gasunie

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KPI PiMS Title

USING PiMS

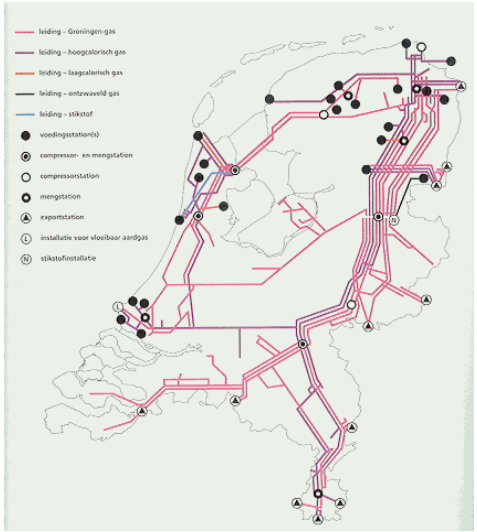
KEY PERFORMANCE INDICATORS

IS ANOTHER STEP FORWARD

IN UNDERSTANDING

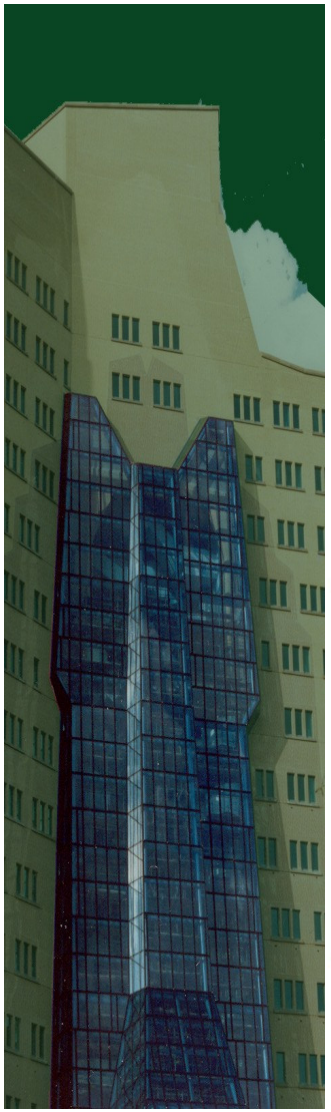
PIPELINE (integrity) MANAGEMENT

Agenda



KPI PiMS

- Introduction
- Aims
- Method
- Results
- Summary
- Questions ?



KPI PiMS Introduction

- ***Pipeline grid***
  - 11,600 km
  - Complex network
  - Highly populated country
  - Still enough room to expand;

- ***Mission***
  - No incident by 1st and 3rd parties
  - Strong reduction of potential severe incidents
  - 0 gas outflow incidents in 2009
  - Halving pipeline incidents
  - No unexpected work within safety zone
  - No pipeline damage from announced work
  - Halving corrosion incidents which needs direct repair

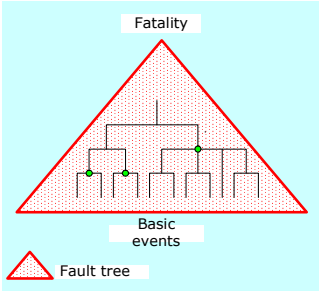
KPI PiMS Aims

- ***Aims PiMS KPI's to demonstrate:***
  - Safe and reliable gas transport;
  - Long lasting
  - Efficient
  - Continuity
  - Profitable

- ***By means of :***
  - Performance monitoring
  - Looking after incident causes below iceberg water level
  - No more feedback monitoring, but
  - Pro-active, feed forward control
  - Root cause analyses and (pre) warning system to
  - Influence, minimize top events to happen

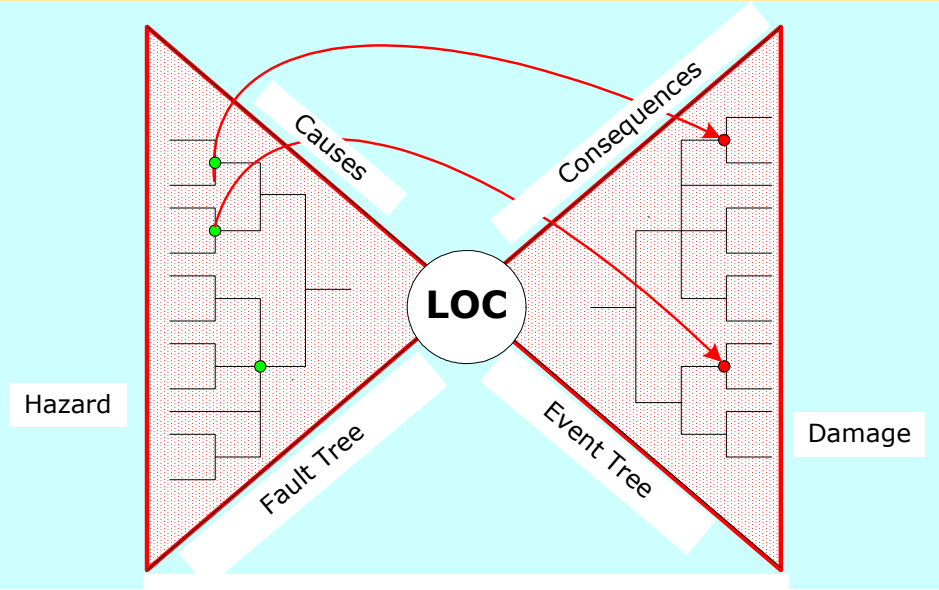
KPI PiMS Methods

- ***Risk Management Methodology***
  - Muhlbauer
  - Overall fault and event tree approach
  - As much quantitative as possible
  - PiMS model
    - Integration and consistency of
      - Databases
      - QRA-models (Pipesafe lite)
      - Key Performance Indicators

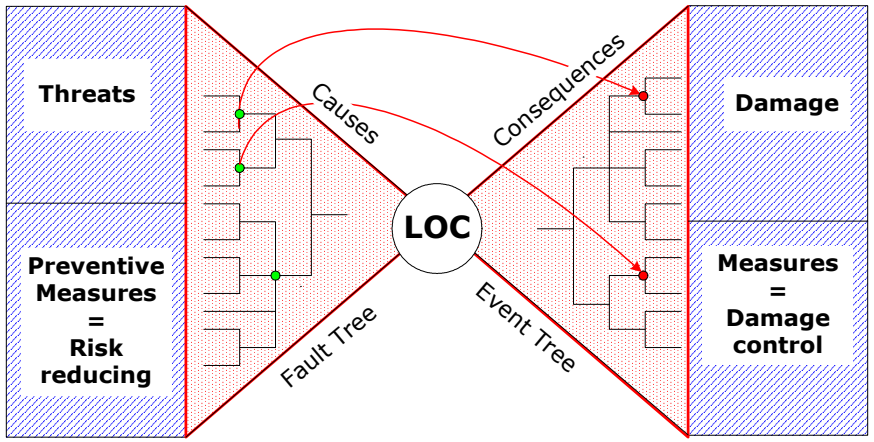


KPI PiMS Model

- ***PiMS Model based on :***
  - Fault tree consisting of
    - Causes
    - Hazards
    - Threats
    - Preventive measures
  - Loss of containment
  - Event tree consisting of
    - Consequences
    - Potential damage
    - Damage
    - Damage control
  - Line of Defences (LOD)



