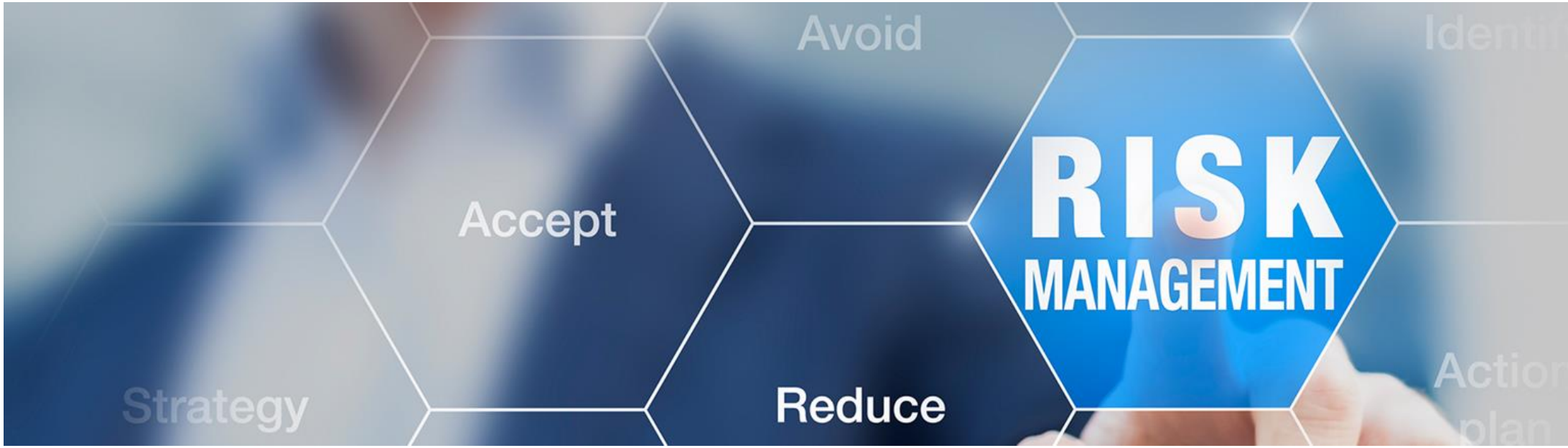
Risk Management



Learning Outcomes

At the end of this lesson, the learner will be able to explain the specific exam blueprint topics referenced in ASP Domain 2, Knowledge item 2 and CSP Domain 3, Knowledge item 3; concepts, techniques, and facts related to risk analysis, risk evaluation, cost/benefit analysis, insurance, risk transfer, hazard analysis, and risk assessment needed to prepare for the ASP and CSP exams.

No actual questions are used. I rewrote the main questions.

Risk Management and Risk Control

- **Risk Management -** technique or profession of assessing, minimizing, and preventing accidental loss to a business through the use of **insurance and safety measures.**
- **Risk Control** a step in the hazard management process. It involves finding a way to neutralize or reduce an identified risk (synonym = Loss Control)

More Terms

- Pure Risk - chance of loss or no loss, but no chance o gain (Ex: risk of becoming disabled because of an injury; risk of floods, fires, hurricanes)
  - Person, Property, Liability
  - Insurance companies only insure pure risk
- Speculative Risk - chance of loss, no loss, or gain (Ex: buying company stock)

Four Types of Loss Exposures

- Property Loss - loss from damage to property in which has a financial interest
  - Tangible Ex: equipment
  - Intangible Ex: copyright or patent
- Liability Loss - possibility of a loss from injury or damage claim
- Personal Loss - loss of a key person depriving organization of hard-to-replace skill or knowledge (from death, disability, retirement, resignation)
- Net Income Loss - possibility of loss due to reduction in net income

Four Classes of Hazards

- Moral - loss resulting from a person acting dishonestly (intentional, exaggerate, fabricate)
- Morale - loss from careless or indifferent behavior (Ex: failure to replace a machine guard)
- Physical - loss from condition of person, property, or operations
- Legal - legal environment which increases frequency or severity of loss (Ex: a court in a specific area may be more likely to favor a plaintiff or large award)

Knowledge Check

Which pure risk situation is covered by worker's compensation insurance?

