Risktec Solutions

risk management and assessment for business

Bowties – One Size Fits All

A Presentation by Andy Lidstone, Principal Consultant, Risktec Solutions Limited

CGE Risk Management User Group, London, 5th September 2013

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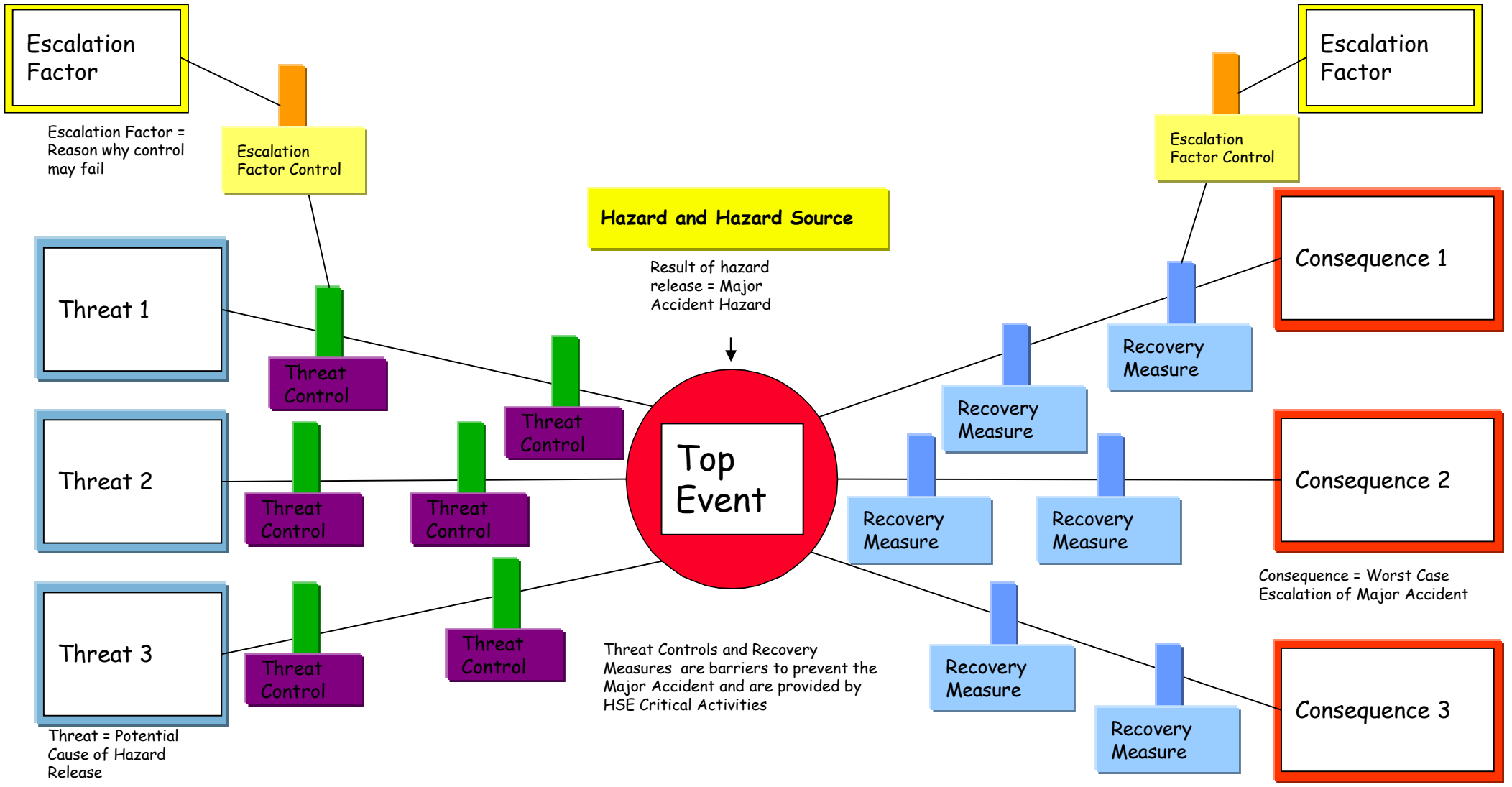
Today’s session

- Bowties are easy to understand but a quality bowtie is deceptively difficult to build. But does one set of “rules” for building bowties work for all applications?
- This session will examine different approaches for different applications, e.g. using bowties for LOPA reviews, Safety Case demonstrations, management control reviews, simple pictorial communication, etc.
- It will explore both the commonalities and differences in the “rules”, as well as giving delegates an opportunity to bring along their own bowties and issues for discussion.

The problem



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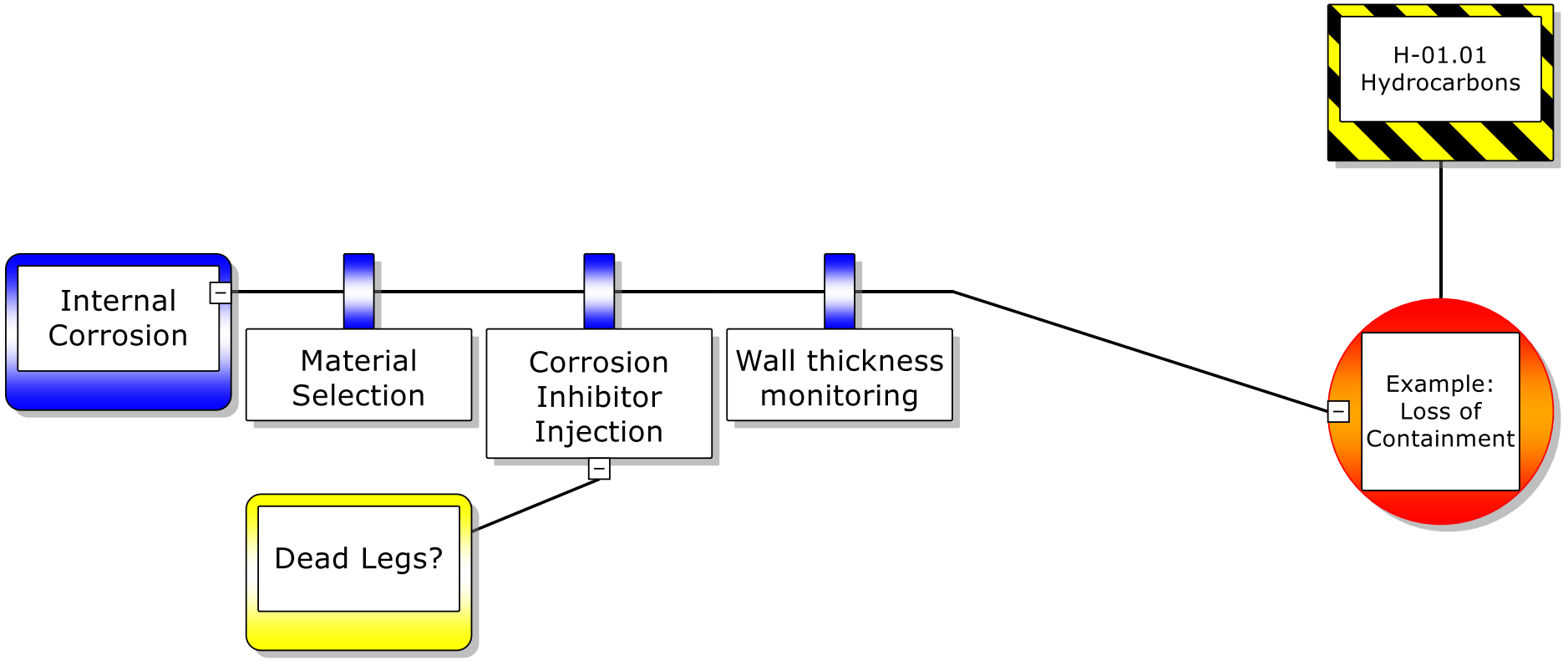
Basics

