

# Bow-tie Risk Analysis

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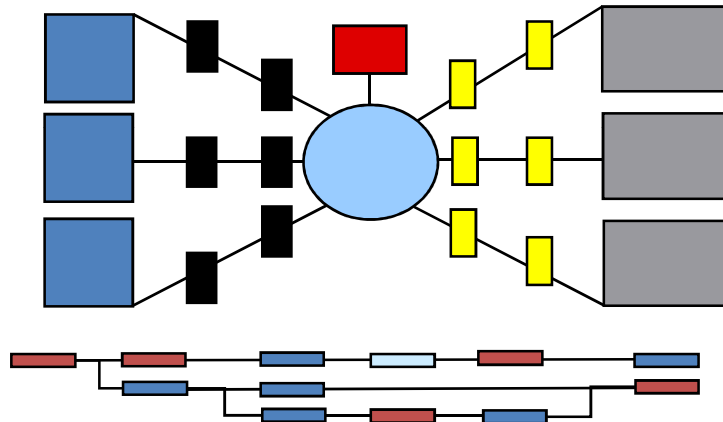


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# Objectives



- ➔ Presentation the Bow-tie methodology basic concepts



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# Risk Management



## **Risk Management is growing in importance because ...**

Increasing complexity and uncertainty in the work space

Increasing opportunities

Increasing stakeholders expectations

Need to optimize management of Upside Risks & Downside Risks

Need to optimize management of Enterprise Risk & Operational Risks

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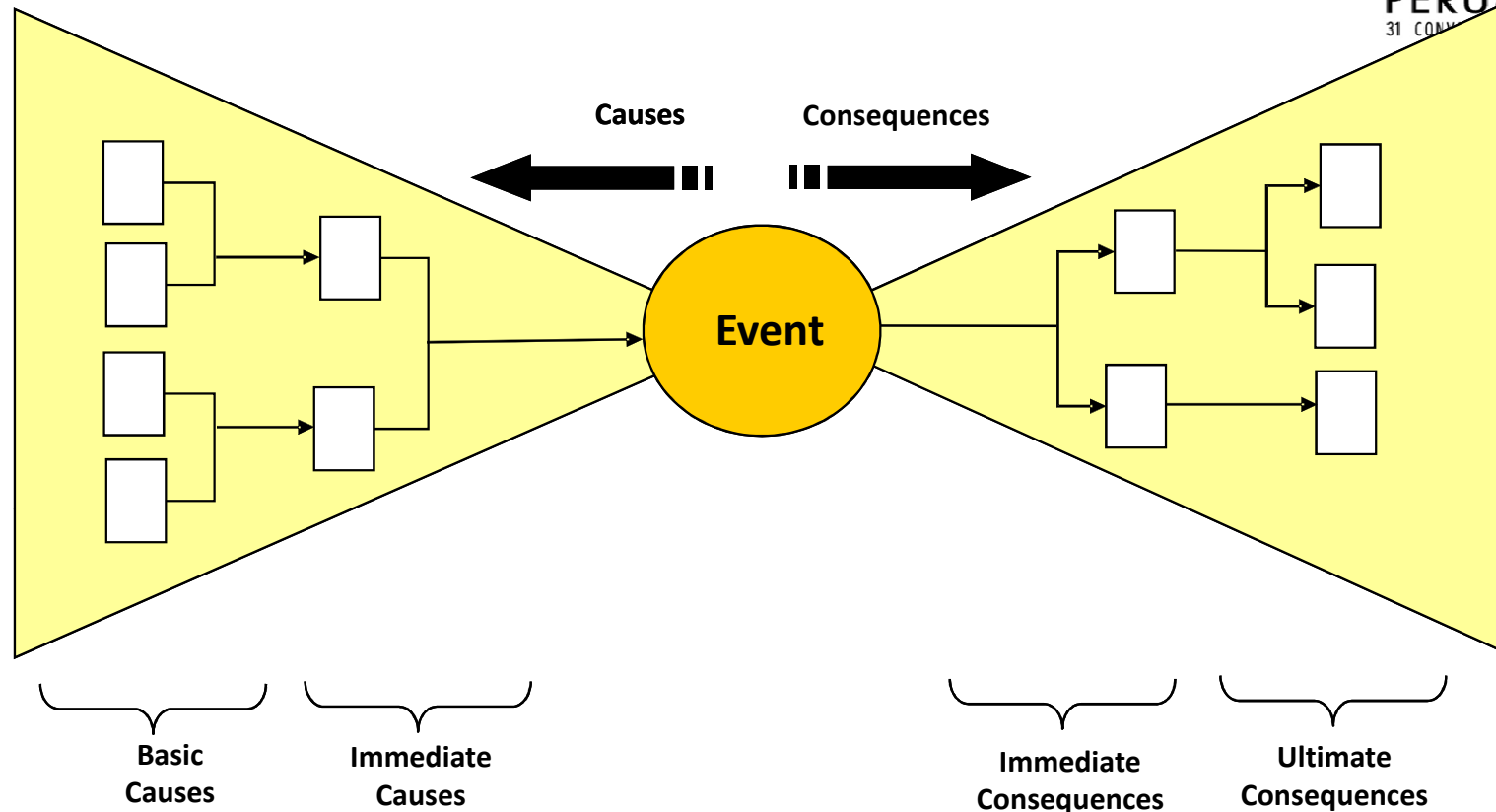