Pro-active Pipeline Incident Control



Hazard **Line of Defences** **Consequences**

KPI PiMS Classifications

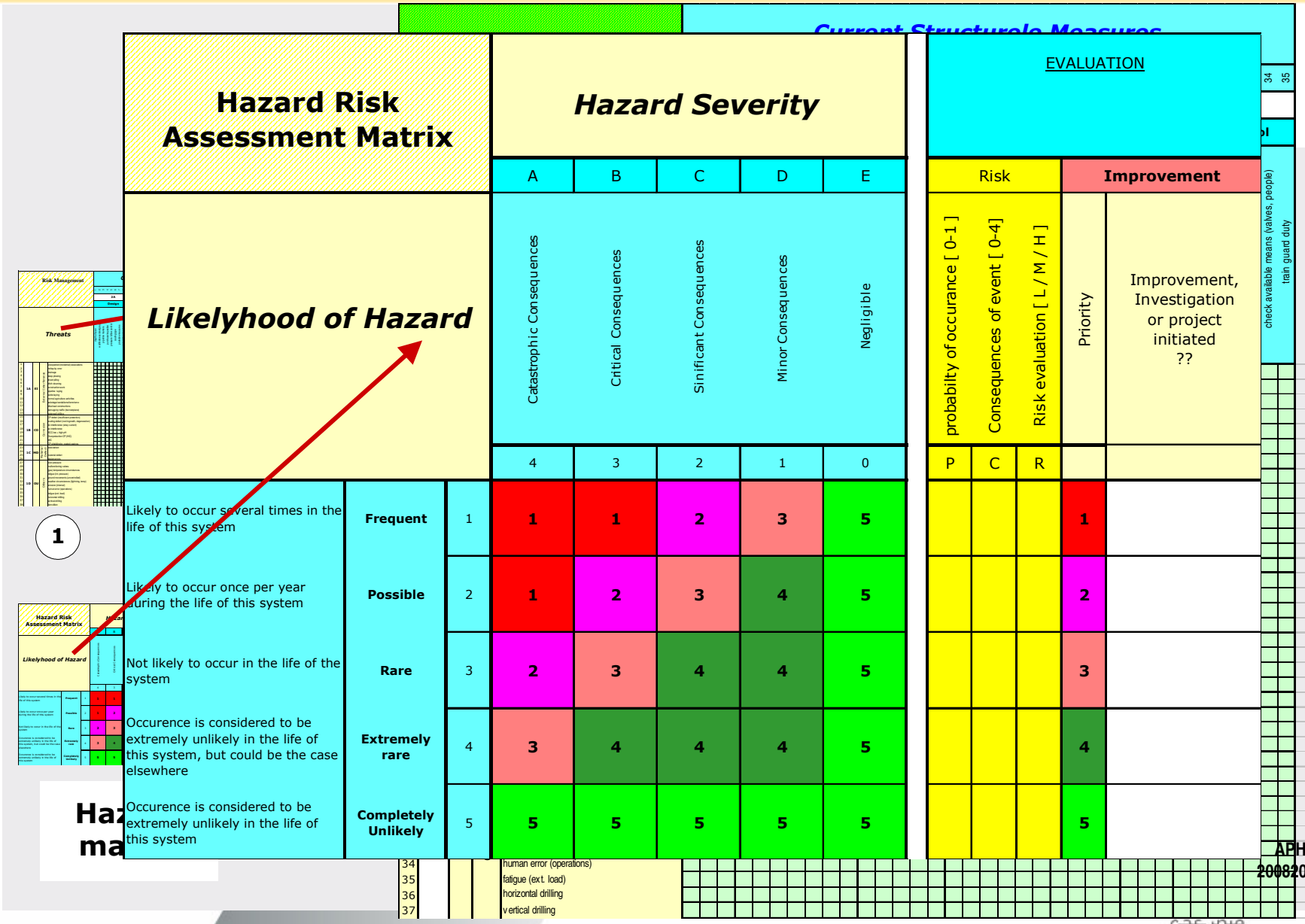
- ***Threats***
  - External interference EI
  - Corrosion CO
  - Material defect MD
  - Other OU

- ***Measures***
  - Design
  - Construction
  - Operational
  - Emergency control

KPI PiMS Classifications

- ***Potential Damages***
  1. Coating defect
  2. CP-defect
  3. Non critical ML defect
  4. Gouge or dent defect
  5. Gouge in a dent defect
  6. Critical ML defect
  7. Pinhole / crack
  8. Small hole
  9. Large hole
  10. Rupture
  11. Propagated rupture
- ***Consequences***
  - Loss of live (fatality / injury)
  - Loss of assets
    - Loss of property
    - Loss of transport medium
    - Loss of transport capacity
  - Loss of image / PR

KPI PiMS Overall model threats & measures



Hazard Risk Assessment Matrix

Likelyhood of Hazard			A: Catastrophic Consequences	B: Critical Consequences	C: Sinificant Consequences	D: Minor Consequences	E: Negligible	Risk: probabilty of occurance [0-1]	Risk: Consequences of event [0-4]	Risk: Risk evaluation [L / M / H]	Improvement: Priority	Improvement: Improvement, Investigation or project initiated ??
			4	3	2	1	0	P	C	R		
Likely to occur several times in the life of this system	Frequent	1	1	1	2	3	5				1	
Likely to occur once per year during the life of this system	Possible	2	1	2	3	4	5				2	
Not likely to occur in the life of the system	Rare	3	2	3	4	4	5				3	
Occurence is considered to be extremely unlikely in the life of this system, but could be the case elsewhere	Extremely rare	4	3	4	4	4	5				4	
Occurence is considered to be extremely unlikely in the life of this system	Completely Unlikely	5	5	5	5	5	5				5	

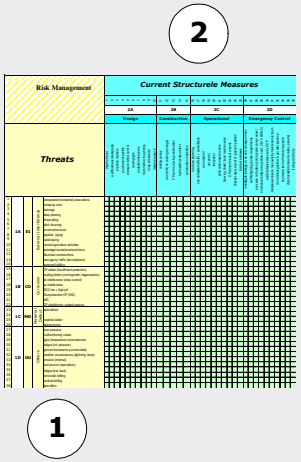
KPI PiMS GDLI – EGIG data

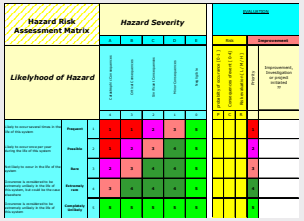
Risk Management				Current Structurele Measures																																
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
				2A										2B					2C										2D									
				Design										Construction					Operational										Emergency Control									
Threats				depth of cover	wallthickness / steelgrade	pipeline markers	purchase inspection	pressure & flow control	coating type	protective measures	material low toughness	hoop stress level	design pressure	coating survey	trench fill (no coating damage)	CP control during construction	hydrostatic pressure test	construction inspection	land use planning	one call system (KLIC) + surveillance	aerial patrol	car patrol	foot patrol	zet & zak measurements	drawing check / tracé maintenance	CP control measurements	check pressure control / gas composition	incident analyses	investigate leakage, area and consequences	call firefighting / police departments	pressure reduction (controlvalve, compressor)	enclose calamity area (yellow card, 3 & 10 kW/m2)	esd blockvalve closure by CCP	blockvalve closure manually by maintenance team	do not block gasflow in parallel pipeline	exercise & train all relevant people	check available means (valves, people)	train guard duty
1	1A	EI	External Interference	unexpected (incidental) excavations																																
2				hottap by error																																
3				drainage																																
4				deep plowing																																
5				sheet piling																																
6				ditch cleaning																																
7				construction work																																
8				pipeline laying																																
9				cable laying																																
10				normal agriculture activities																																
11				sabotage/vandalisme/terrorisme																																
12				dike/road constructions																																
13				damage by traffic (train/airplane)																																
14				waterwell drilling																																
15	1B	CO	Corrosion	CP defect (insufficient protection)																																
16				coating defect (root ingrowth, degeneration)																																
17				dc-interference (stray current)																																
18				ac-interference																																
19				SCC low + high pH																																
20				Overprotection CP (HIC)																																
21				MIC																																
22				CP shielding by coated casings																																
23	1C	MD	Material Defect	weld defect																																
24																																		
25				material defect																																
26				design errors																																
27	1D	OU	Others	over pressure																																
28				malfunctioning valves																																
29				(gas) temperature circumstances																																
30				fatigue (int. pressure)																																
31				ground movements (uncontrolled)																																
32				weather circumstances (lightning, temp)																																
33				errosion (internal)																																
34				human error (operations)																																
35				fatigue (ext. load)																																
36				horizontal drilling																																
37				vertical drilling																																

