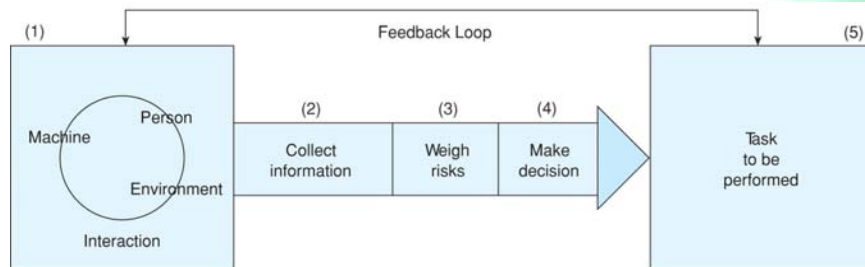
See "Systems Theory in Practice" on textbook page 41.

## SYSTEMS THEORY OF ACCIDENT CAUSATION



- As a person interacts with a machine within an environment, three activities take place:

If information was right & the risk assessment accurate, the task will probably be accomplished without accident.



See "Systems Theory in Practice" on textbook page 41.

## SYSTEMS THEORY OF ACCIDENT CAUSATION



**Stressors** can cloud judgment of those collecting information, weighing risks & making the decision:

A machine operator working in an unusually hectic environment.

Intense pressure to complete an order already behind schedule.

## SYSTEMS THEORY OF ACCIDENT CAUSATION



Five factors should be considered before beginning the process of collecting information, weighing risks, and making a decision:

1. Job requirements.
2. The workers' abilities and limitations.
3. The gain if the task is successfully accomplished.
4. The loss if the task is attempted but fails.
5. The loss if the task is not attempted.

Particularly important when stressors such as noise, time constraints, or supervisor pressure may tend to cloud one's judgment.

## COMBINATION THEORY OF CAUSATION



Often the cause of an accident cannot be adequately explained by one model or theory.

According to the combination theory, the actual cause may combine parts of several different models.

Safety personnel should avoid the tendency to try to apply one model to all accidents.

### Discussion Case

#### What Is Your Opinion?

"All accidents, one way or another, are the result of human error." "No, accidents are the result of a combination of things. I like the combination theory." "You're both wrong. Accidents are best explained by the domino theory." So the debate went in Dr. Jameson's class at Burton State University. What is your opinion concerning the various theories of accident causation?

See "Combination Theory in Practice" on textbook page 43.

## BEHAVIORAL THEORY OF CAUSATION



This theory of accident causation & prevention is often referred to as **behavior-based safety (BBS)**.  
has seven basic principles:

Intervention that is focused on employee behavior;

Identification of external factors that will help understand and improve employee behavior.

Direct behavior with activators or events antecedent to the desired behavior, and motivation of the employee to behave as desired with incentives and rewards.

Focus on the positive consequences that will result from the desired behavior as a way to motivate employees.

## BEHAVIORAL THEORY OF CAUSATION



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- Identification of external factors that will help understand and improve employee behavior.
- Direct behavior with activators or events antecedent to the desired behavior
- Focus on the positive consequences from the desired behavior as a way to motivate employees
- Application of the scientific method to improve attempts at behavioral interventions.
- Use of theory to integrate information rather than to limit possibilities.
- Planned interventions with the feelings and attitudes of the individual employee in mind.

## BEHAVIORAL THEORY OF CAUSATION



An innovative, practical application of standard behavioral theory to the field of occupational safety.

Positive reinforcement in the form of incentives and rewards is used to promote the desired (safe) behaviors.

- And discourage undesirable (unsafe) behaviors.

Proponents use the “ABC” model to summarize understanding human behavior & developing interventions when behavior is undesirable (unsafe).

“A” stands for activators or antecedent events that precede behavior—“B” & “C” refer to consequences following behavior, or produced by it.

*See “Behavioral Theory in Action” on textbook page 44.*

## DRUGS AND ACCIDENT CAUSATION



Drugs & alcohol are the root or contributing cause of many accidents on the job every year.

According to Health & Human Services surveys, an estimated 6.5% of full-time & 8.6% of part-time workers use illicit drugs.

More than a third of all workers between the ages of 18 and 25 are binge drinkers.

Many companies implement drug-free workplace programs, typically with the following components:

Drug-free workplace policy; Supervisory training.  
Employee education; employee assistance programs.  
Alcohol and drug testing.

## DEPRESSION AND ACCIDENT CAUSATION



People who suffer from clinical depression are seriously impaired and pose a clear & present safety risk to themselves, fellow workers & their employee

Mental health professionals estimate up to 10% of the adult population in the US suffers from clinical depression.

Depression results costs the US economy over 200 million lost workdays & \$43.7 billion annually.

Including \$23.8 billion in absenteeism & lost productivity.

Studies suggest that depressed workers may be more prone to accidents.

Lack of concentration, fatigue, failing memory and slow reaction time are reasons workers may not work safely.

## Warning Signs



Safety & health professionals should be alert to the warning signs of clinical depression in employees.

Persistent dreary moods. (sadness, anxiety, nervousness)

Sleeping on the job or persistent drowsiness.

Sudden weight loss or gain; Chronic physical problems.

General loss of interest, restlessness, inability to concentrate, or irritability.

Forgetfulness or an inability to make simple decisions.

Persistent feelings of guilt; Feelings of low self-worth.

Focus on death or talk of suicide.

## Warning Signs



Safety & health professionals who recognize any or all of these symptoms in an employee should get the employee into the hands of competent mental health professionals right away.

Approach the employee's supervisor & recommend referring the employee to the company's employee assistance program (EAP) or HR department.

If the supervisor is uncomfortable, or does not know how to go about it, recommend that he/she use the statement suggested by the Society for Human Resource Management:





*“I’m concerned that recently you’ve been late to work often and are not meeting your performance objectives.”*

***“I’d like to see you get back on track.”***

“I don’t know whether this is the case for you, but if personal issues are affecting your work, you can speak confidentially to one of our employee assistance counselors.”

**“The service was set up to help employees.”**

“Our conversation today and appointments with the counselor will be kept confidential.”

**“Whether or not you contact this service, you will still be expected to meet your performance goals.”**

## MANAGEMENT FAILURES AND CAUSATION



A leading cause of accidents in the workplace is failure of management to ensure a safe & healthy work environment.

The level of management with the most direct, hands-on, day-to-day responsibility for workplace safety & health is the supervisory level.

Supervisors should be assigned responsibility for the work environment and for the safety of employees in their units.

Safety & health professionals should be readily available to help supervisors fulfill this responsibility.

## Supervisor Role in Workplace Safety & Health



Key responsibilities of supervisors relating to workplace safety and health include the following:

- Orienting new employees to the safe way to do their jobs.
- Ensuring new & experienced employees receive safety & health training they need on a continual basis.
- Monitoring employee performance and enforcing safety rules and regulations.
- Assisting safety & health professionals in conducting accident investigations and developing accident reports.
- Keeping up-to-date on safety issues.
- Setting a positive example for employees that says *"The safe way is the right way"*.

## Management Failures That Cause Accidents




If management is serious about providing a safe and healthy work environment for employees it must...

- Show employees that safe, healthy work practices are expected by including such practices in job descriptions.
- Monitor employee work practices, and set an example of safe & healthy work practices
- Provide training in how to work safely, including orientation training for new employees and ongoing updated training for experienced employees.
- Include safe & healthy work practices as criteria in the periodic performance appraisals of employees.
- Reinforce safe & healthy work practices by rewarding and recognizing employees who use them.

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