A. Risk of lightning strike damaging company equipment

B. Risk of building value dropping

C. Risk of vehicle damage in a car accident

D. Risk of amputating a finger in a machine

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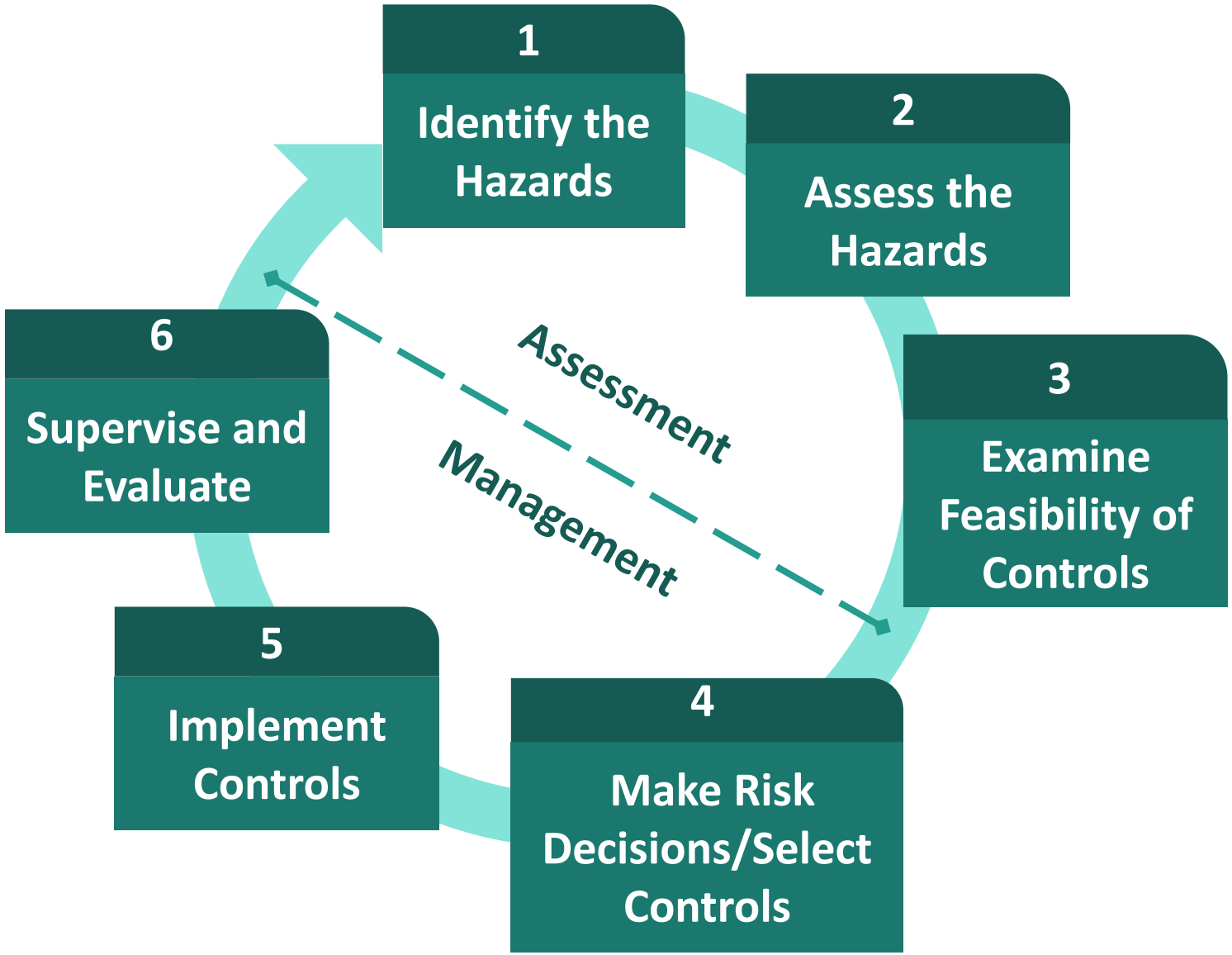
Risk Management