- Why are you doing it/ What do you want to find out?/What does the client want?
- How to record?
  - Flip chart/white board
  - Post it notes
  - Word/Excel/PowerPoint
  - Bowtie software
- How much detail?
  - Basic bowtie
  - Effectiveness
  - Tasks
  - Elements
  - Documents
  - SIL ratings
  - Others?

Basic

To allow a rapid review of the issues e.g. concept design



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Pictorial

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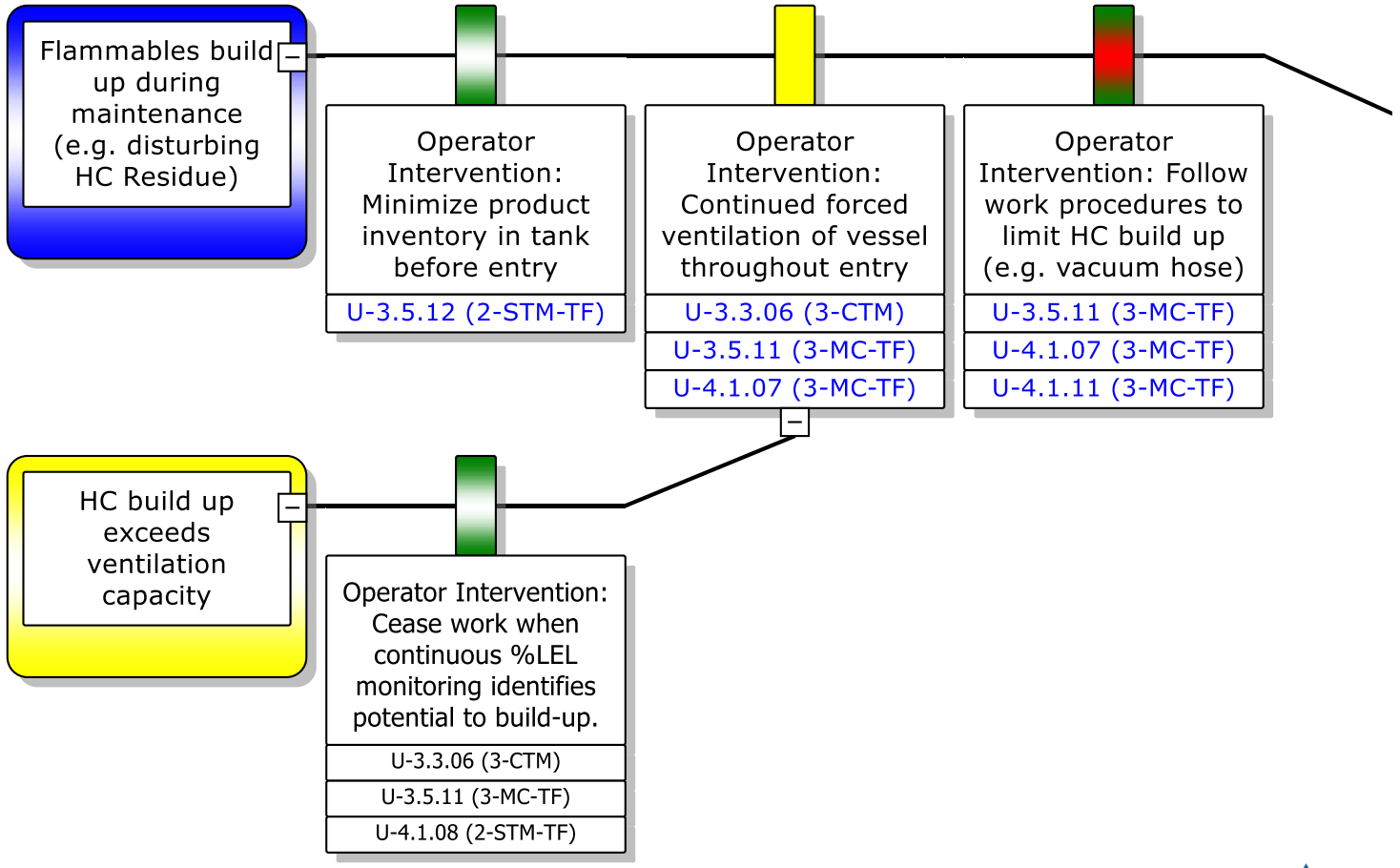
Design/ Safety Case

- To show additional information e.g.
  - Tasks
  - Effectiveness
  - Critical elements



