FPST 2023 – Industrial and Occupational Safety

Safety Through Design
Part 1

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What is Occupational Safety?

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Occupational Safety

- Protecting the safety and health of people engaged in work or employment through assessing, eliminating/mitigating risk and fostering a safe work environment
  - Protecting People, Property, Process, and the Environment

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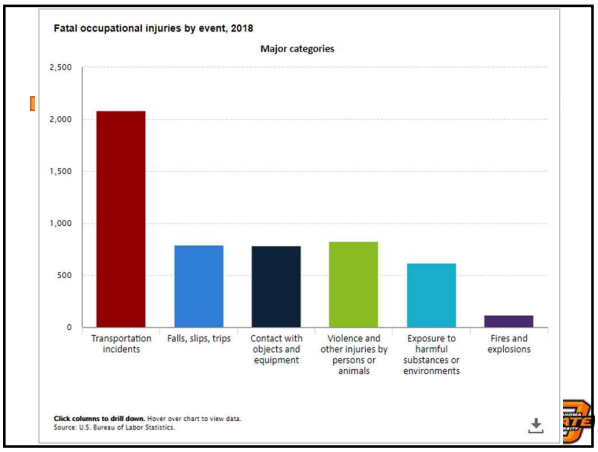

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29 USC 654 Section 5(a)(1)

"The Employer shall furnish each employee …a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

What is this section typically referred to as?

OSHA's General Duty Clause

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Safety Through Design

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Safety thru Design

Defining safety through design

Integrating **hazard analysis** and **risk assessment** methods **early** in the design and redesign process and taking the actions necessary so that the risks of injury or damage are at an acceptable level.

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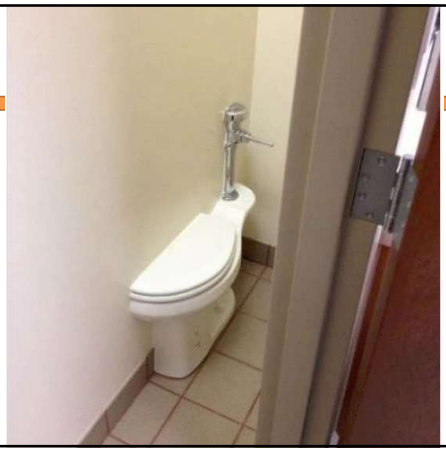

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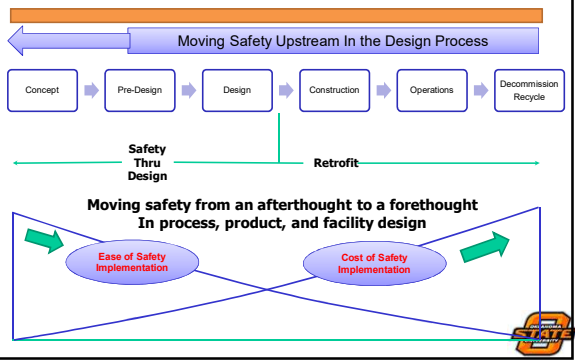
Designing Safety into the Workplace



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We can identify hazards and analyze risks at any step in this process

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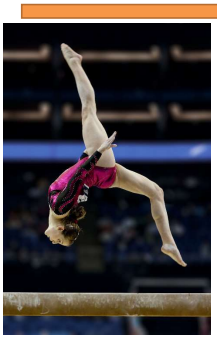
Are all hazards bad?



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Are all hazards equal?

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Risk Assessment Matrix

Consequence (C)		Likelihood (L)				
		L1	L2	L3	L4	L5
		Very Unlikely	Unlikely	Possible	Likely	Almost Certain
C5	Severe	Medium	High	High	Very High	Very High
C4	Major	Medium	Medium	High	High	Very High
C3	Moderate	Low	Medium	High	High	High
C2	Minor	Low	Low	Medium	Medium	High
C1	Negligible	Low	Low	Medium	Medium	High

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Consequence [C]		What could go wrong? How would it affect me or others?
C5	Severe	Loss of life, limb, or eyesight or multiple severe injuries. Total loss of facility or operation.
C4	Major	Severe injuries, complex medical treatment, permanent incapacity, property damage greater than $50,000 or loss of partial facility/operation.
C3	Moderate	Hospitalization, restricted or lost time, property damage greater than $5,000.
C2	Minor	Medical treatment provided by a licensed professional and return to work, but no restricted or lost time. Property damage greater than $1,000 but less than $5,000.
C1	Neligible	First aid or no injury. Property damage less than $1,000.

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C4	Major	Medium	Medium	High	High	Very High
C3	Moderate	Low	Medium	High	High	High
C2	Minor	Low	Low	Medium	Medium	High
C1	Negligible	Low	Low	Medium	Medium	High

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Likelihood [L]		What is the reasonable probabilty that consequences will occur?
L5	Almost Certain	It is expected to occur imminently, or at some time in the very near future.
L4	Likely	Will occur in most circumstances. Likely to be an ongoing issue.
L3	Possible	Might occur at some time.
L2	Unlikely	Occurance is not expected, but could occur in exceptional circumstances.
L1	Very Unlikely	Not expected to occur under the existing circumstances.

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C1	Negligible	Low	Low	Medium	Medium	High

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Risk Assessment Process

1. Establish parameters (system size)
2. Identify the hazards
3. Consider the failure modes
4. Determine the frequency and duration
5. Determine occurrence probability (not possibility)
6. Assess the severity of consequences
7. Define the risk
8. Rank risks
9. Develop means to eliminate/mitigate
   - Is residual risk acceptable?
10. Follow up on actions taken
11. Document the results

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Simple Risk Assessment

1. What am I doing?
2. Why am I doing it?
3. What could go wrong?
4. How could this affect me or others?
5. What can I/we do to reduce the risk?

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Is safety only an industrial issue?

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What is a Hazard?

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Safety vs. Health

Safety	Health
Deals with **acute** effects of hazards	Deals with **chronic** effects of hazards
Safety specialist with process experience and practical on-the-job knowledge	Industrial hygienists with sophisticated instruments and scientific expertise

The goal is same: to eliminate hazards in workplaces

- Safety
- Health
- Environment

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Hazard Recognition, Evaluation and Control

Recognition

↓

Evaluation

↓

Control

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Hazard

The inherent potential in a material, a condition, and/or a situation, to **cause damage** to people, to the environment, and/or to property.

Condition, Behavior, Practice, Operation

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Different Types of Hazards

Condition

Behavior

Practice

Operation

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Types of Hazards

Condition

Behavior

Practice

Operation

27

Types of Hazards

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Behavior

Practice

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28

Types of Hazards

Condition

Behavior

Practice

Operation

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Hazard + Energy Exchange = Loss

Damage occurs when the energy exchange between the hazard and the object (people, property or environment) exceeds the capability of the object.

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Energy Exchanges

- Struck against
- Struck by
- Fall to lower level
- Fall on the same level
- Caught in (pinch or nip point)
- Caught on (snagged, hung)
- Caught between (crushed, amputated
- Contact with (harmful energy)
- Overstress/overexertion/overload
- Release of energy