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# Risk



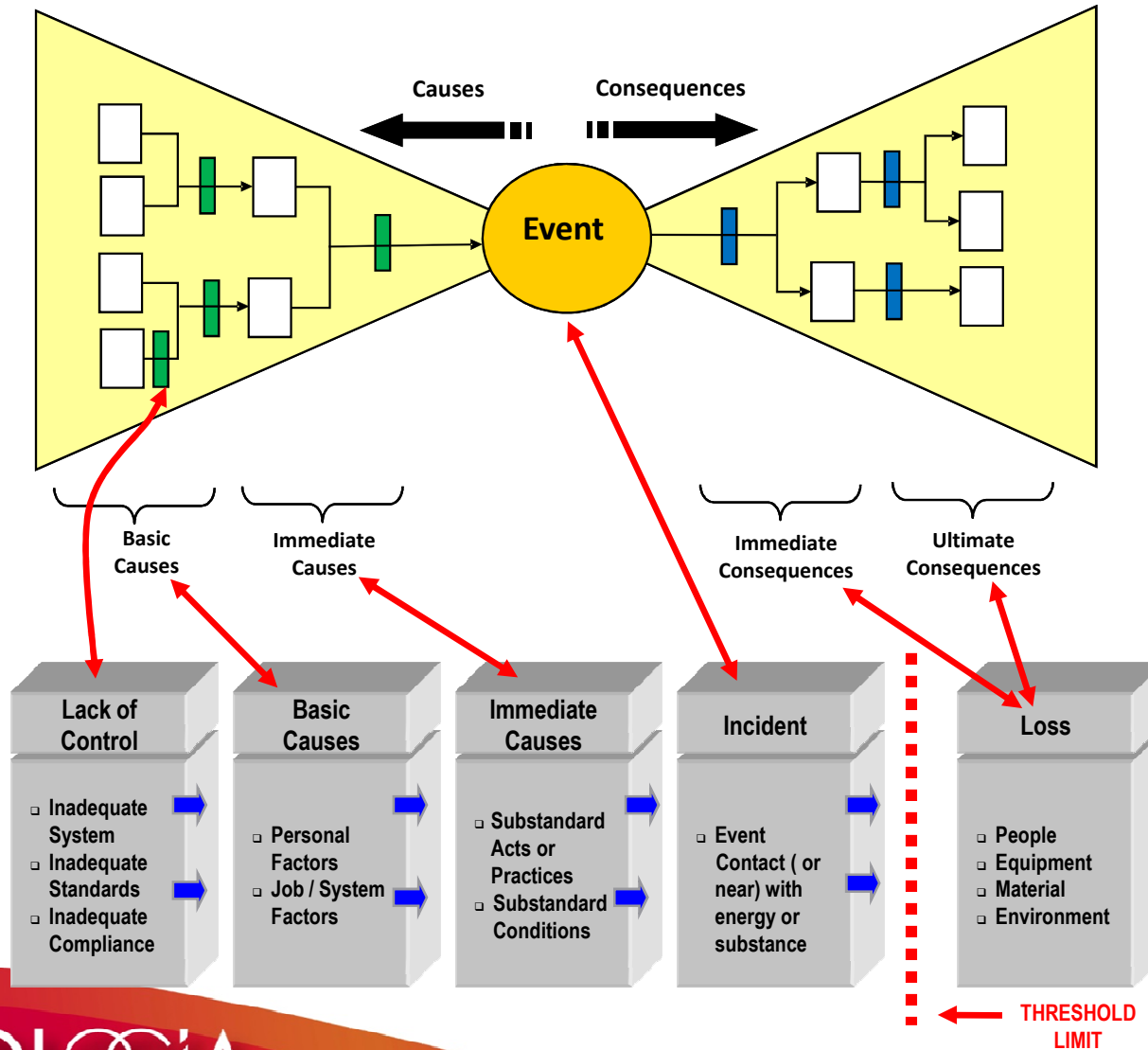
**Risk:** The combination of a event probability and its consequences (ISO/IEC Guia 73).

**Risk Management:** A process to ensure that all significant risks are identified, prioritized, and managed effectively(DNV).