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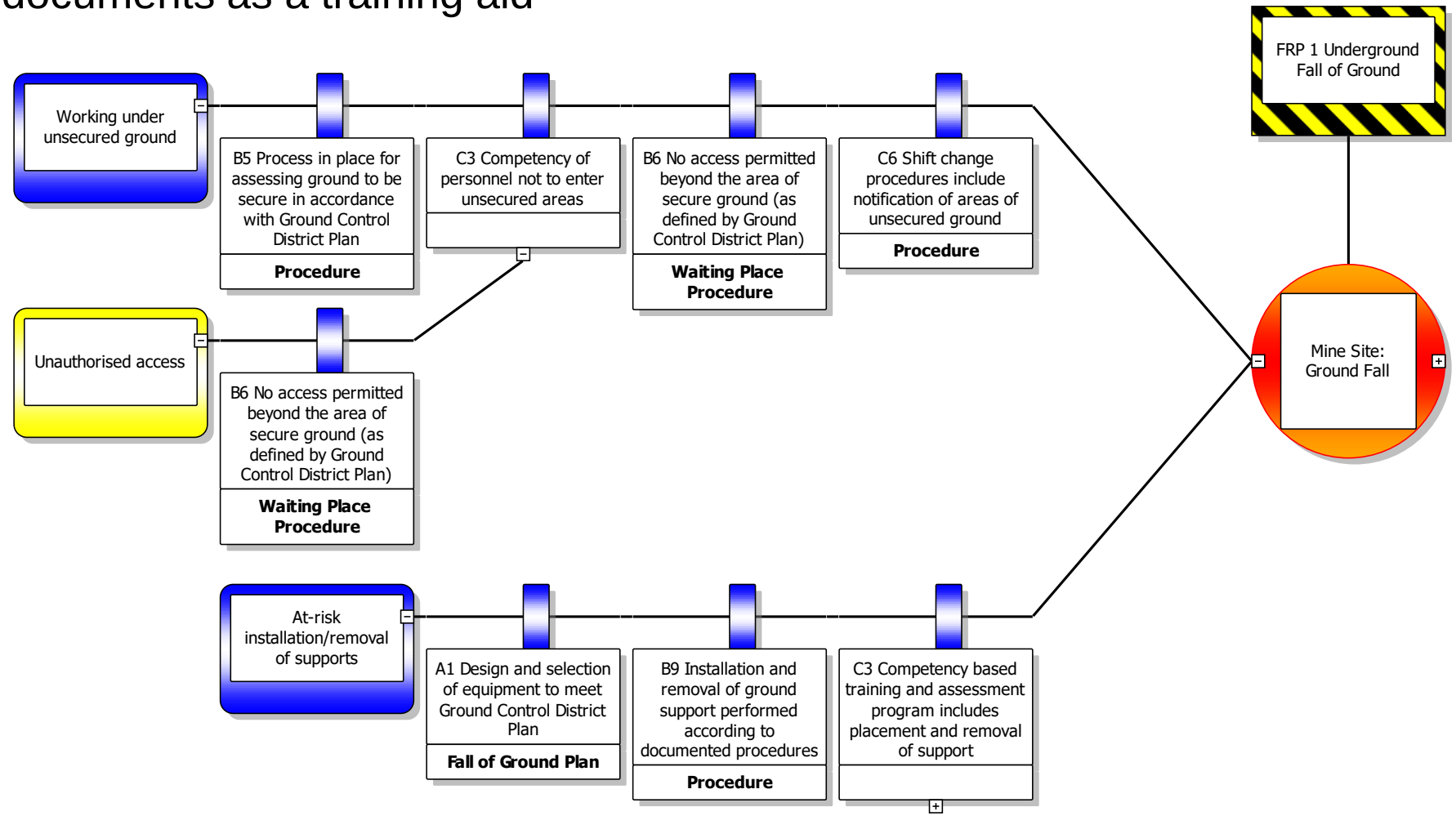
Documents

Hot linked documents as a training aid



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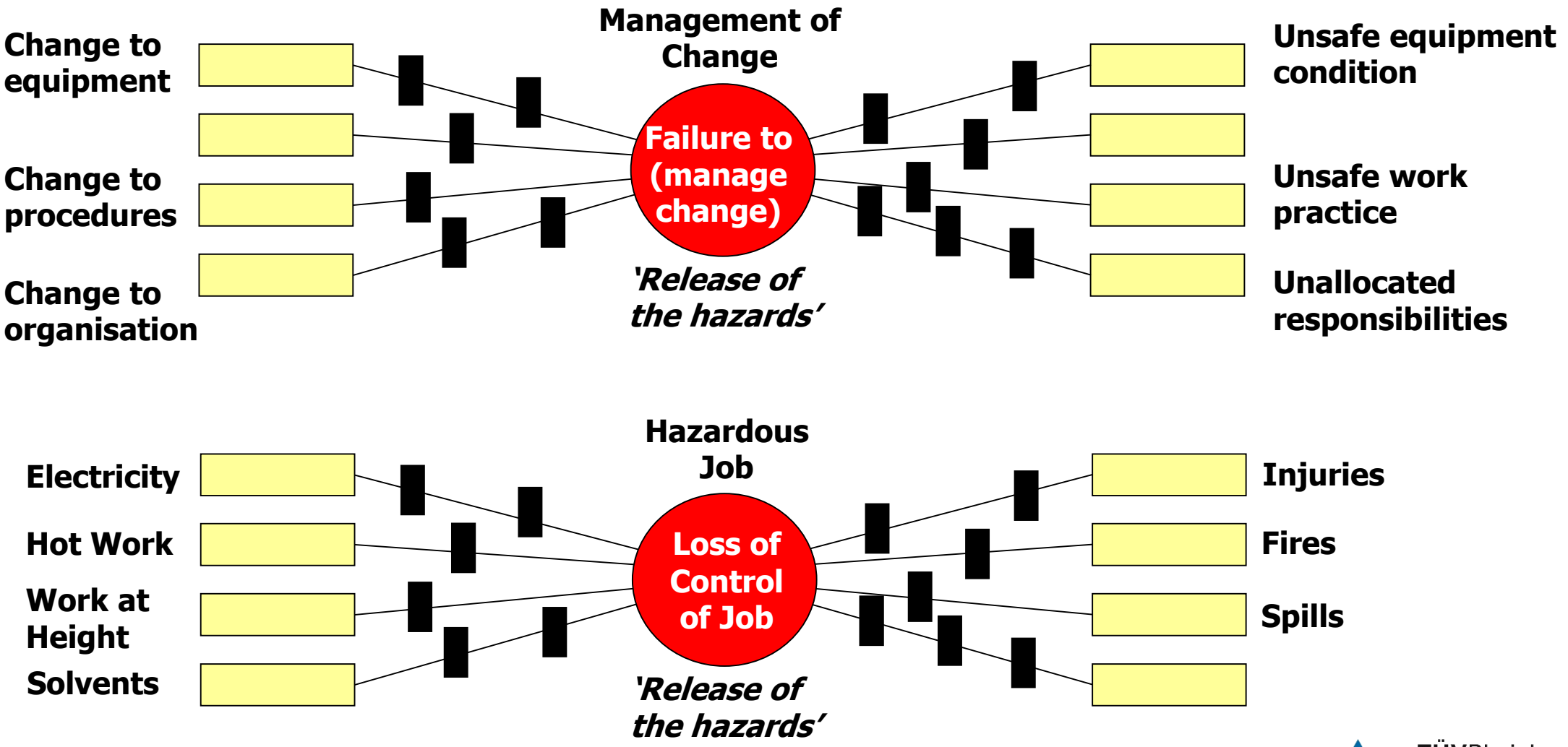
Management Systems