The Identification, Evaluation, and Prioritization of Risks



Knowledge Check

Risk Control

A.Is a subset of Risk Management

B. Always has a goal of zero injuries and illnesses in order to reduce costs

C. Prioritizes costs in the risk decision making process

D. Minimizes risk through safety interventions and insurance

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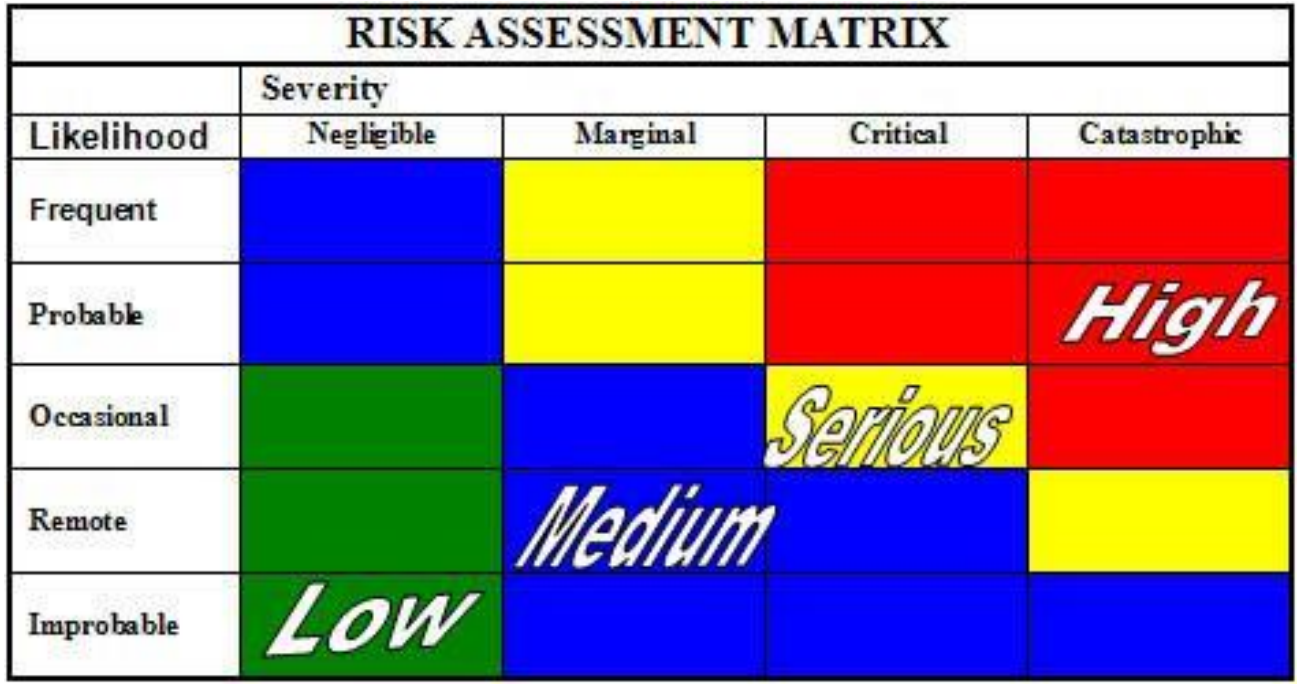
Hazard Identification and Assessment

Ongoing process to identify and assess **workplace hazards**.

- **Hazard:** What can go wrong?
- **Consequences:** How bad could it be?
- **Likelihood:** How often might it happen?

Risk Assessment Matrix Tool

- Safety Professionals may use a Risk Assessment Matrix to assess the various risks of hazards.
- This typically occurs during a job hazard analysis, and allows the organization to manage risk effectively and reduce workplace illnesses and injuries.
- **Ensure that you "Assess Each Job."**



Knowledge Check

10. A risk matrix is traditionally based upon two general elements. Those elements are:

a. The person’s injury index and affected cost of medical treatment.
b. The probability of occurrence and severity of outcome.
c. Skill of worker and work environment.
d. Frequency of task and number of workers involved.

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Risk Transfer

- A risk management and control strategy that involves the contractual shifting of a pure risk from one party to another
- Risk Transfer - if a problem occurs, who is responsible/has to pay

Knowledge Check

Risk transfer is a

A. Method for resolving direct vs. indirect costs of injuries/illnesses

B. Process which is ideally suited for use with a risk matrix

C. Technique which shifts financial risk from one party to another

D. Safety principle involving worker rotation to reduce chemical exposures.

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FINANCIAL JUSTIFICATION OF HAZARD CONTROLS

RETURN ON INVESTMENT (ROI)

$$ROI = \frac{\text{Gain from Investment - Cost of Investment}}{\text{Cost of Investment}}$$

Injury/illness cost for 1 year = $1,100,000

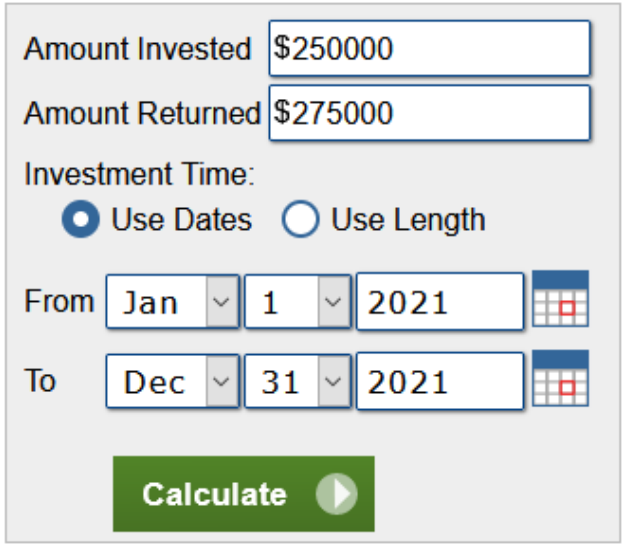
Hazard control cost for 1 year = $250,000