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# Risk and Loss Causation

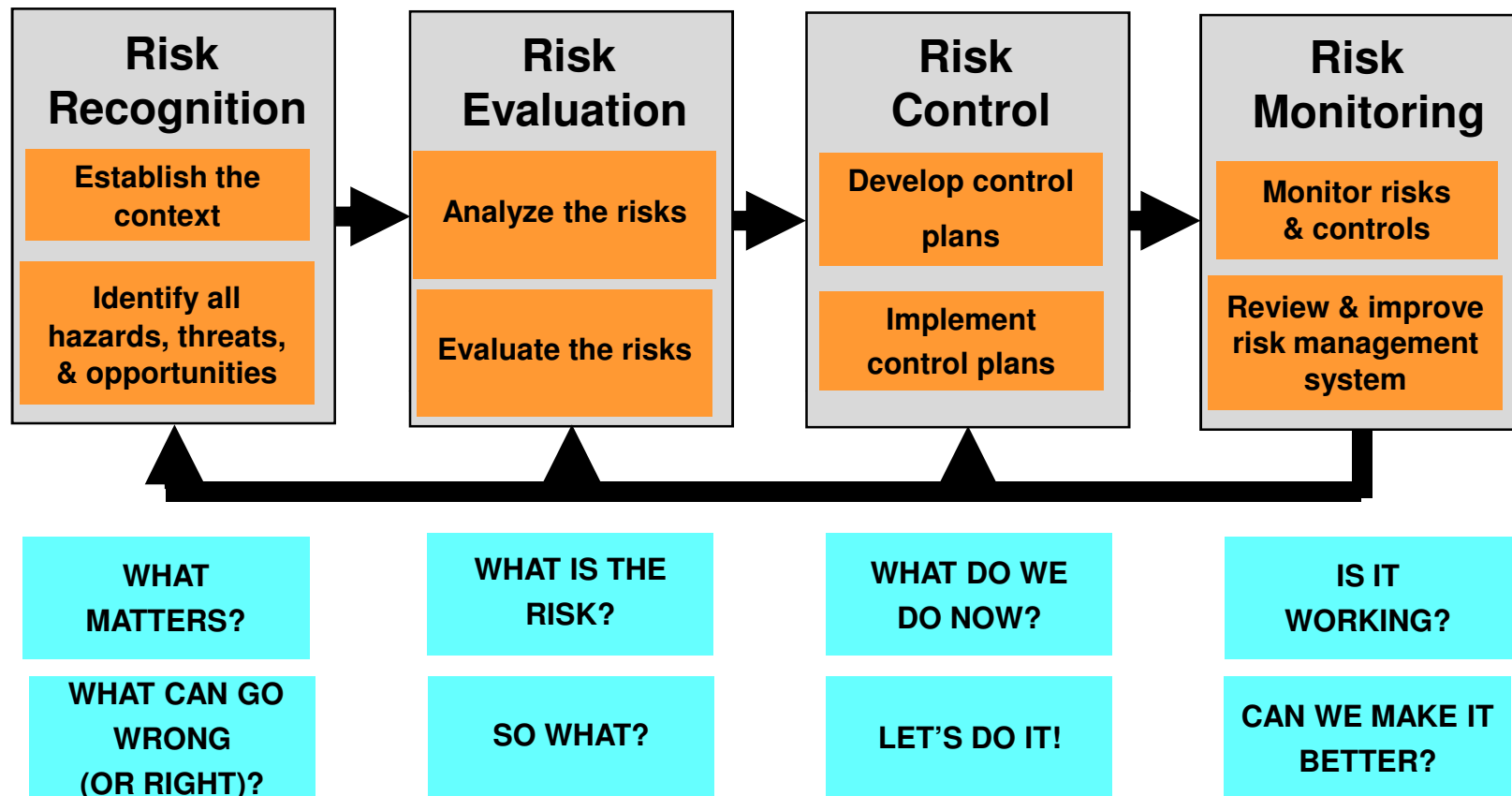


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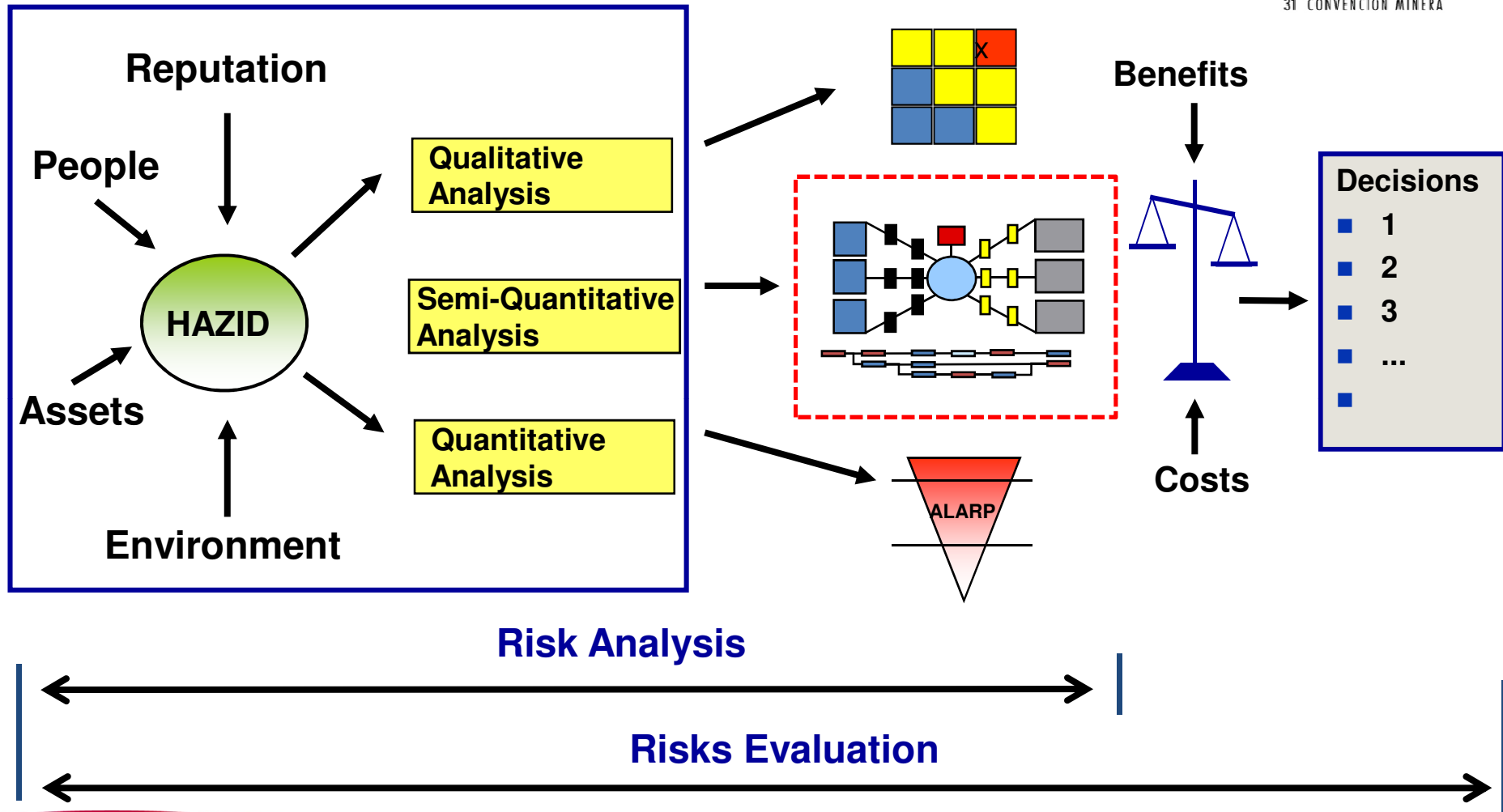
# Managing Risk





