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Pulp and Paper Safety Assoc.

Layers of Protection Analysis

Presented by:

ENSAFE

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?

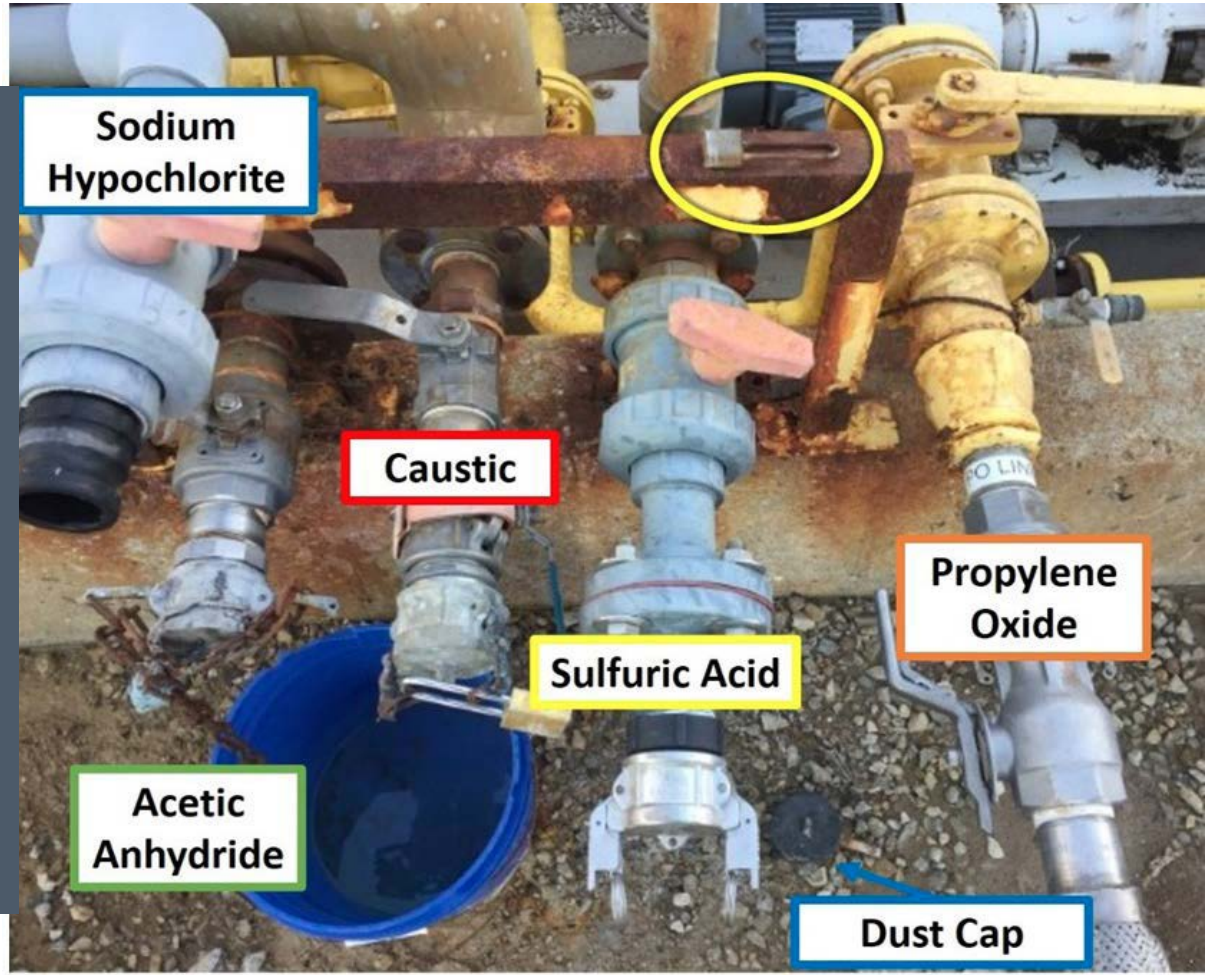
- Acceptable Risk Criteria
- Initiating Event Frequency
- Enabling Conditions
- Conditional Modifiers
- Independent Protection Layers
- Mitigated Risk