Gasunie Database pipeLine Incidents				EGIG		
	Threats					
1A	EI	External Interference	unexpected (incidental) excavations	EI, HO	EI	digging
			hottap by error		HO	hottap by error
			drainage		EI	drainage
			deep plowing		EI	trenching
			sheet piling		EI	piling
			ditch cleaning		EI	ditch cleaning
			construction work			
			pipeline laying		EI	trenching
			cable laying		EI	cabling
			normal agriculture activities		EI	agricultural
			sabotage/vandalisme/terrorisme			
			dike/road constructions		EI	public works
			damage by traffic (train/airplane)		EI	traffic
			waterwell drilling		EI	unknown
1B	CO	Corrosion	CP defect (insufficient protection)	CO		
			coating defect (root ingrowth, degeneration)			
			dc-interference (stray current)			
			ac-interference			
			SCC low + high pH			
			Overprotection CP (HIC)			
			MIC			
			CP shielding by coated casings			
1C	MD	Material Defect	weld defect	CD, OU	CD	construction defect
			material defect		CD	material defect
			design errors		OU	design error
1D	OU	Others	over pressure	OU, GM		
			malfunctioning valves			
			(gas) temperature circumstances			
			fatigue (int. pressure)			
			ground movements (uncontrolled)		GM	ditch break
			weather circumstances (lightning, temp)		OU	lightning
			errosion (internal)		OU	corrosion
			human error (operations)			
			fatigue (ext. load)			
			horizontal drilling			horizontal drilling
			vertical drilling			vertical drilling
			demolition		OU	unknown

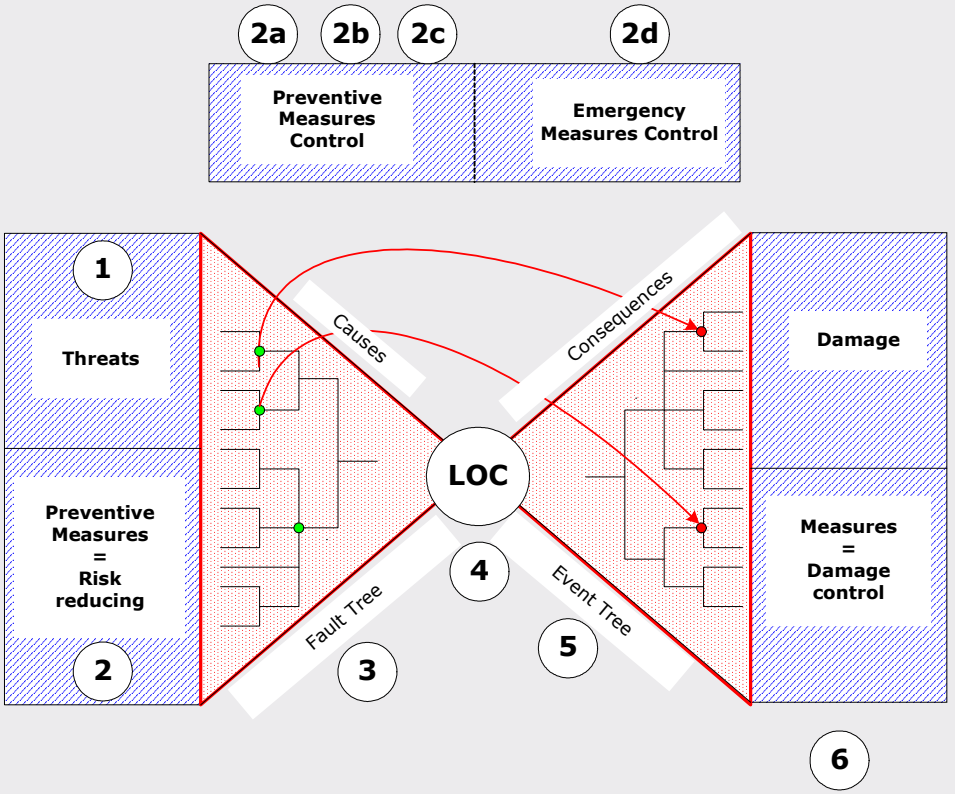
KPI PiMS Overall model threats & measures