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# Risk Analysis and Assessment



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# Why Bow-tie?



- ➔ Visualization of the relationship between undesirable event, its causes, accidental scenarios, the preventive and mitigation measures to limit their consequences
- ➔ Demonstrates the effectiveness of existing controls
- ➔ Structured risk analysis where quantification is not possible or desired
- ➔ Extremely versatile / Success in various applications
- ➔ Required multidisciplinary team

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# The “Swiss Cheese” Barrier Model



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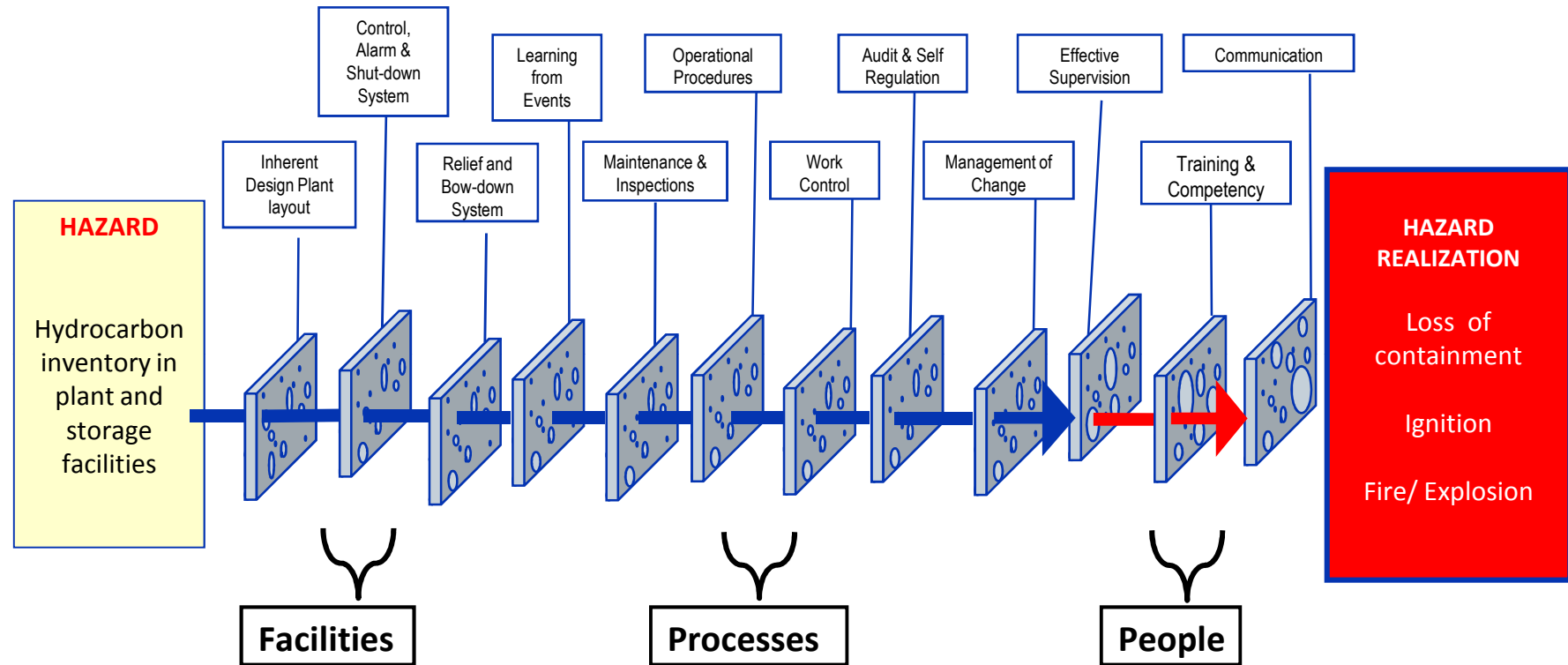