Eliminate 25% of losses 1 year Gain = $275,000

$275,000 - $**250,000**/$250,000 = 0.1

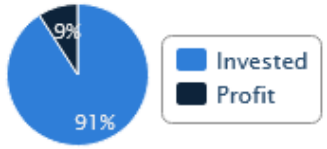
10% ROI for one year

Return on Investment (ROI) Calculator



Result

Investment Gain	$25,000.00
ROI	10.00%
Annualized ROI	10.00%
Investment Length	1.00 years



Knowledge Check

Return on Investment calculations are useful for

A. Calculating an incremental budget

B. Showing financial risk

C. Determining whether to use PPE or engineering controls

D. Determining the profitability of an expenditure.

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Pareto Principle

The Pareto Principle states that for many outcomes, roughly 80% of the consequences come from 20% of the causes.

- *A rough general and financial principle. Know the term!*
- *Useful for assessing risks and prioritizing action*
- *Useful for taking action on your workload*

Process Safety Management (PSM)

- Safety program aimed at unexpected releases of toxic, reactive, flammable liquids or gases
- Bhopal 1984 5295+ deaths Methyl Isocyanate gas
- Institute, WV 1985 Union Carbide, many more cases
- Where do PSM hazards often fall on the risk management matrix?
- 1990 Clean Air Act Amendments requirements for OSHA and EPA
  - OSHA Develop PSM standard
  - EPA List of chemicals and Risk Management Plan

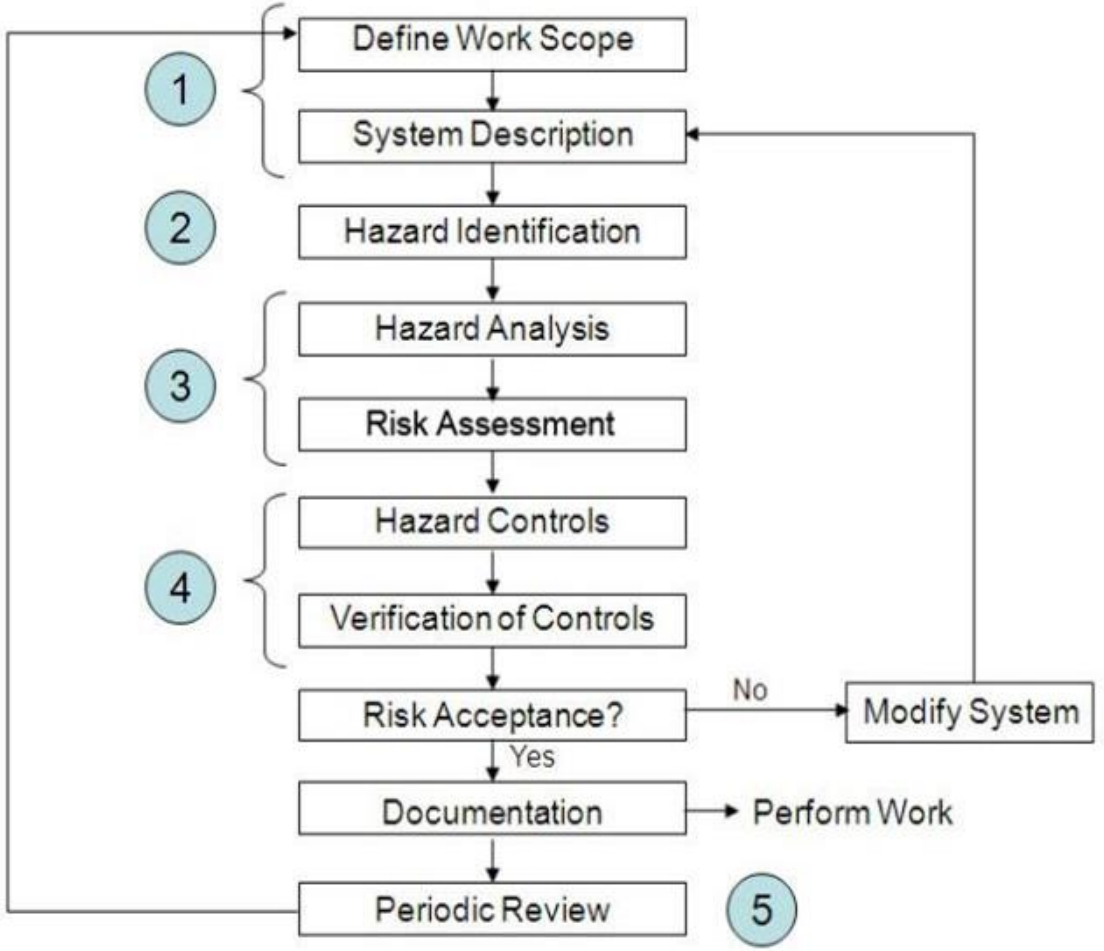
Process Safety Management Program Elements