Overall PiMS Model
Hazard & Calamity Control
Pipeline Incident

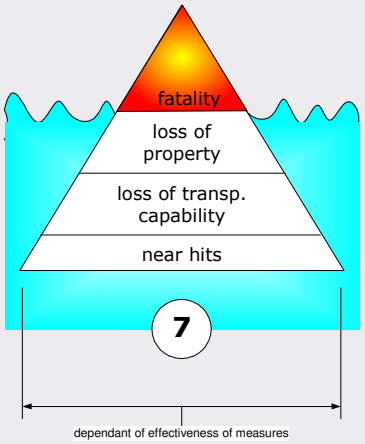




Hazard matrix



Line of Defences

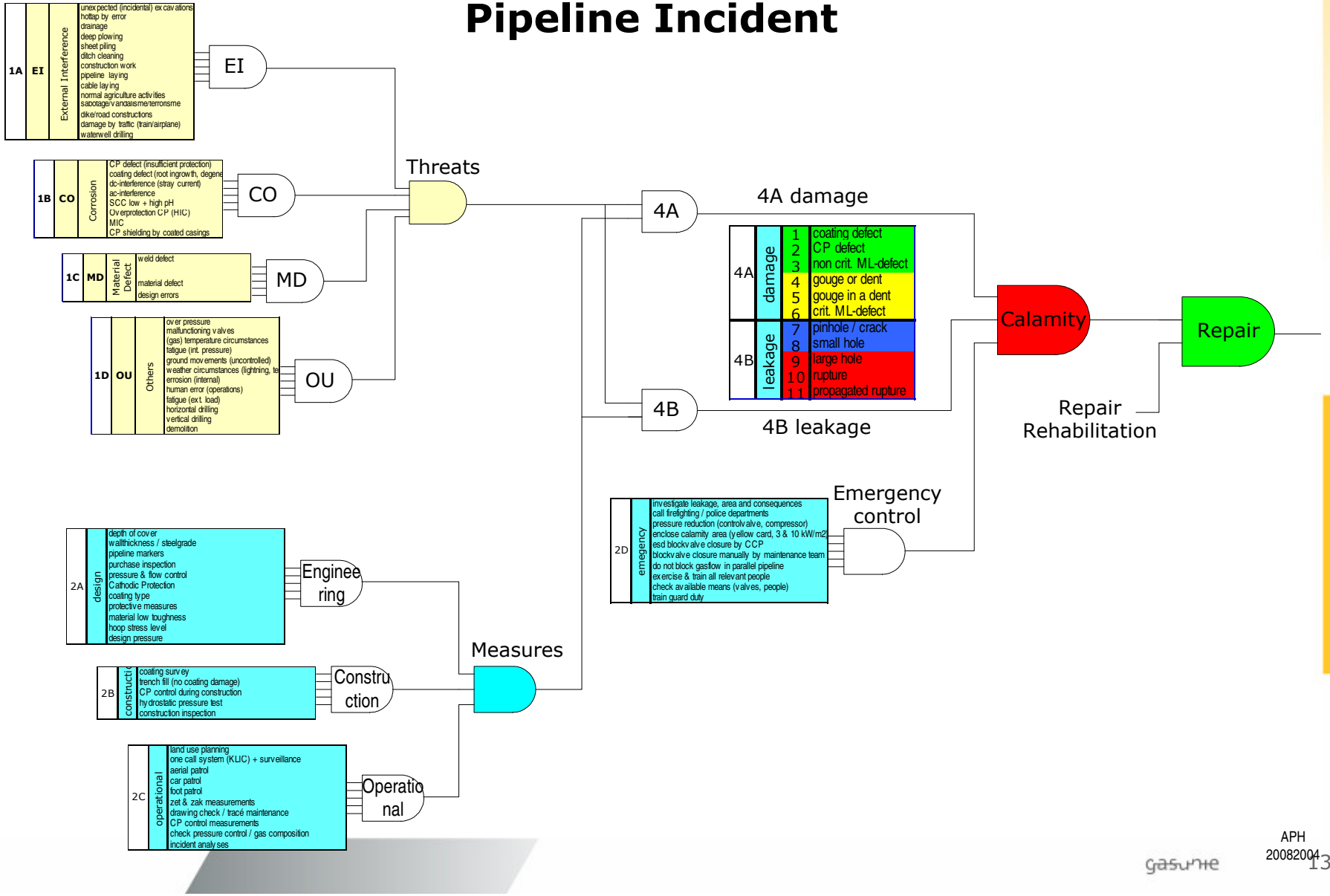


Consequences

APH
20082004

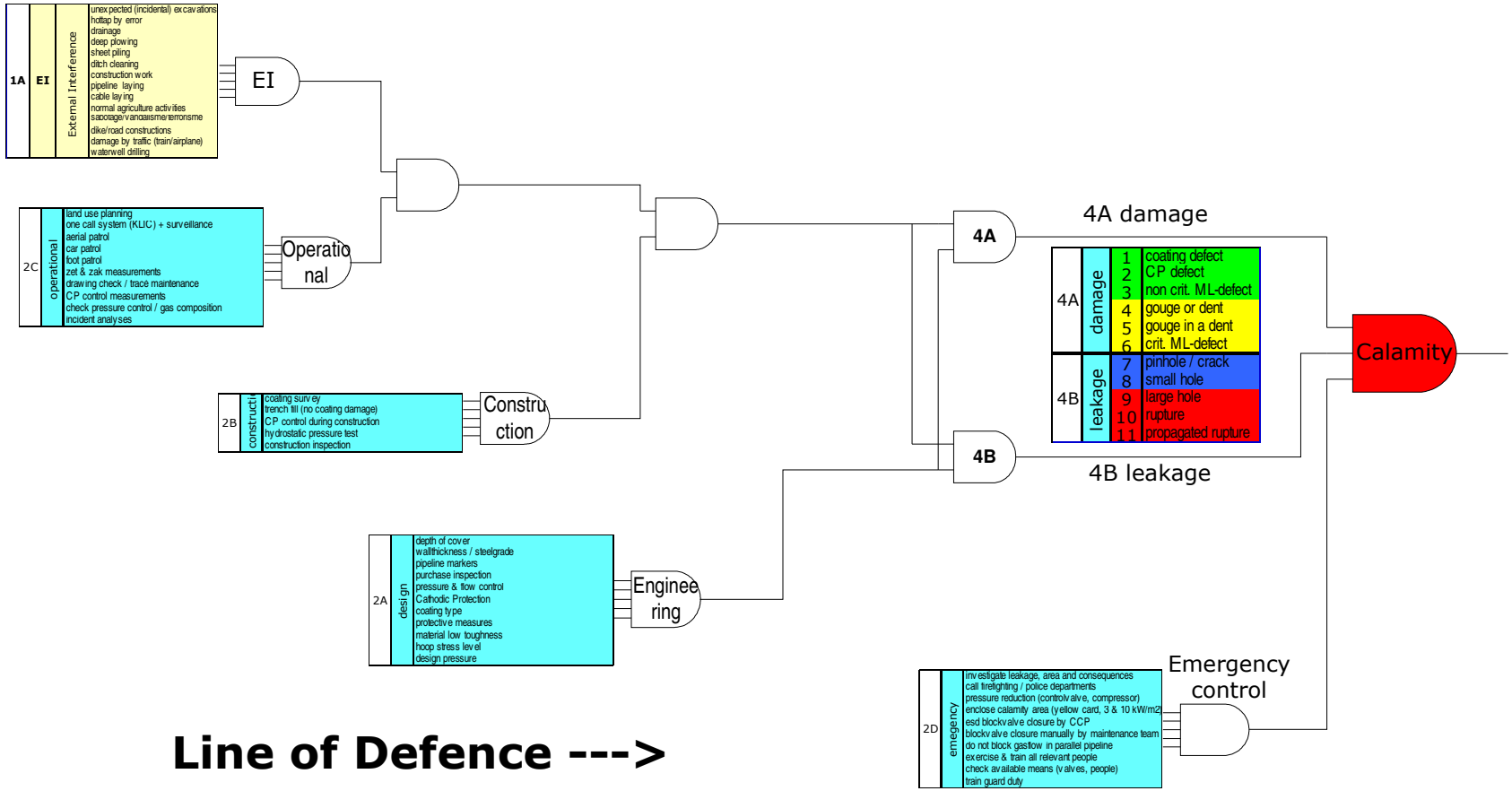
KPI PiMS Overall model fault & event trees + LOD