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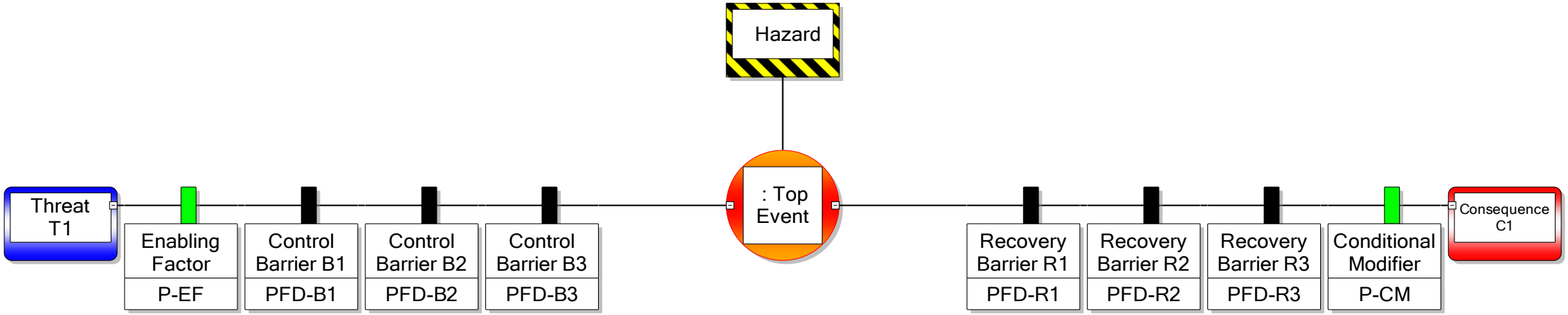
LOPA

To calculate sequence frequencies



Frequency of consequence C1 from threat T1 =

IEF(T1) x P(EF) x PFD(B1) x PFD(B2) x PFD(B3) x PFD(R1) x PFD(R2) x PFD(R3) x P(CM)

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Rules

- To achieve consistency
- Set basic expectations
- Must be fit for purpose(s)
- Must be communicated
- May cover e.g.
  - Approach
  - Attendees
  - Acceptance criteria
  - Effectiveness ratings/scorings

Rigid Rules

“There shall be three barriers between a threat and the top event”

- For all frequencies of threat?
- Is inspection a separate barrier to maintenance?

“Barriers shall be fully functional to stop the consequence from occurring”

- Is a gas detection system fully functional?
- What about the emergency response plan?

“A single barrier can function as either a prevention or mitigation barrier but not both”

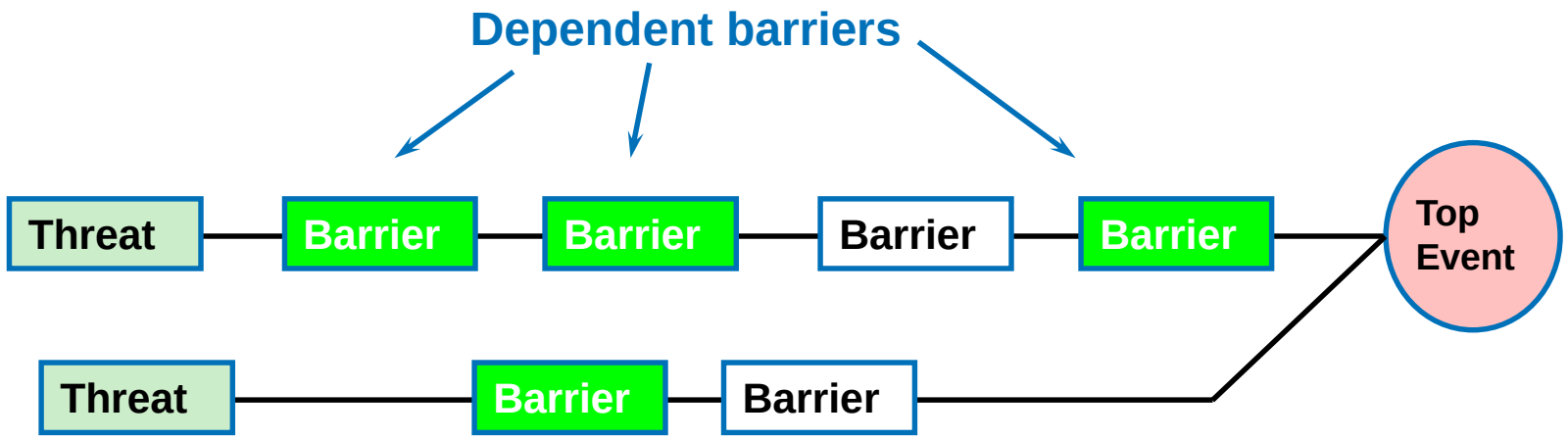
- What about a tank farm bund?
  - Prevents access and impacts
  - Limits extent of spills

Potential Problem Areas

- Barrier independence
- Use of escalation factors
- Effectiveness and Acceptability
- Level of detail
- Human error

Dependency

If controls are dependent, there is less defense



- What counts as dependency?
  - Same person?
  - Same systems?
  - Common services?
- Separate bowtie for common areas?