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

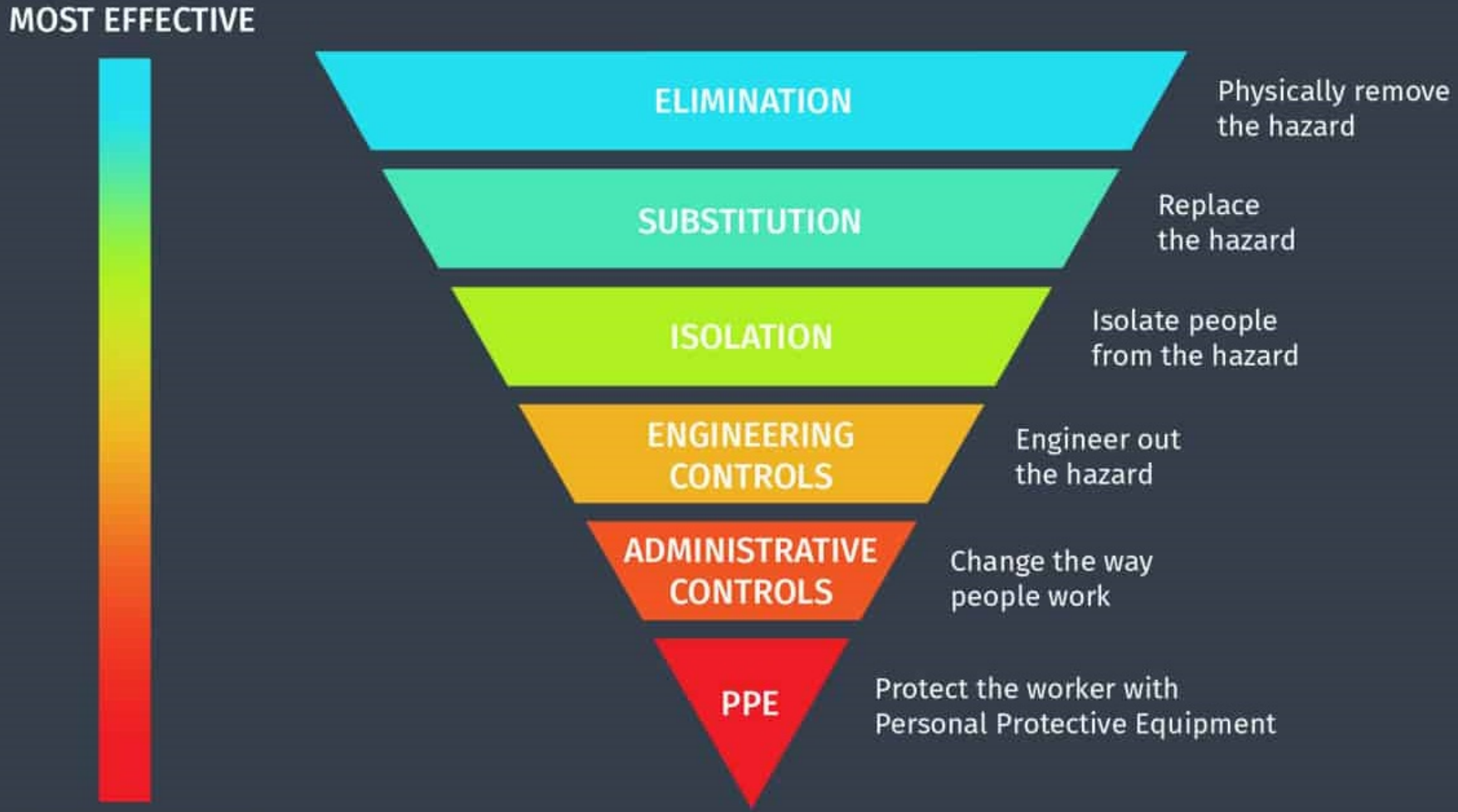
Independent Protection Layers

- 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)



Credit: National Institute for Occupational Safety & Health

Mitigated Risk (MEL)

The likelihood of this specific scenario happening with all safeguards failing

MEL = IEF x CM x EC x IPL

Goal is met when MEL < 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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