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Pulp and Paper Safety Assoc. Layers of Protection Analysis

ENSAFE

Presented by:



A hand holding a camera lens against a sunset background. The lens is held in the foreground, and the sunset is visible through the lens and in the background. The background is a blurred sunset over a body of water, with the sun low on the horizon, creating a warm orange and yellow glow. The water is a deep blue. The hand is holding the lens from the side, with the fingers visible. The lens is a large, professional-style lens with a silver and black finish. The background is a soft, out-of-focus sunset scene.

LOPA Objectives

- Semi-quantitative risk analysis
- Helps support qualitative judgements
- Justifies independent engineering controls

Why LOPA?

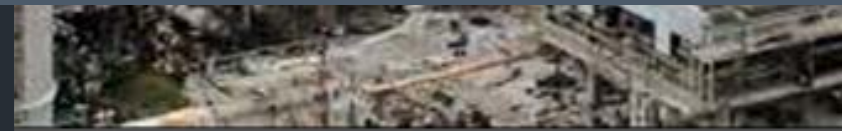
- **Flammable Liquid Storage Tank**
- PHA:
 - Deviation – Over filling leading to a fire
 - Severity = 4
 - Safeguards
 - High level alarm
 - High-High level interlock
 - Secondary containment
 - LEL detection and alarm
 - Class 1, Div. 1
 - Likelihood = 1
- Overall risk score = 4 (4X1) Acceptable





What Comprises a LOPA?

- Acceptable Risk Criteria
- Initiating Event Frequency
- Enabling Conditions
- Conditional Modifiers
- Independent Protection Layers
- Mitigated Risk



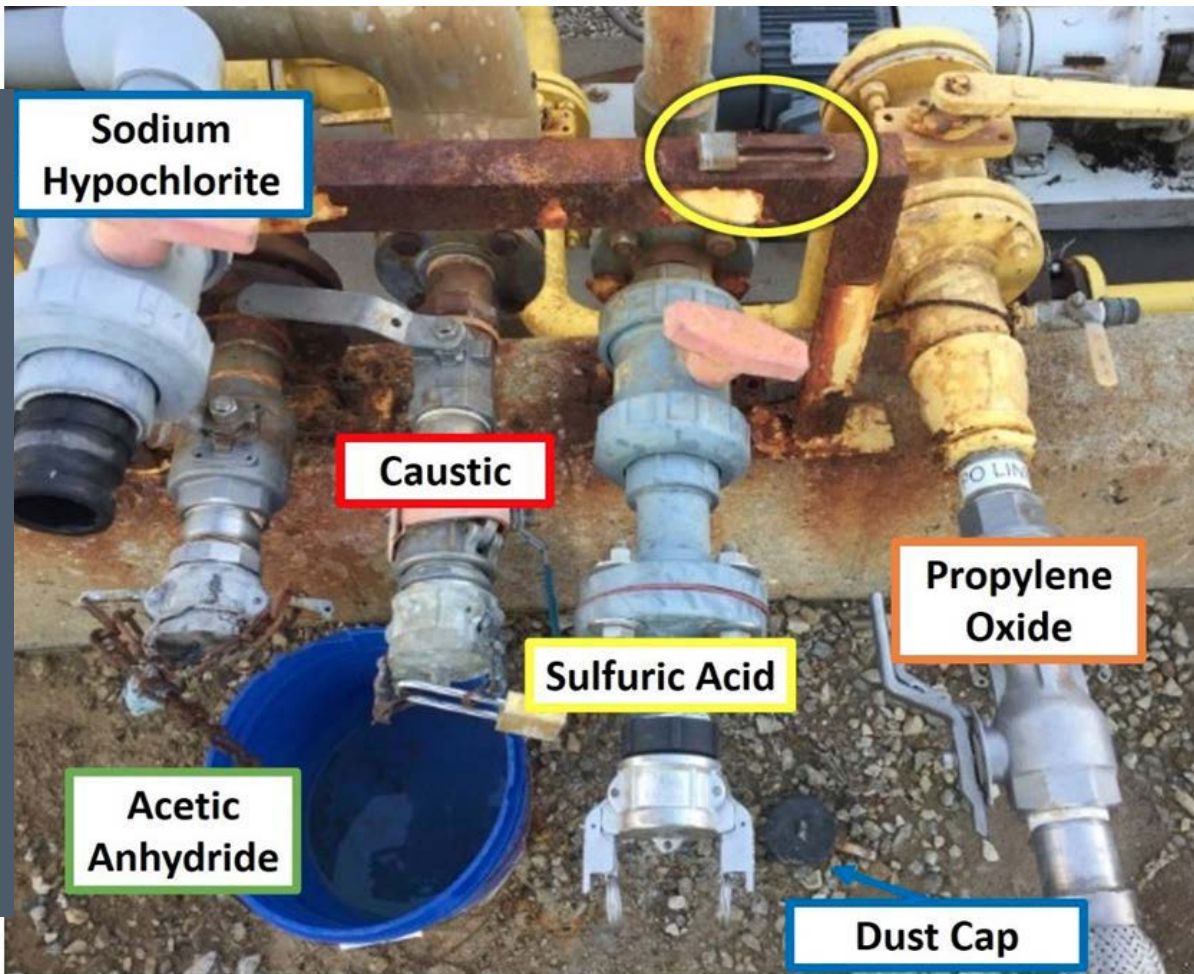


LOPA Terms

- Acceptable Risk Criteria
 - Fatality 1 in 10,000
 - Explosion 1 in 100,000
- Initiating Event Frequency
 - Opportunities for failure
- Enabling Conditions and Conditional Modifiers