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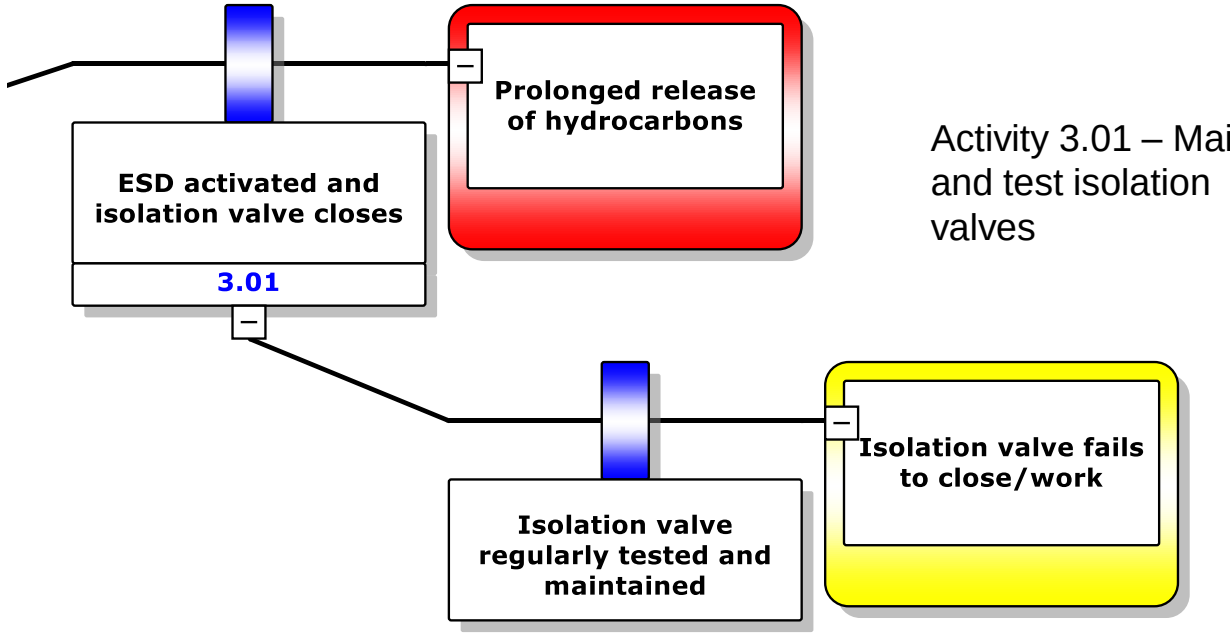
Use of Escalation Factors

- Adds local failure cases
- Can get very repetitive
- Use for barrier general failures?



Activity 3.01 – Maintain and test isolation valves

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Effectiveness and Acceptability

- Gut feel
- 1 to 3, 1 to 5
- Numerical
- SIL

Rating	Is it used? Is it in place?	Does it work/is it effective/human dependency?	Bowtie code
Very Reliable	Always	Control has more than a 99.5 % of working when required, no human involvement	
Reliable	Frequently	Control has a > 90 % chance of working when required, little human involvement	
Fairly Reliable	Mainly	Control has a < 90 % > 60 % chance of working when required, active human involvement	
Unreliable	Occasionally	Control has a < 60 % > 30 % chance of working when required, very active human involvement, complex and stressful to operate	
Very Unreliable	Rarely	Control has less than a 30 % chance of working when required, continuous human involvement, very complex	
-	-	Additional risk reduction measure (as part of ALARP demonstration)	

Effectiveness	Source	Criteria
Effective	Field Experience	Hardware: Inspections/tests conducted as per Performance Standard; Functions properly when tested Processes: Audits conducted, corrective actions resolved or planned Personnel: HSE training up-to-date, Personal Job Profile accurate; Competence assured; Contractor HSEMS meets standards
	Internal or Asset Integrity Audit	No or Low audit finding
	Incident Investigation	Control is in place
Partially Effective	Field Experience	Hardware: Inspections/tests conducted but hardware needs frequent adjustment to pass function test; some backlog of preventive maintenance activities that could impair performance Processes: Not applied consistently but still considered functional by each crew Personnel: HSE training only partially up-to-date, all Personal Job Profile not completed; Contractor HSEMS has some deficiencies
	Internal or Asset Integrity Audit	Medium audit finding
	Incident Investigation	Investigation determines Human Element is at fault
Ineffective	Field Experience	Control is Missing, Failed, or does not meet mandatory aspects of performance standard.
	Internal or Asset Integrity Audit	High or Serious audit finding
	Incident Investigation	Control found to be Missing or Failed

		Barrier Operating Effectiveness Level			
		Industry best practice / world class	Industry standard	Minor degradation	Major degradation
Barrier Design Effectiveness Level	Industry best practice / world class	6	5	4	3
	Industry standard	5	4	3	2
	Sub-standard	4	3	2	1
	Ineffective or unknown	3	2	1	0

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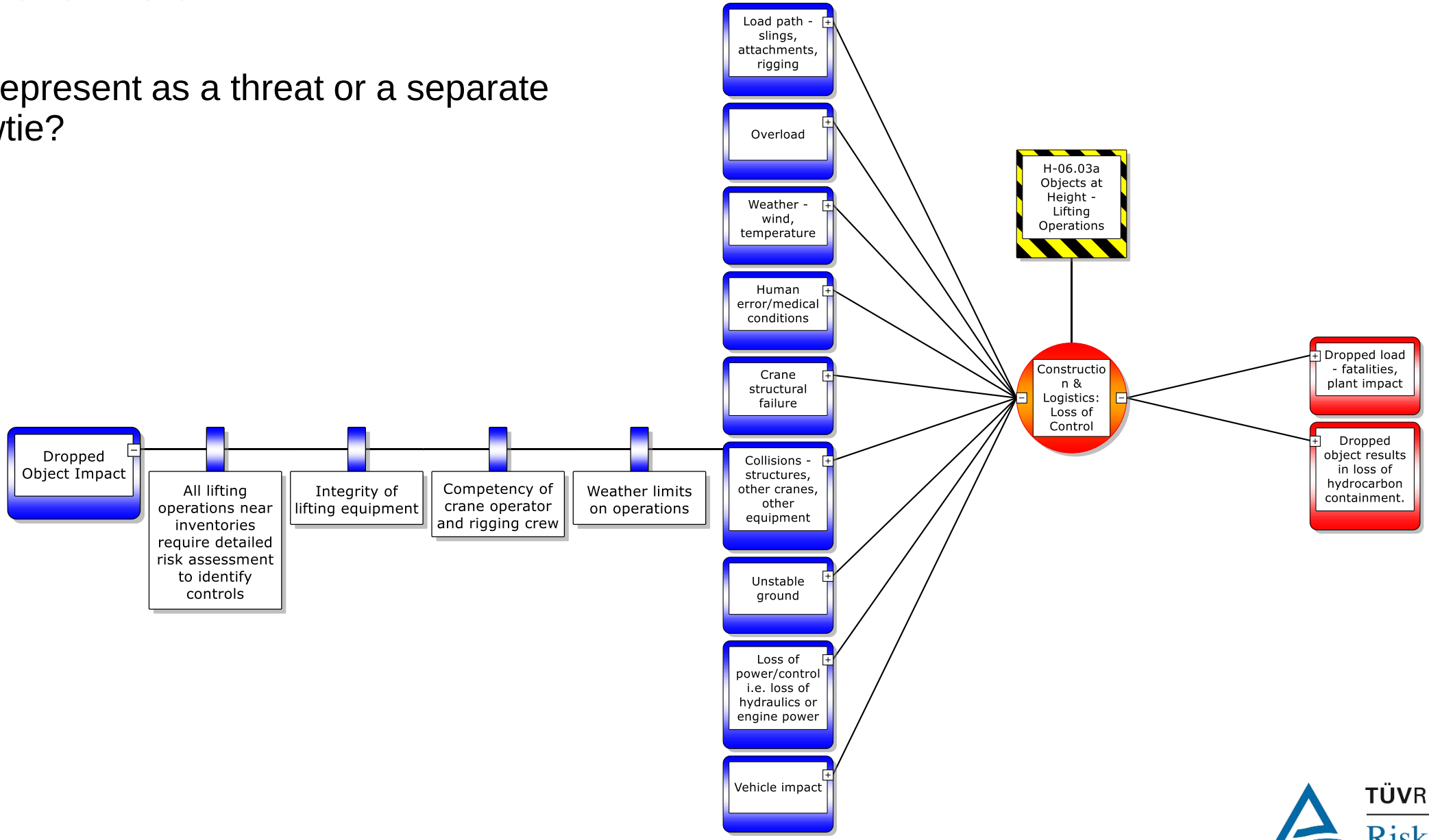
Level of Detail