Overall Fault Tree Pipeline Incident



KPI PiMS Fault tree & LOD

Fault Tree
Pipeline Incident
External Interference



Line of Defence --->

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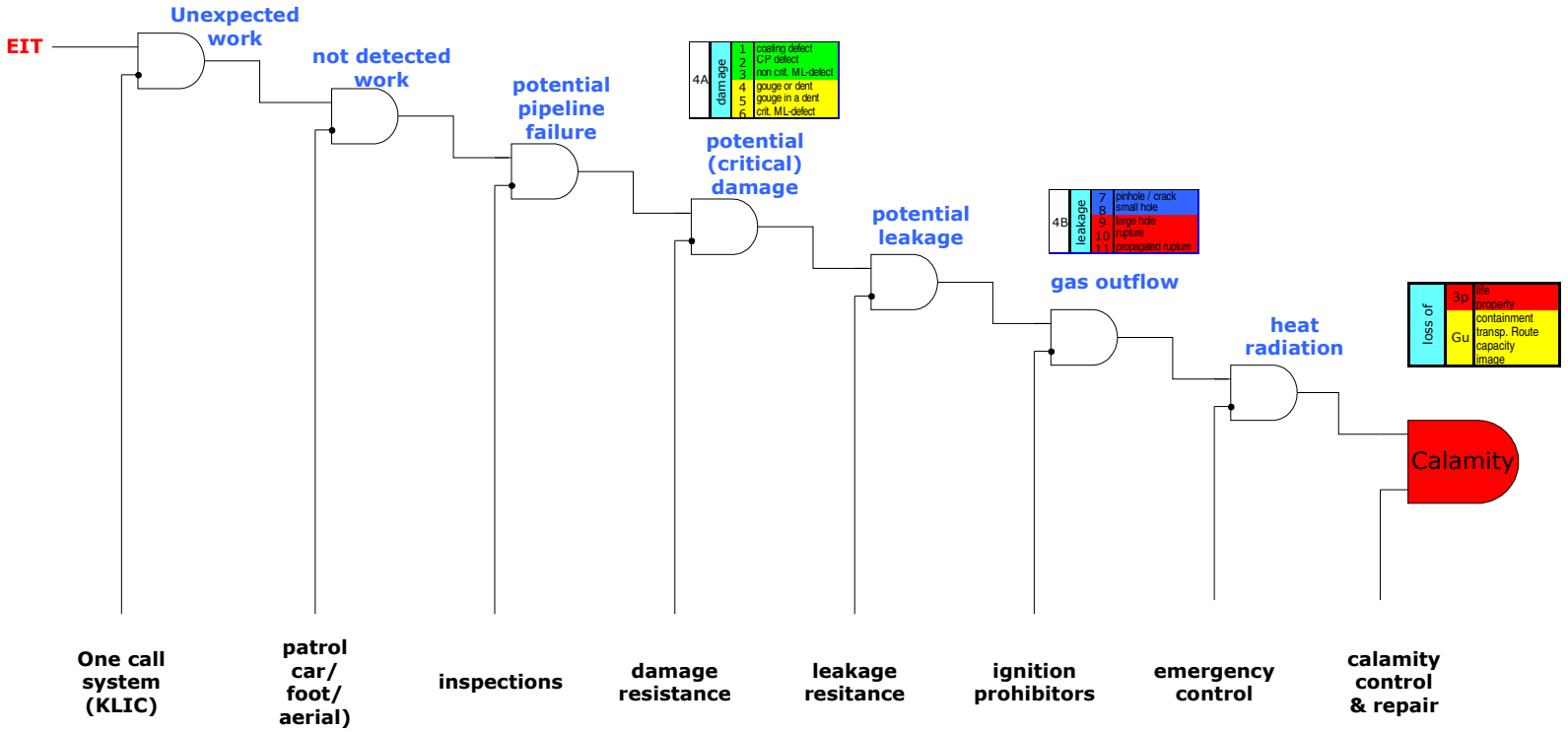
KPI PiMS Pipeline incident

Fault Tree
Pipeline Incident
External Interference



Line of Defence --->

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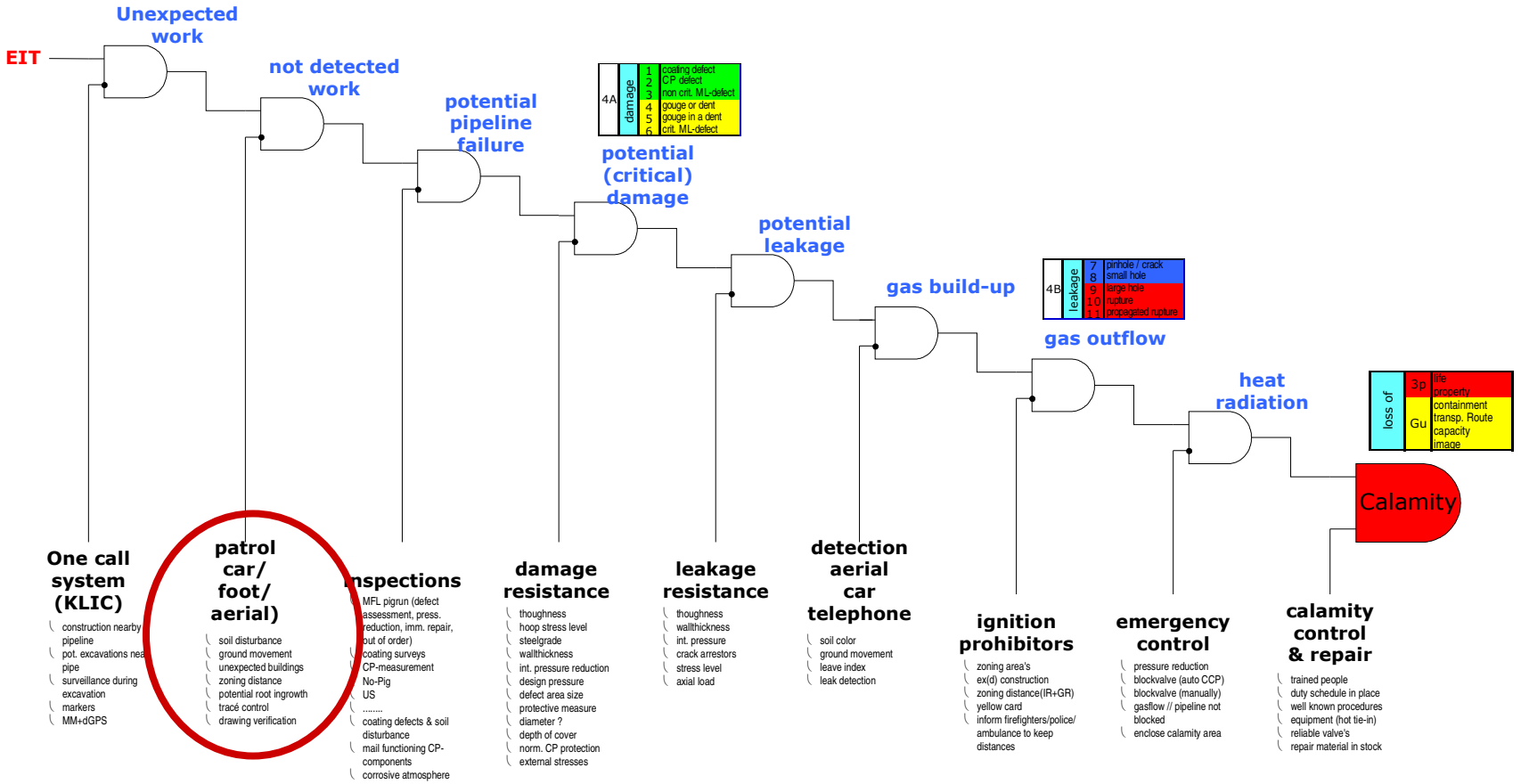
KPI PiMS Line of Defences

Fault Tree
Pipeline Incident
External Interference



Line of Defence --->

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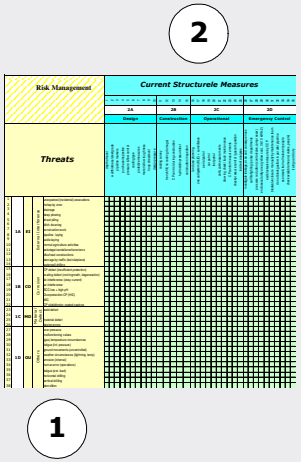
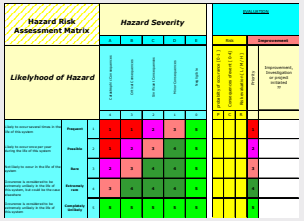
KPI PiMS Overall model threats & measures