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# Prevent Barriers

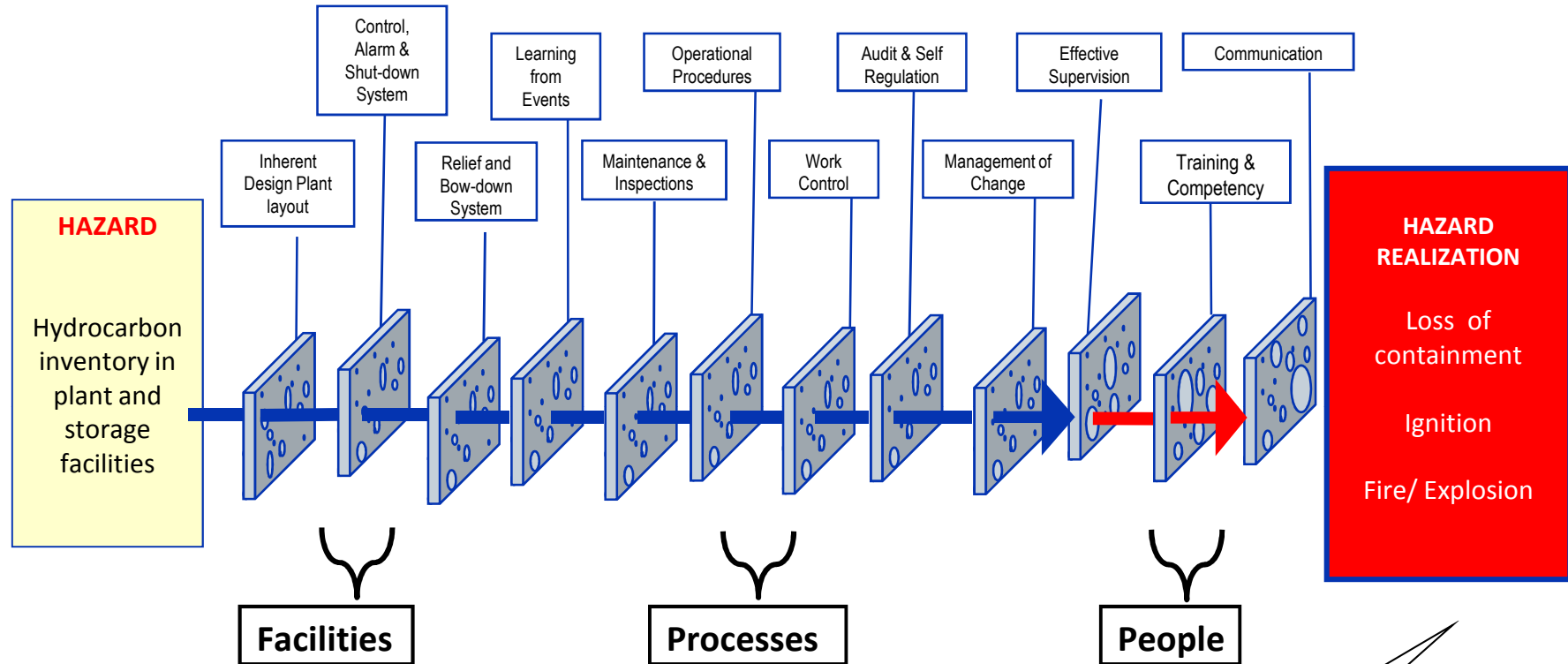


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# Prevent Barriers



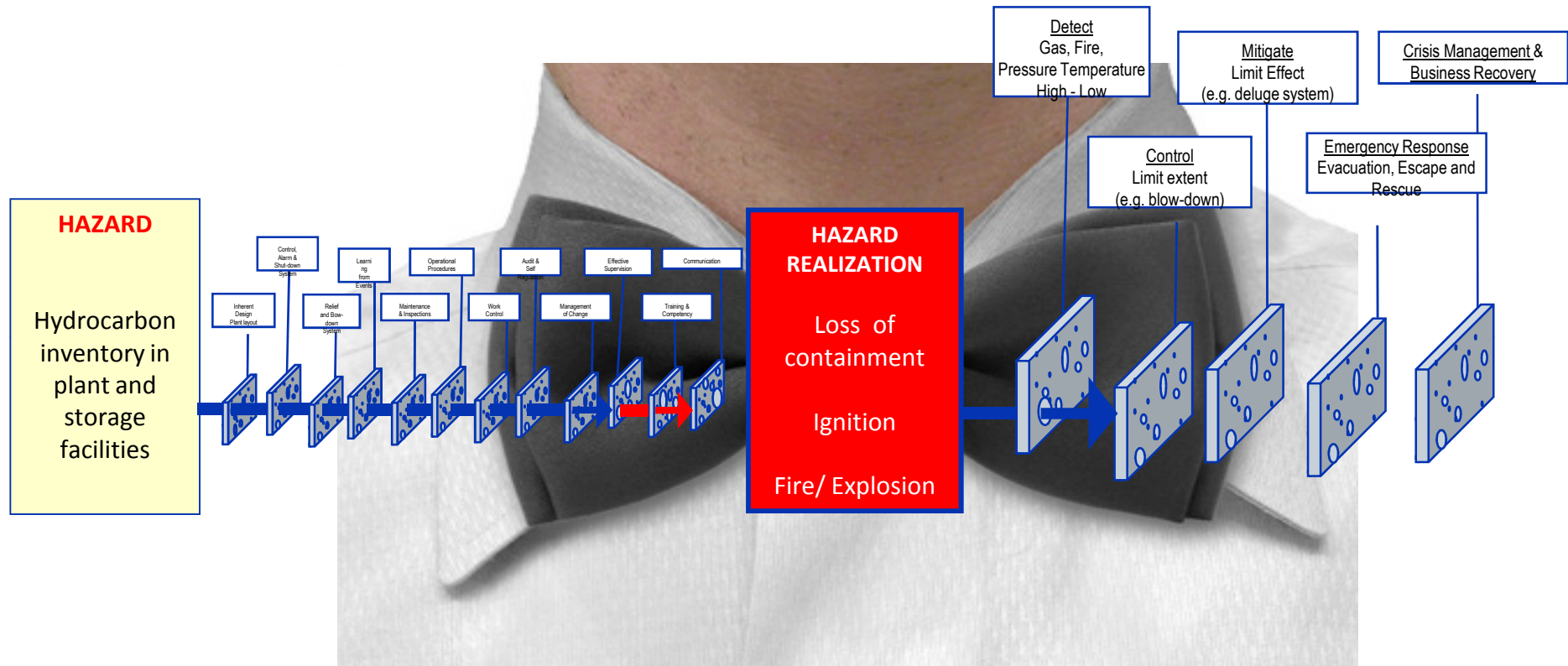
**So what do we  
do now?**

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# Detect, Control, Mitigate and Recovery Barriers