To represent as a threat or a separate bowtie?



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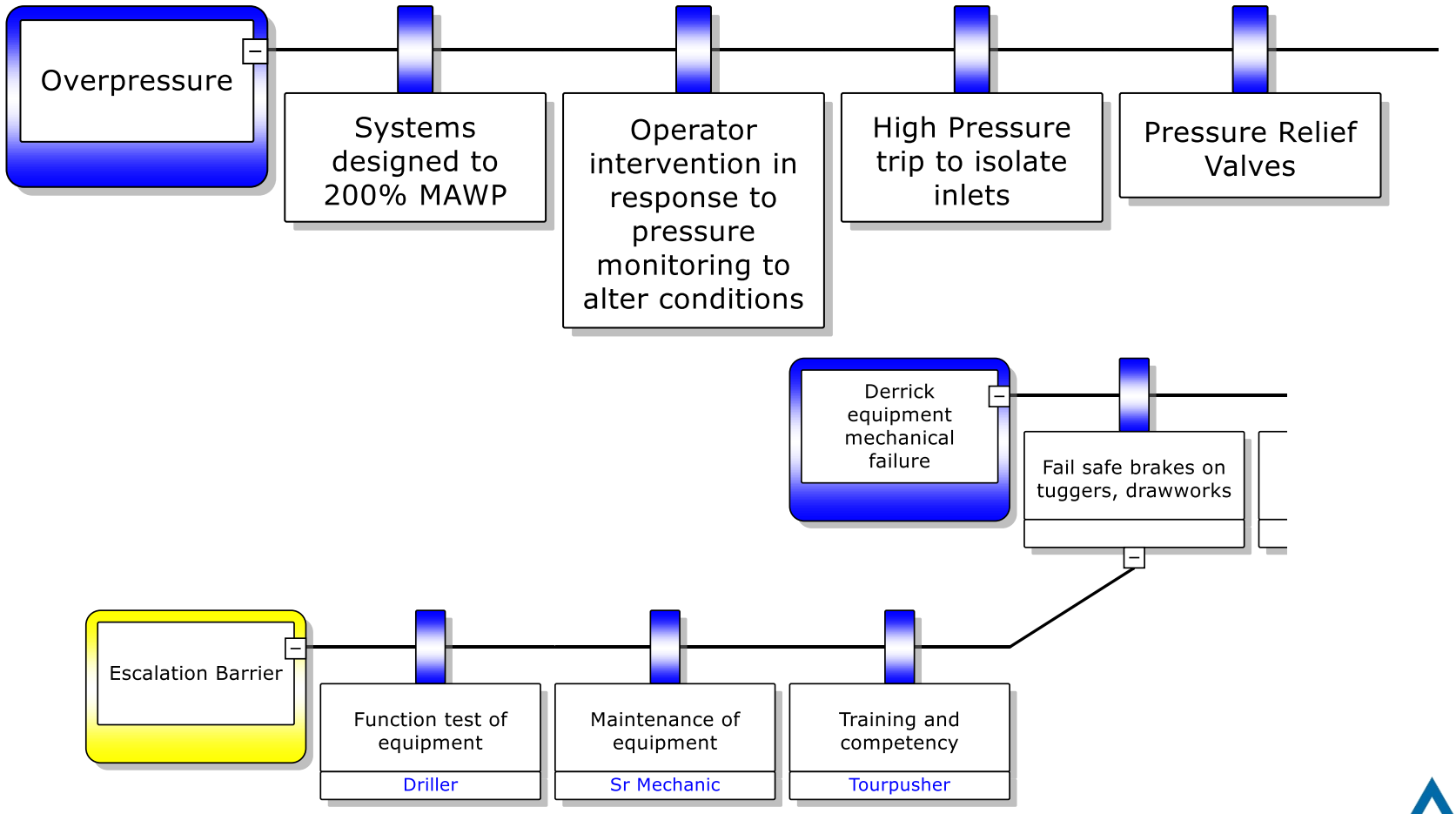
Representing Human Error