Independent Protection Layers

- Independent
- Effective
- Auditable



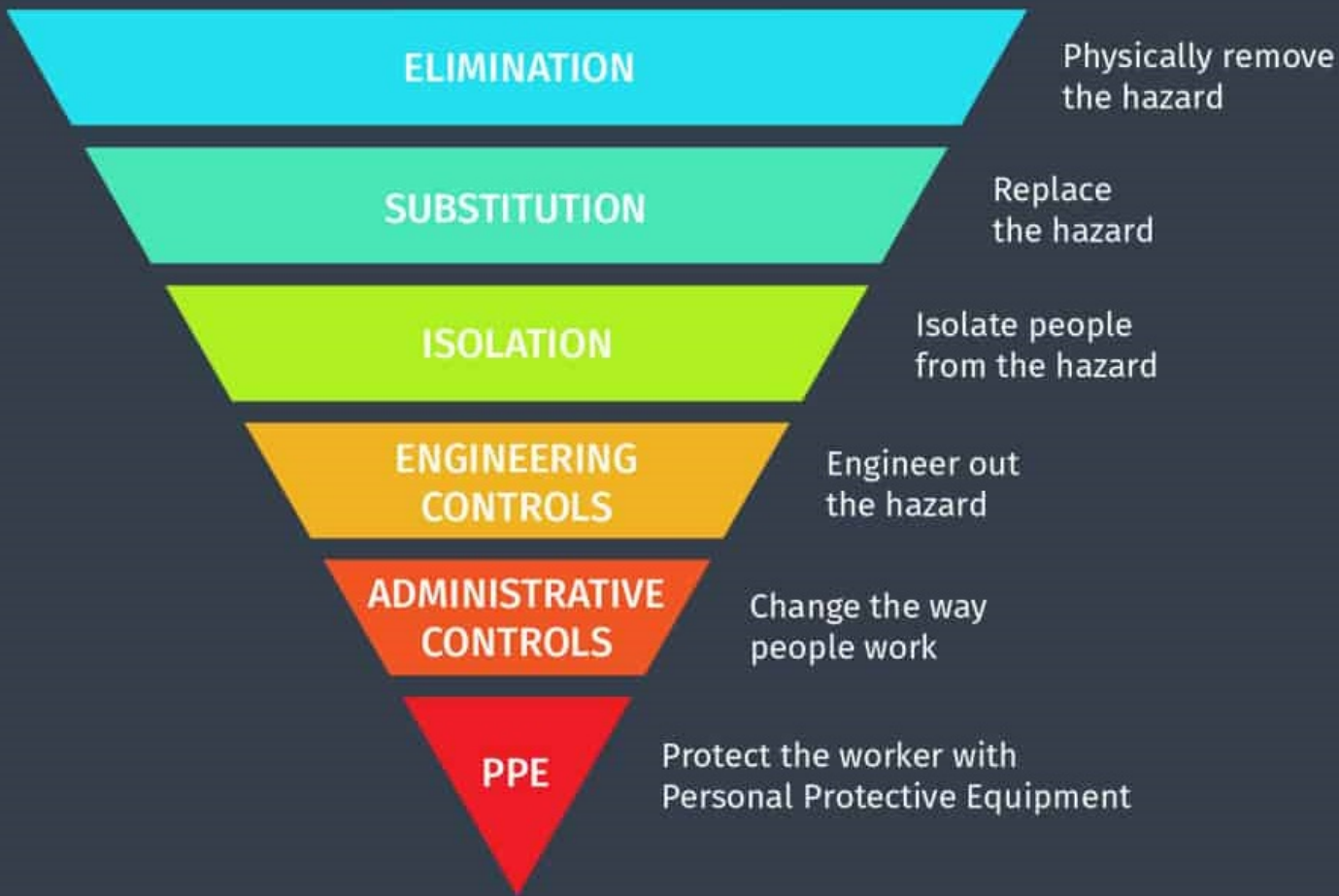
PFD – Probability of failure on demand – the probability that a given safeguard will not function when needed

- Interlocks (PFD based on SIF rating of equipment 0.001-0.1)
- Pressure relief devices (Mechanical equipment usually having a PFD 0.01)
- Human interaction (PFD is massively variable)

MOST EFFECTIVE



LEAST EFFECTIVE



Credit: National Institute for Occupational Safety & Health

Mitigated Risk (MEL)

The likelihood of this specific scenario happening with all safeguards failing

$$\text{MEL} = \text{IEF} \times \text{CM} \times \text{EC} \times \text{IPL}$$

Goal is met when $\text{MEL} < \text{Acceptable Risk}$

- Retain as supporting documentation for driving factors
- Possible change to qualitative risk ranking in PHA
- Place documentation for ongoing action tracker



When is LOPA Justified

- High residual risk in a PHA
 - Need to evaluate additional controls
- High severity deviations/events in a PHA
 - Need to evaluate effectiveness of controls
- Incident investigation –corrective actions





If You Need Our Support

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