Overall PiMS Model
Hazard & Calamity Control
Pipeline Incident





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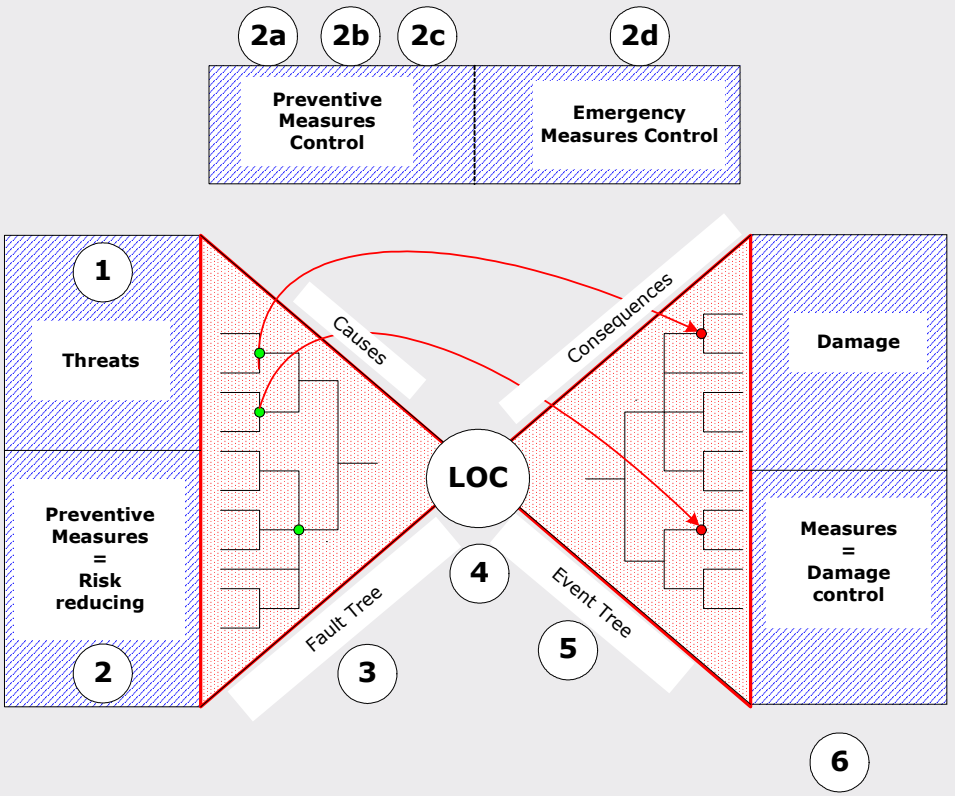
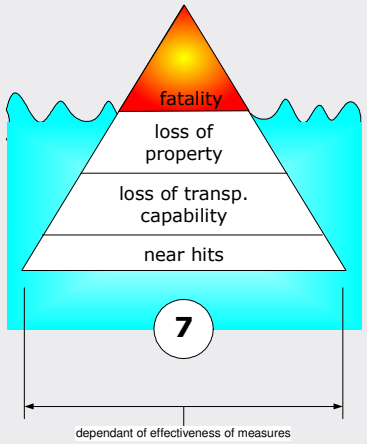


Line of Defences



Consequences

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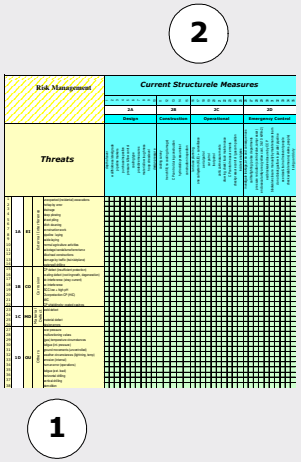
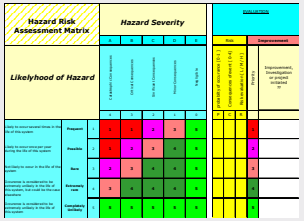
KPI PiMS Consequences

Overall PiMS Model
Hazard & Calamity Control
Pipeline Incident





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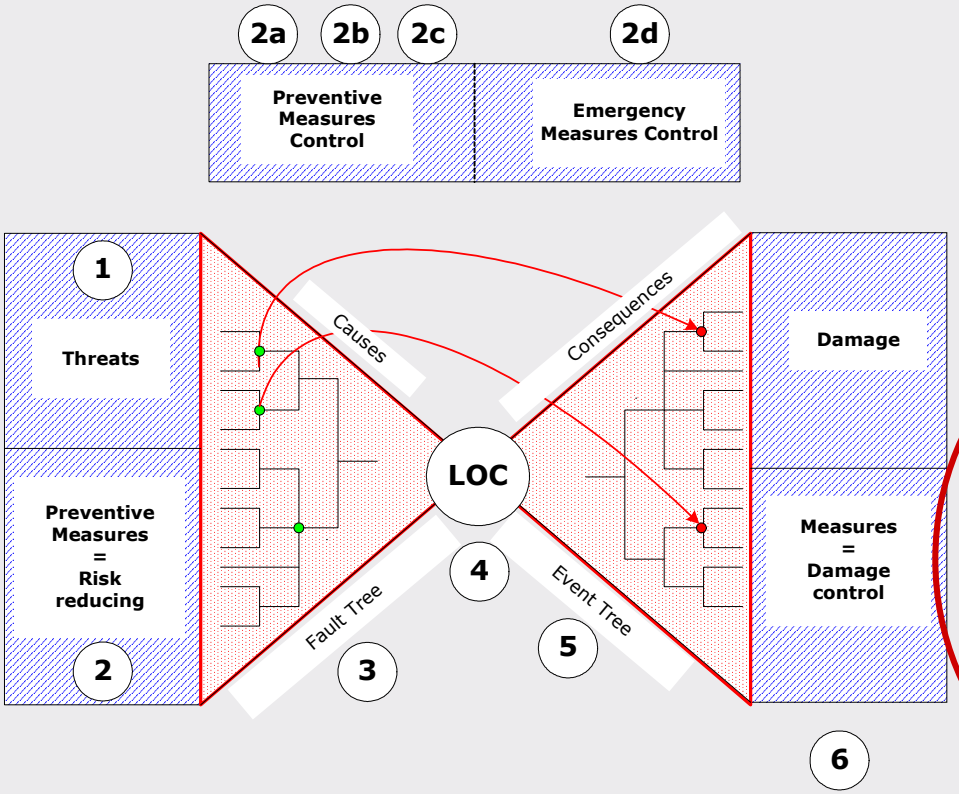
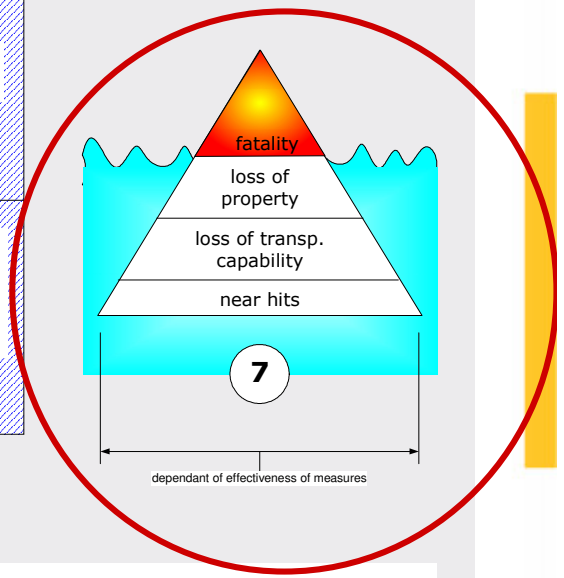