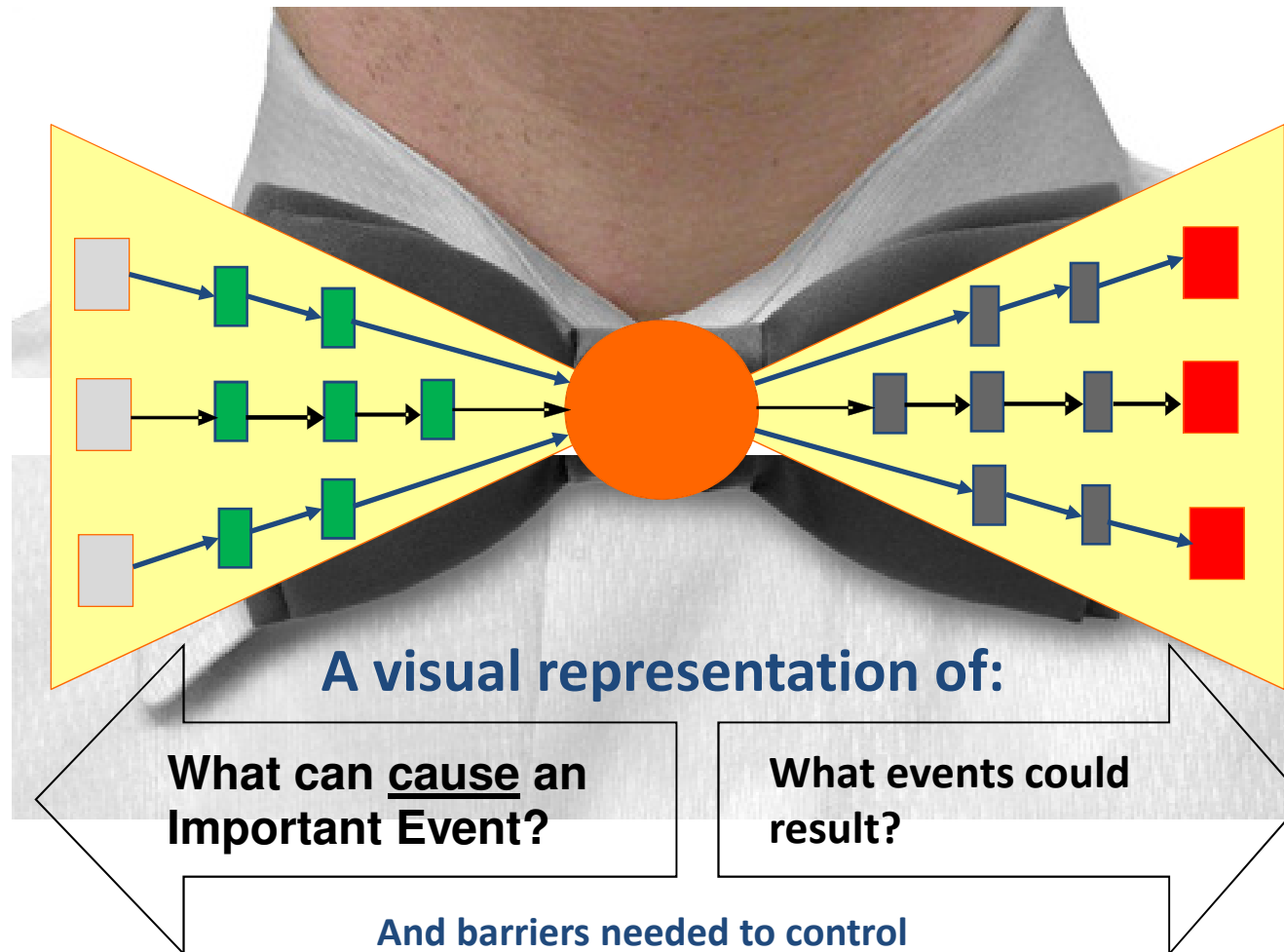


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# Bow-tie Diagram

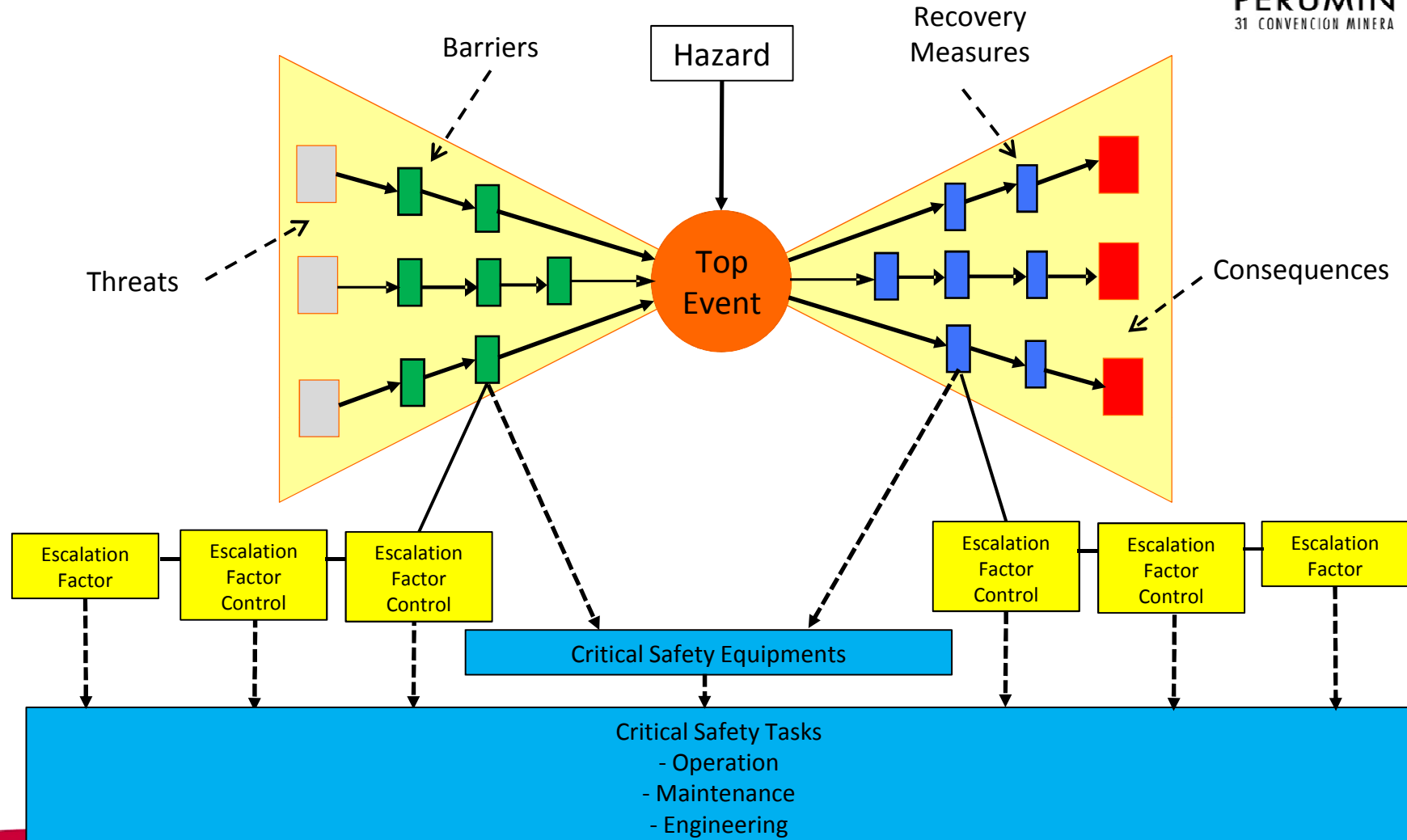


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# Bow-tie Diagram



# Bow-tie Diagram Construction

❶ Define the Hazard and the **Top Event** which is the initial consequence

"What happens when the danger is" released "?"

❷ Identify the **Threats** which are the Top Event causes

"What causes the release of danger?"

"How can lost control?"

❸ Identify the existing Protection **Barriers** each Threat

- Prevent the Top Event occurrence
- Can be independents or dependents

"How can controls fail?"

"How can that their effectiveness can be compromised?"

# Bow-tie Diagram Construction

## ④ Identify for each Barrier their **Escalation Factors**

- Factors that make the Barrier fail

“How can we avoid that the hazard being released?”