Explicit claims on operator actions



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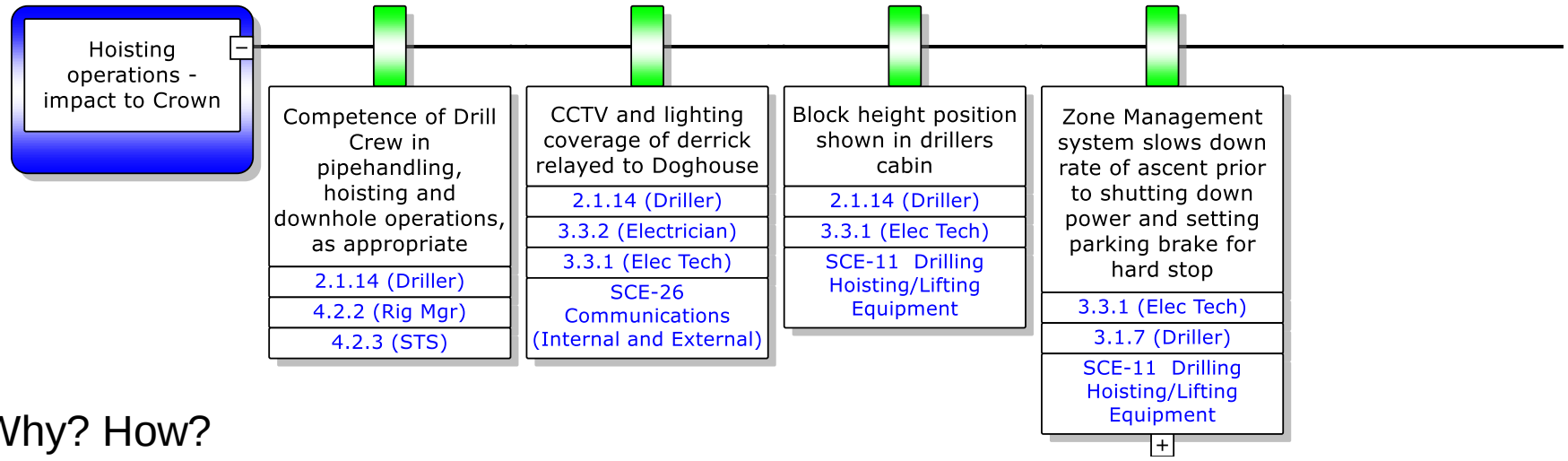
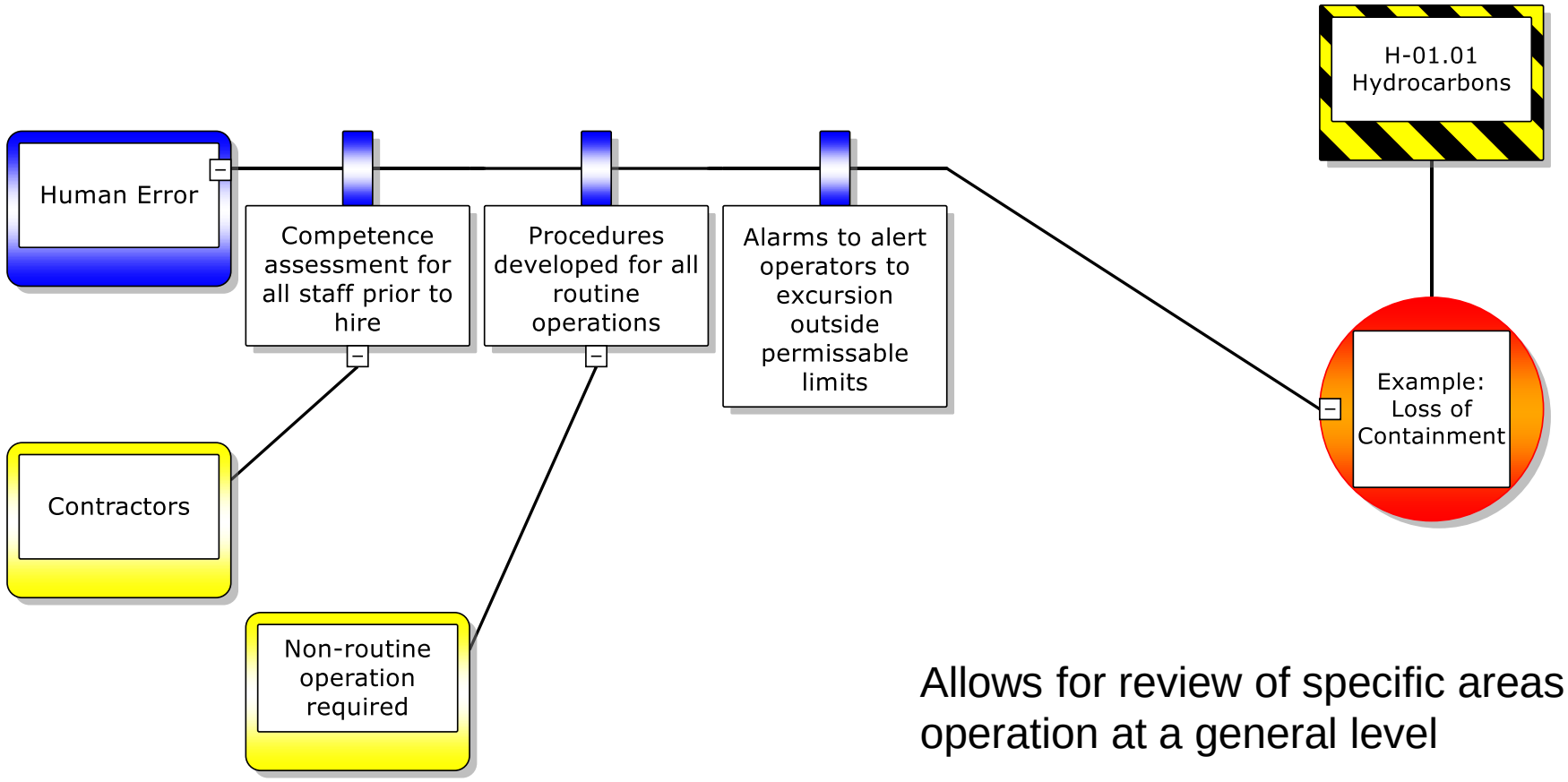
Using Tasks



Who? What? Why? How?
Can also dig deeper e.g. competency

3.3.1	Maintenance and testing of critical instrumentation	Perform maintenance, testing and calibration of critical rig instrumentation systems (including hand held/portable systems) and all associated equipment and protective systems in accordance with Noble maintenance procedures. Includes - drilling system instrumentation e.g. level indicators, pressure gauges, string weight indicators, zone management system etc. - marine systems e.g. navigation, radar, consoles and control stations, current monitors, anemometers - watertight door indicators, bilge sensors - crane boom angle and weight indicators - crane AOPS and MOPS systems - gantry crane photo-cell and motion alarms - bulk storage system level gauges and alarms - fire, smoke and heat detectors and fire&gas panel alarms - Emergency Shutdown systems - communications systems, including PA/GA - CCTV - UPS systems	• Manufacturer's Instructions • SAP Workorder	Completed maintenance records