Line of Defences



Consequences

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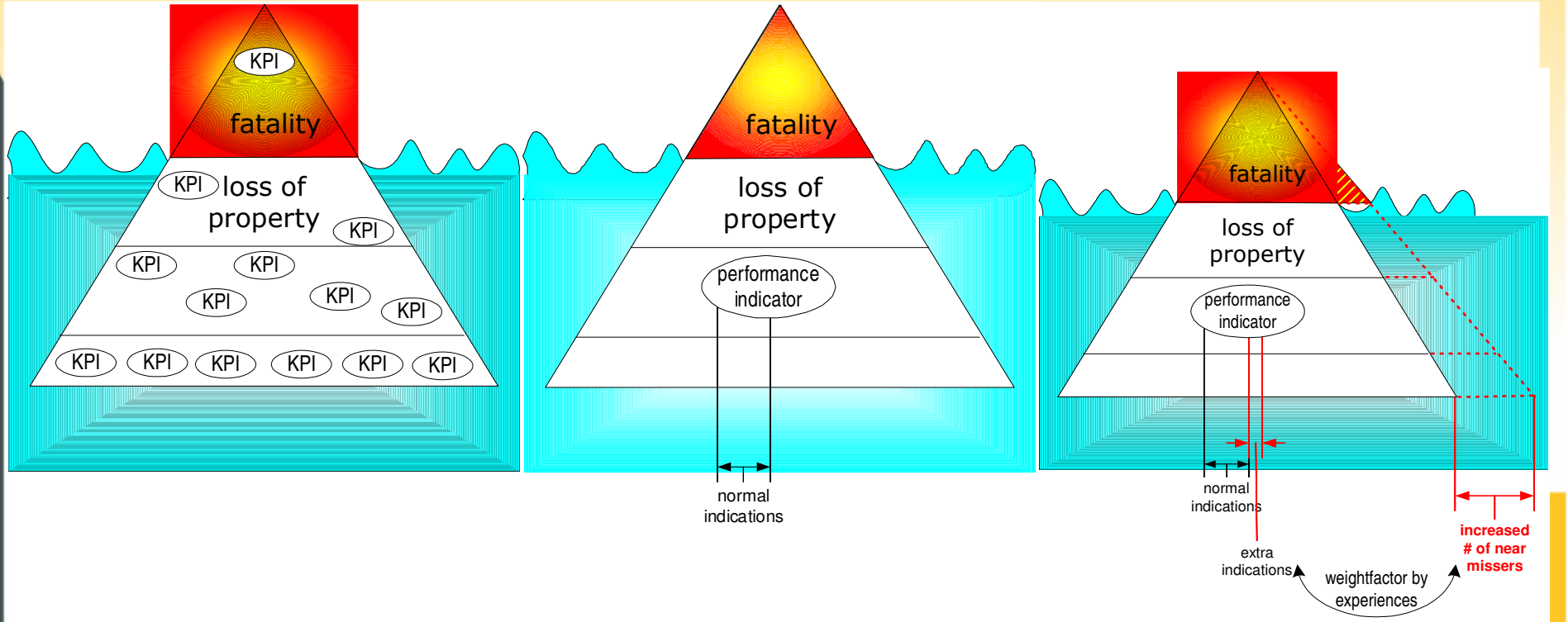
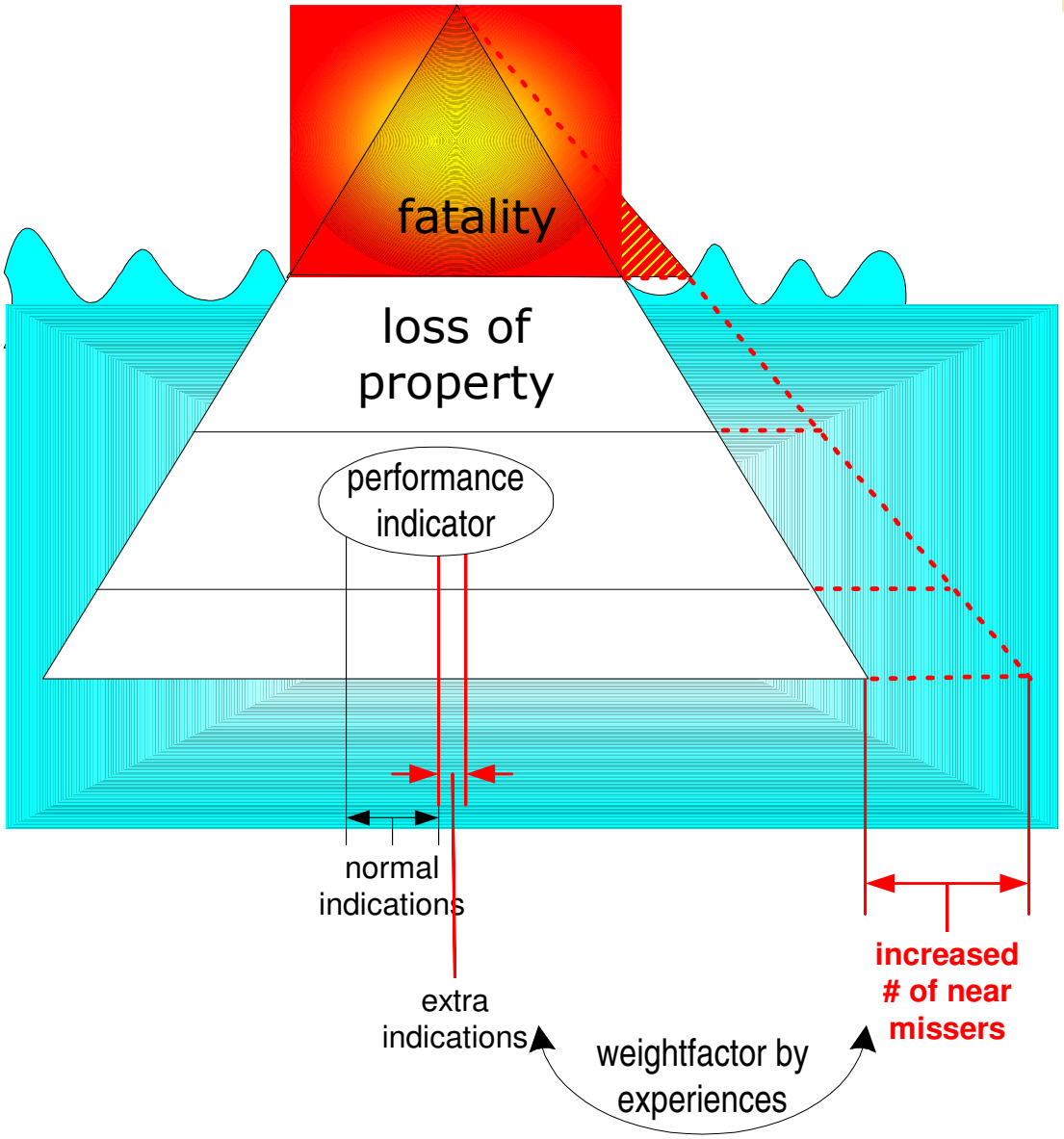
KPI PiMS Iceberg theory

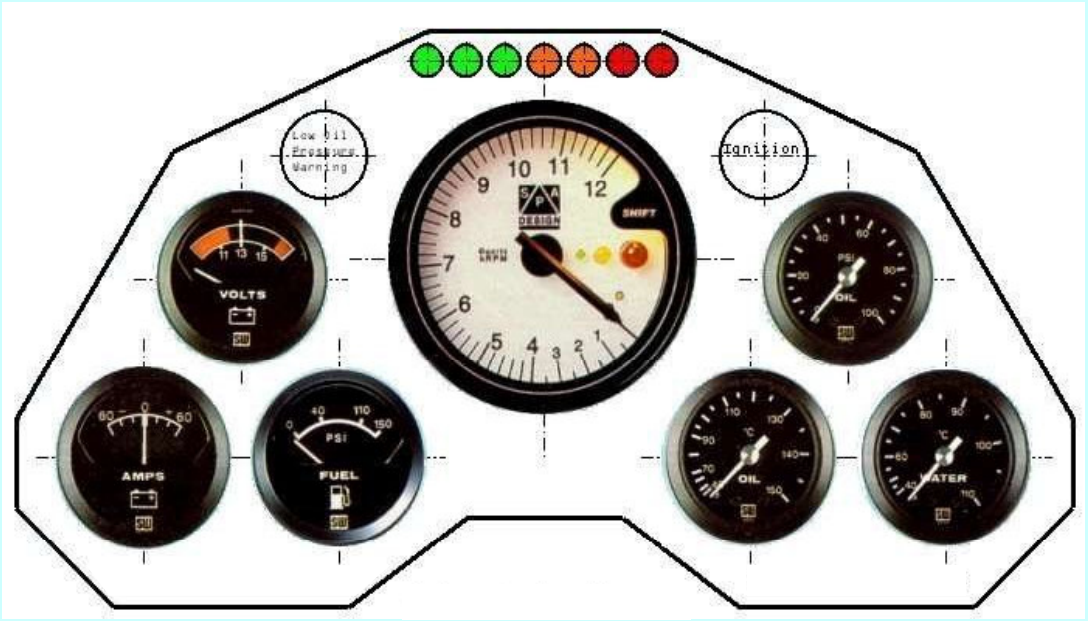


KPI PiMS Iceberg theory

- ***Consequences***
  - Loss of live (fatality / injury)
  - Loss of assets
    - Loss of property
    - Loss of transport medium
    - Loss of transport capacity
  - Loss of image / PR