No.	Name of Element
(1)	Process Safety Information
(2)	Employee Participation
(3)	Process Hazard Analysis
(4)	Operating Procedures
(5)	Hot Work Permits
(6)	Mechanical Integrity
(7)	Contractors
(8)	Training
(9)	Management of Change
(10)	Pre-startup Safety Review
(11)	Emergency Planning and Response
(12)	Incident Investigation
(13)	Compliance Audits
(14)	Trade Secrets

= New or unusual for an OSHA Standard

Process Hazard Analysis (PHA)

- Generic term for process hazard study
- Structured brainstorming to identify hazards not currently known
- Qualitative
- Method to determine plant or process chemical hazards and develop policies, procedures and safeguards against emergencies which may occur



Knowledge Check

The Process Safety Management program

A. Closely parallels FEMA's Risk Management Program

B. Applies to all chemical processes

C. Begins with a Process Hazard Analysis

D. Requires submitting hazard determinations to the state environment board.

Knowledge Check

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Process Hazard/Root Cause Analysis Needs

- Information
  - Full description of process
  - Piping and instrumentation diagrams (P&IDs)
  - Layout drawings
  - Hazardous area drawings
  - Safety data sheets
  - Relevant codes or standards
  - Plant operating manual (for an existing plant)
  - Outline operating procedures (for a new plant)
- Team
  - Chair
  - Engineers (design, process, electrical, instrumentation)
  - Operations manager
  - Operators, Supervisors
  - Recorder

HAZOP Guide Words

- A **HAZOP** study encourages the use of "**guide words**" to help explore where the procedure could **deviate** from its **intended function**.
- Each **guide word** has a set meaning when applied to different **nodes**, or variations, of the plan.

Guideword	Interpretation
No/None	Complete negation of the design intention / No part of the intention is achieved and nothing else happens
More	Quantitative increase
Less	Quantitative decrease
As Well As	All the design intention is achieved together with additions
Part of	Only some of the design intention is achieved
Reverse	The logical opposite of the design intention is achieved
Other than	Complete substitution, where no part of the original intention is achieved but something quite different happens
Early	Something happens earlier than expected relative to clock time
Late	Something happens later than expected relative to clock time
Before	Something happens before it is expected, relating to order or sequence
After	After Something happens after it is expected, relating to order or sequence

Example: More flow (in a process) ---> Is more flow possible ---> Yes ---> Is it a hazard or is it inefficient?

Knowledge Check

A PHA is often done using HAZOP. What cues are used when conducting a HAZOP?

A. P&IDs

B. Design FMEAs

C. Ishikawa diagrams

D. Guide words

Knowledge Check

A PHA is often done using HAZOP. What cues are used when conducting a HAZOP?

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Failure Mode and Effects Analysis

- Used during design to prevent failures
- Two most common types are Design FMEAs and Process FMEAs
- Failures are **prioritized** according to:
  - **how serious** their consequences are,
  - **how frequently** they occur, and
  - **how easily** they can be detected.
- The **purpose** of the FMEA is to **take actions** to eliminate or reduce failures, starting with the highest-priority ones.

Failure Mode and Effects Analysis

- **Failure Modes and Effects Analysis** (**FMEA**) is a step-by-step approach for identifying all possible failures in a design or process.
- "**Failure modes**" means the **ways** in which something might fail.
- "**Effects analysis**" refers to studying the **consequences** of those failures.