Human Error Threat



Allows for review of specific areas of operation at a general level

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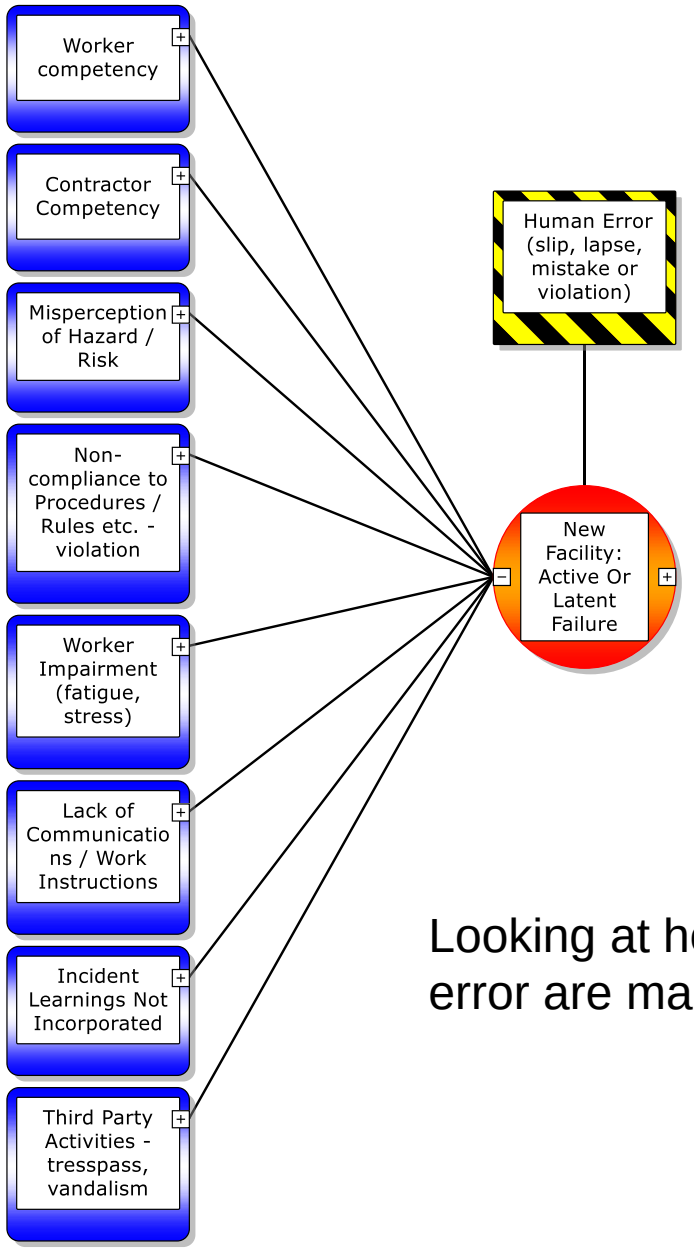
Human Error Bowtie



Looking at how common causes of human error are managed across the facility

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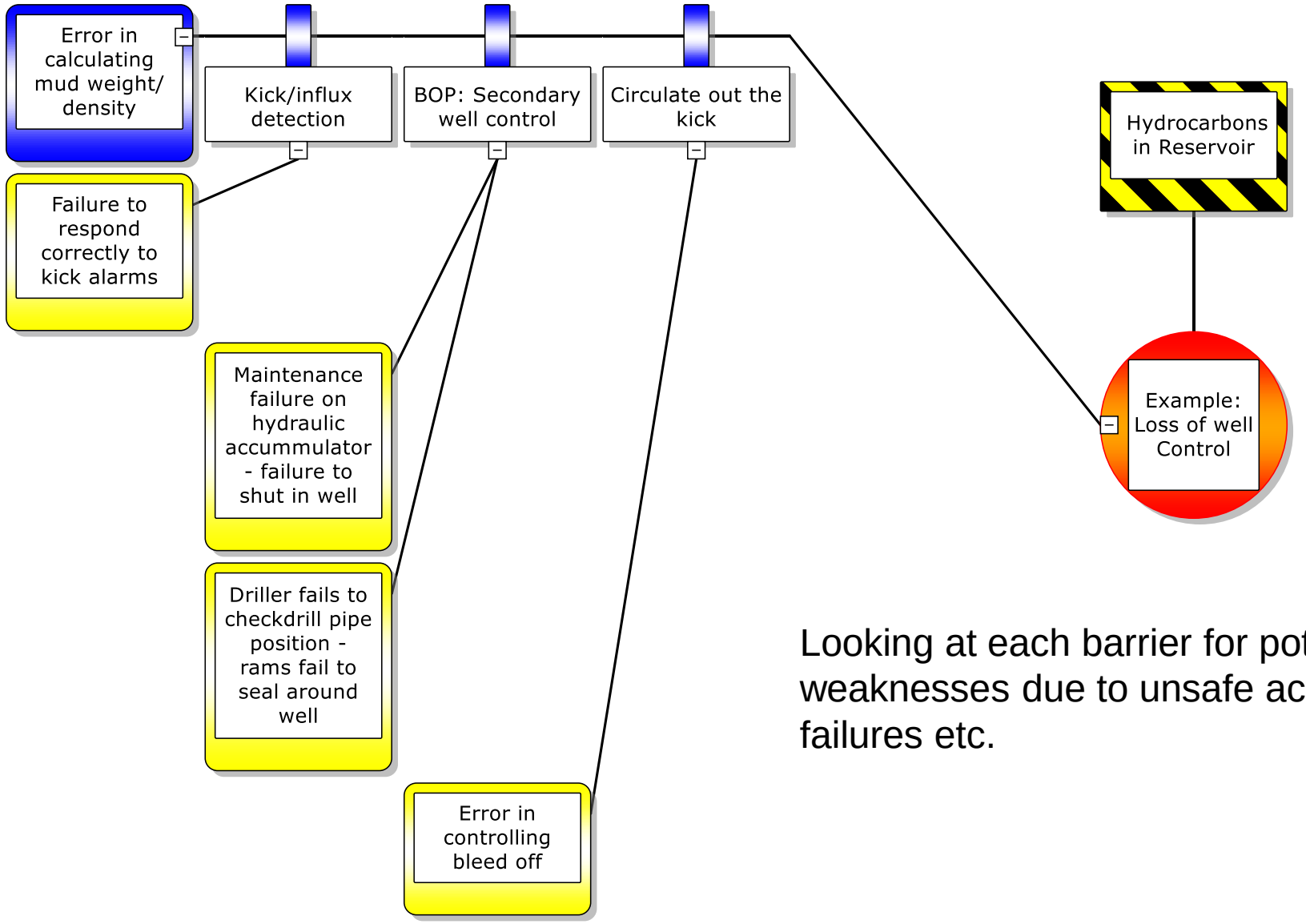
Human Factors Assessment



Looking at each barrier for potential weaknesses due to unsafe acts, latent failures etc.

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Summary

- What do you actually want to achieve?
- Rules to guide rather than mandate
- Start simple, but ask questions to aid level of detail

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Thank you for your attention

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