“How can we keep the control?”

## ⑤ Identify for each Barrier their **Escalation Factors Control**

- Factors that prevent or minimize the possibility of the Barrier or the Recovery Measures becomes ineffective

"How to ensure that the controls will not fail?"

## ⑥ Identify the consequences

- Top Event could have several consequences

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# Bow-tie Diagram Construction



## ⑦ Identify the **Recovery Measures**

- Factors that make the barriers fail

"How can we limit the severity of the event?"

"How can we minimize the effects?"

## ⑧ Identify for each Recovery Measure their **Escalation Factors and Escalation Factors Controls**

## ⑨ For each Barrier, Recovery Measures and Escalation Factors Controls identify the **Critical Safety Tasks**

# Bow-tie Diagram Construction

## Critical Safety Tasks

Tasks prevent and/or minimize the possibility of the Barrier, the Escalation Factor Control or the Recovery Measures fails or becomes ineffective

What tasks can be taken to ensure that the control is working?

- Project engineering, operation, maintenance, management.

"How can we ensure that these tasks are done?"

"Who do these tasks?"

"How do you know when to do the tasks?"?

"How do you know what to do?"

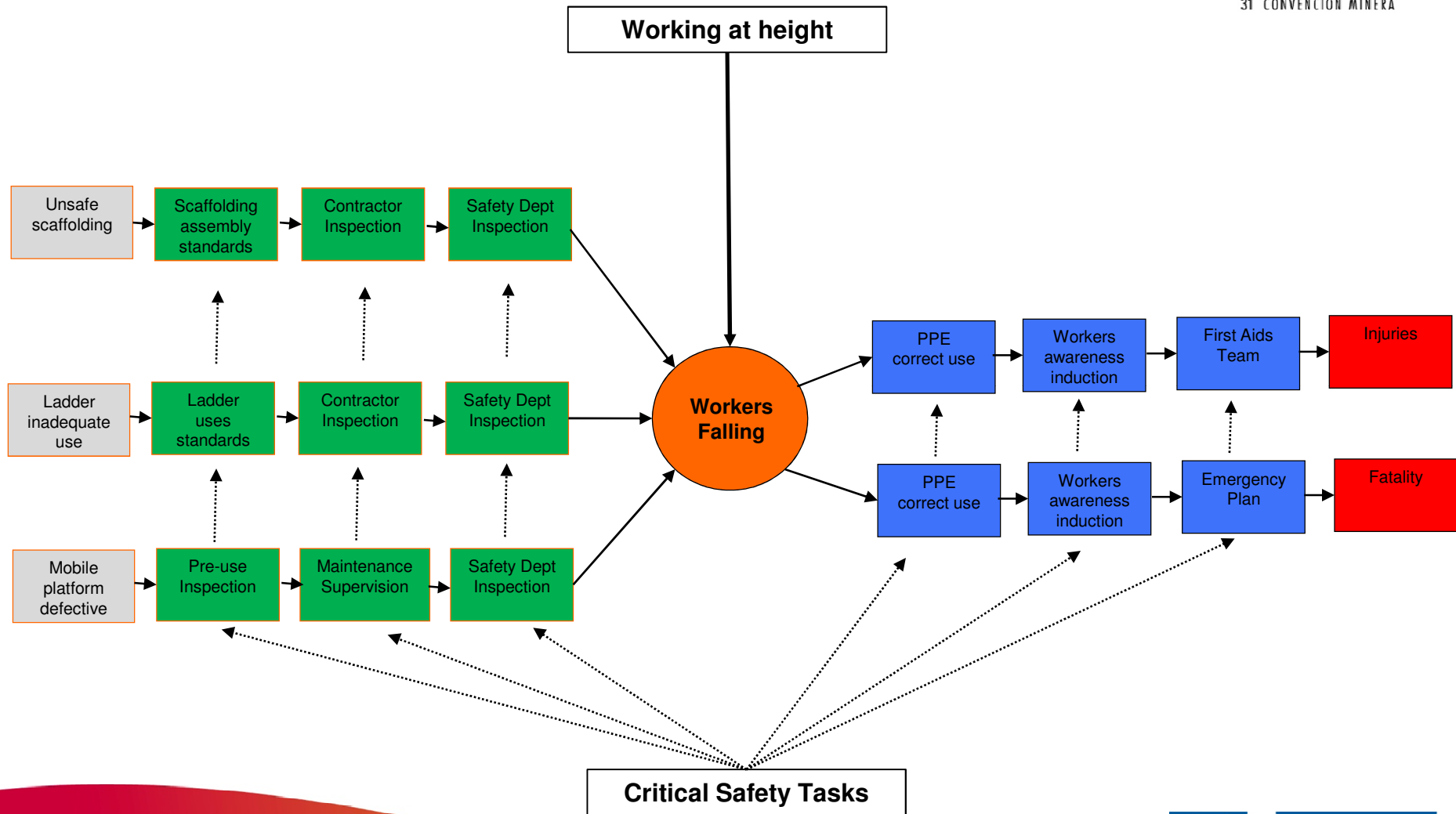
"Is there a procedure, checklist, instruction?"

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# Bow-tie Example



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