FAILURE MODE & EFFECTS ANALYSIS (FMEA)

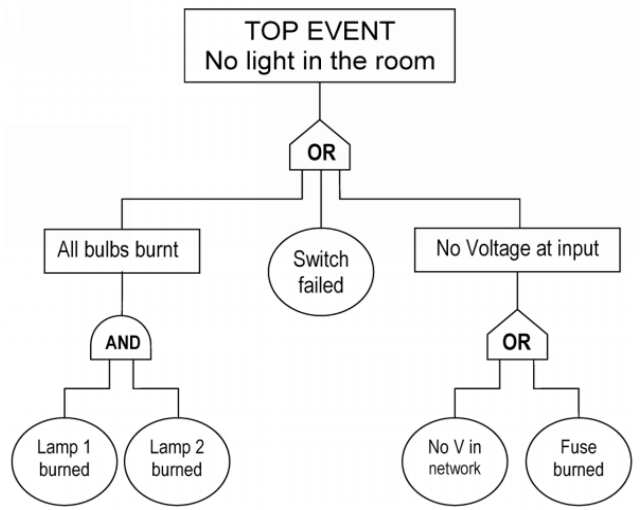
Date: 1/1/2018

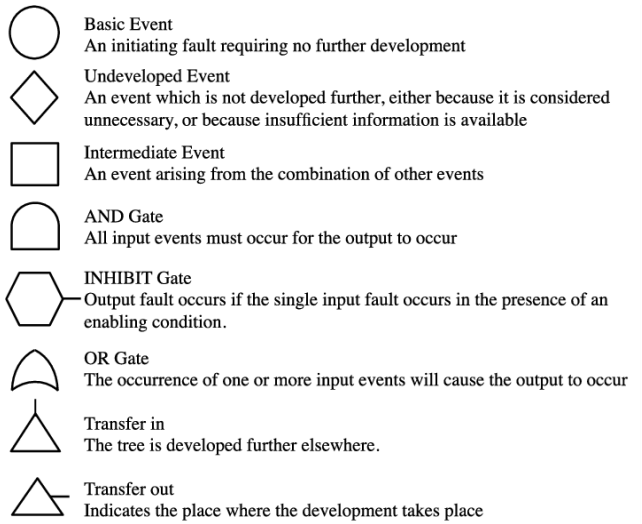
Revision: 1.3

Process Name: Left Front Seat Belt Install Process Number: SBT 445

Failure Mode	A) Severity Rate 1-10 10=Most Severe	B) Probability of Occurence Rate 1-10 10=Highest Probability	C) Probability of Detection Rate 1-10 10=Lowest Probability	Risk Preference Number (RPN) AxBxC
1) Select Wrong Color Seat Belt	5	4	3	60
2) Seat Belt Bolt Not Fully Tightened	9	2	8	144
3) Trim Cover Clip Misaligned	2	3	4	24