KPI PiMS Dashboard



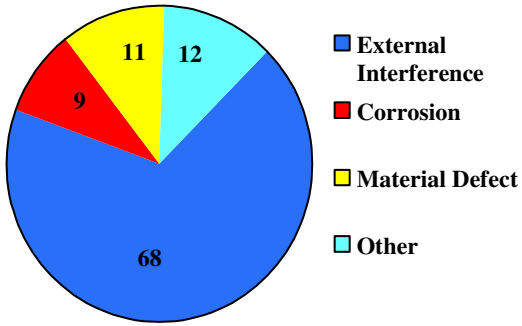
Dashboard Pipeline management

KPI PiMS Potential KPI's

Categorie	Nr	Item	Sub item	Criterium	Signaal level Criteria L	Signaal level Criteria M	Signaal level Criteria H		# KPI's
EI	1	inspectie per auto		50% / 1 jaar	x	x	x		24
	2	inspectie per voet		60 % / 2 jaar	x	x	x		
	3	inspectie per helikopter		90% / 2 week	x	x	x		
	4	verwerking KLIC melding		< 2 dgn	x	x	x		
	5	begeleiding door RT'er bij KLIC-melding		100%					
	6	# incidenten, geKLICt, geen RT		< 0					
	7	# niet gedetecteerde werkzaamheden							
	8								
	9	aantal incidenten		< 30 /jr	x	x	x		
	10	aantal incidenten HTL			x	x	x		
	11	aantal incident RTL			x	x	x		
	12	aantal PE incidenten							
	13	aantal incidenten voortschrijdend		< xx / km.jaar					
	14	aantal incidenten vlgs EGIG definitie		< 2 / 10 jr					
	15	diepteligging HTL		> 1.20 meter					
	16	diepteligging RTL		> 0.80 meter	x	x	x		
	44				x	x	x		
	45				x	x	x		
	46								
									105
				Aantal	35	35	35	105	Ok

KPI PiMS Performance Indicator

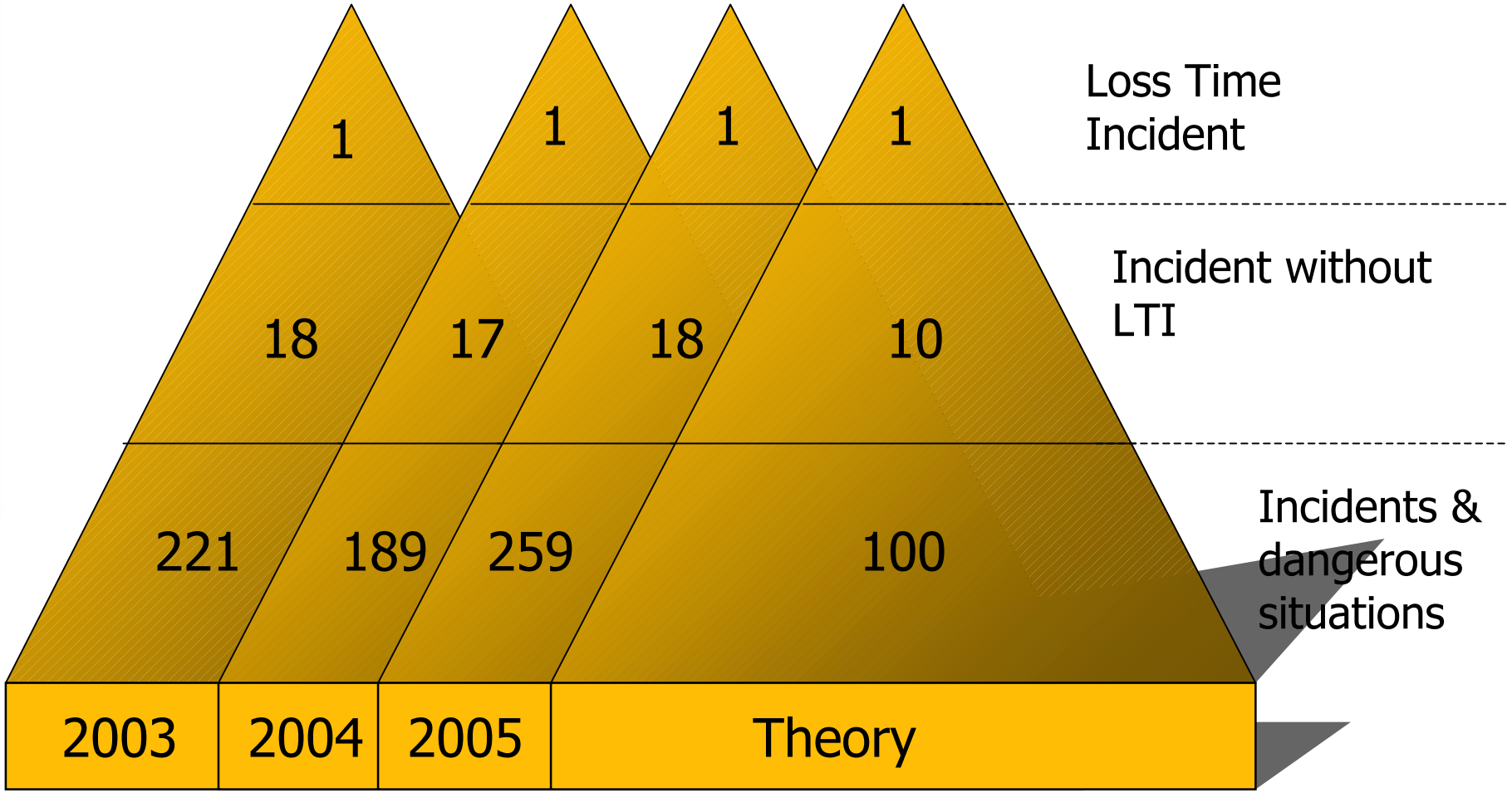
- ***KPI***
  - Heinrich incident distribution
  - $F \triangleleft (W_{EI} * EI + W_{CO} * CO + W_{MD} * MD + W_{OU} * OU)/330$
  - Ratio of LOD's
  - Cost beneficial yes/no
  - Maximum allowable basic events



KPI PiMS Results

- ***Results***
  - Still under development, however
  - Already integrated in yearly safety report
  - Change in strategy and more awareness
  - From incident driven towards long term strategy
    - Not only incident monitoring
    - From incident monitoring to corporate strategy
    - From looking in the past to future assessment
    - And a feed forward control on basic events
  - Controlling effectiveness of L.O.D.

KPI PiMS Results



Thank you for your attention

Questions ?