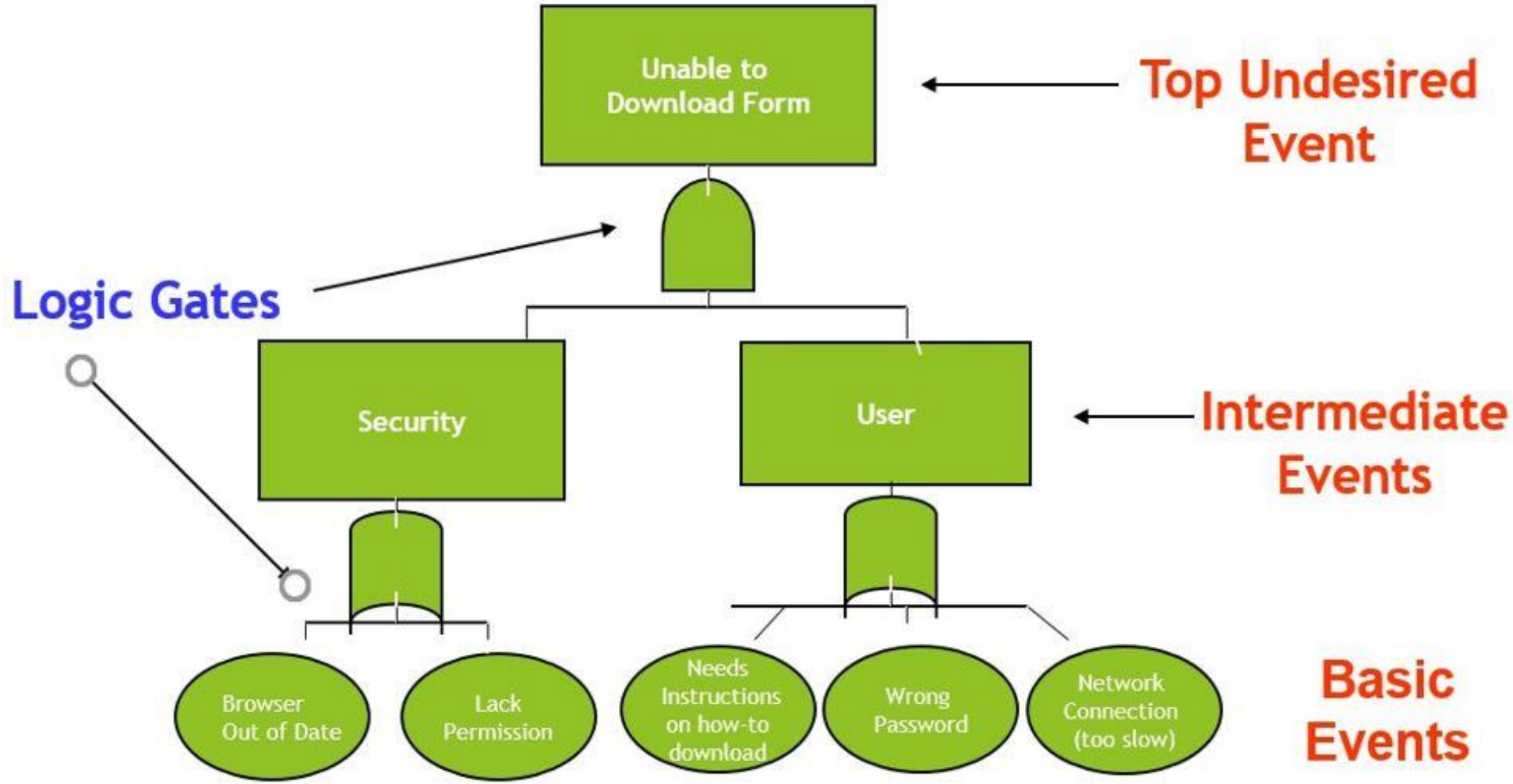
Fault Tree Analysis



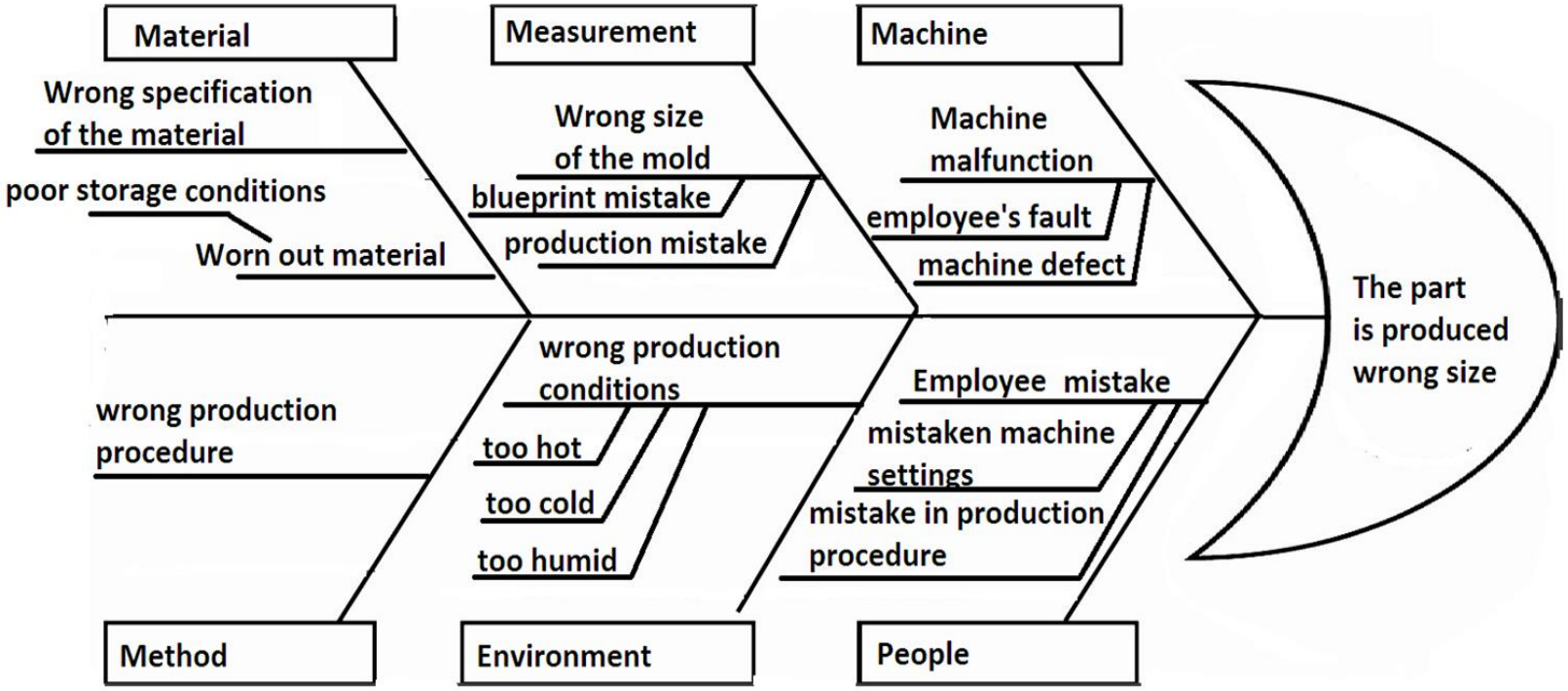


- System design or improvement
- Identifies causes of a particular incident.
- **Top-down diagram** used to identify **where** and **how** the system can fail.
- **Top event** is system failure
- An FTA **maps** out the **combinations** of equipment failure and human error that can lead to a **worst-case scenario**.
- FTA can be used to determine **proactive steps** to address the **root cause** and avoid or reduce the risk.

Fault Tree Analysis



Fishbone Analysis



- A **fishbone** or **Ishikawa diagram** is a **cause-and-effect diagram** that helps track down the reasons for imperfections, defects, or failures.
- The diagram looks like a **fish's skeleton** with the **problem** at its **head** and the **causes** for the problem feeding into the **spine**.
- Helps to identify the **underlying causes** of any problems.

Knowledge Check

One of the most commonly used Process Hazard Analysis tools Process Safety Management is

A. Hazard and Operability Analysis HAZOP

B. Job Hazard Analysis JHA

C. Systemic Cause Event Tree SCET

D. Energy Flow Analytical Procedure EFAP

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What-If Analysis

- Tasks an **interdisciplinary team** with examining a given process and generating "**What if**" questions to test it for hazards.
- Team **walks** the process and **talks** to those in charge of running and maintaining it.
- The team then brainstorms **possible hazards** by posing the question "**what if..?**"
- Well-suited for Management of Change studies

What-If and Checklist Analysis

Summary of the "What-if" Review of a Vessel's Compressed Air System				
What if…	Immediate system condition	Ultimate consequences	Safeguards	Recommendations
1- The intake air filter begins to plug	Reduced air flow through the compressor, affecting its performance	Inefficient compressor operation, leading to excessive energy use and possible compressor damages. Low or no air flow to equipment, leading to functional inefficiencies and possibly outages.	Pressure/vacuum gauge between the compressor and the intake filter. Annual replacement of the filter. Rain cap and screen at the air intake	Make checking the pressure gauge reading part of someone's weekly round **OR** Replace the local gauge with low pressure switch that alarms in a manned area.
2- Someone leaves a safety valve open	High air flow rate through the open valve to the atmosphere	Low or no air flow to equipment leading to functional inefficiencies and possibly outages. Potential for personnel injury from escaping air or blown debris.	Small drain line would divert only a portion of the air flow, but maintaining pressure would be difficult.	

Knowledge Check

2. Which are the key elements of a “what if” hazard analysis?

a. Designed to support a root cause analysis
b. Requires minimal time, has few resources, and needs little preparation
c. Fulfills regulatory requirement for pre-task planning
d. Cost effective, uses a multi-skilled team, and is qualitative in its approach

Knowledge Check

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Other Types of Analysis Methods

- Subsystem Hazard Analysis
- Energy Trace and Barrier Analysis
- Change Analysis
- Systemic Cause Analysis Technique (SCAT)

Management of Change (MOC)

- Management of Change (MOC) is a systematic approach to dealing with organizational change, typically in industrial facilities and operations.
- Written procedures must be implemented to manage changes.

PSM MOC Examples

- Modification of heating coils
- Replacement of motor drives
- Increasing process temperature
- Changing process viscosity
- Change in catalyst and boosters
- Installation of new lines in the process
- Disconnection of the cooling water system
- New instrumentation
- Changes in raw materials...

Knowledge Check

5. How can the effective management of potential risks at the task level be accomplished?

a. Keeping other workers out of the work area.
b. Using the proper personal protective equipment.
c. Compiling and discussing a job safety analysis with workers.
d. Hiring workers certified in performing the task.

Knowledge Check

5. How can the effective management of potential risks at the task level be accomplished?

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Questions