Risk Based Management for Process Industries

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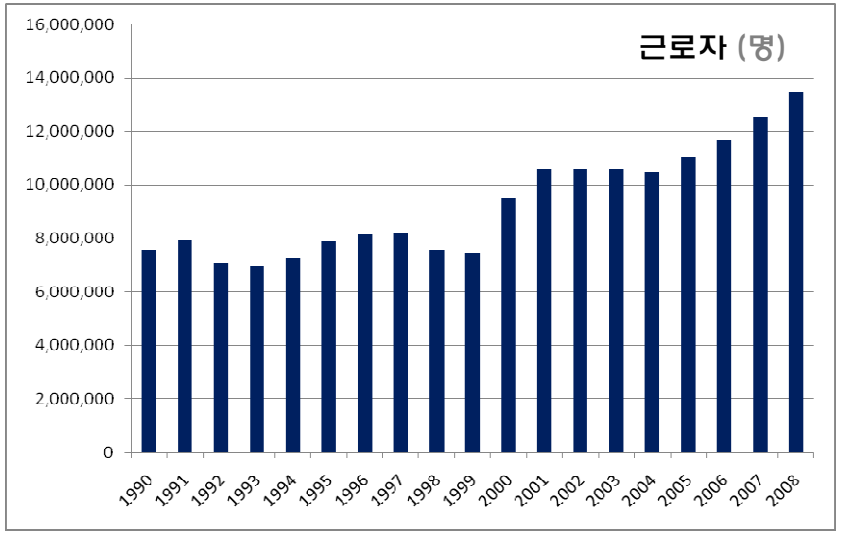
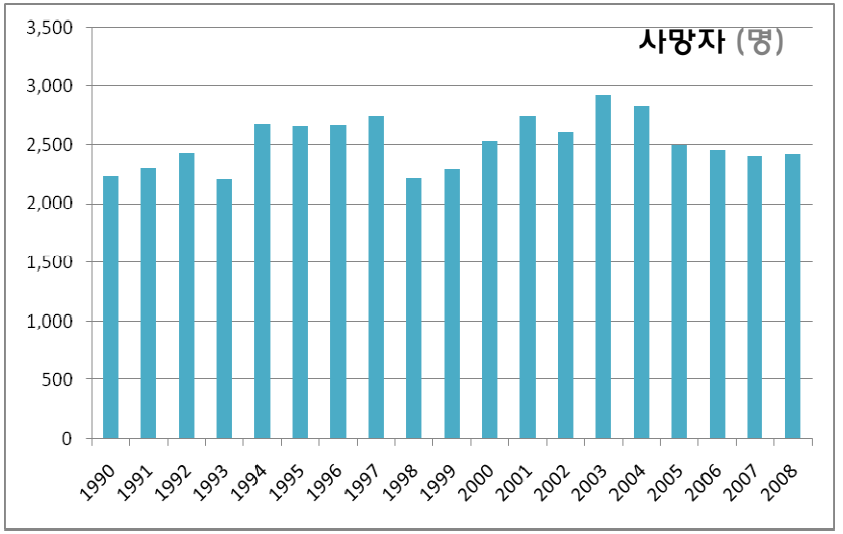
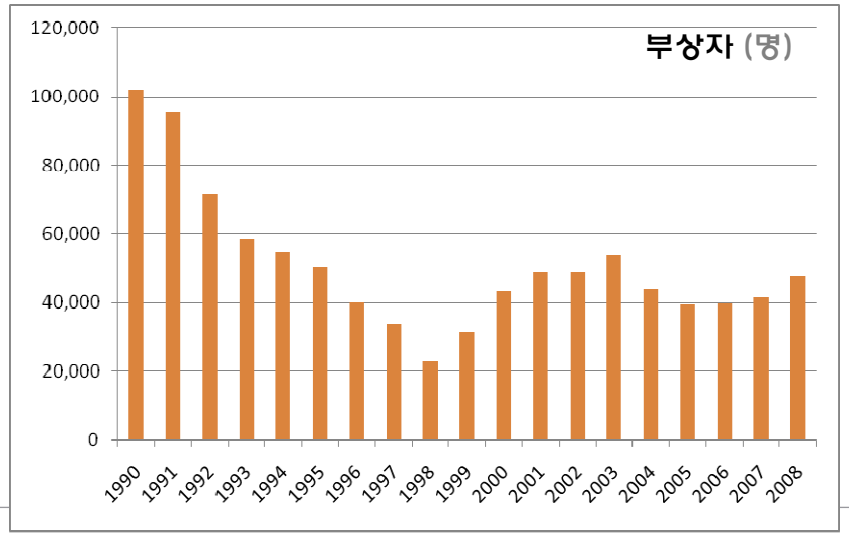
MANAGING RISK

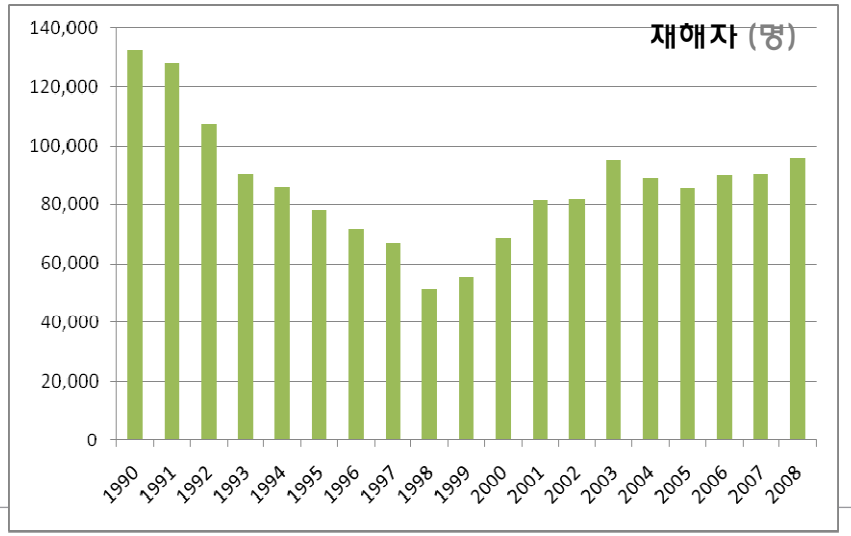

Risk?

Accidents : Statistical Analysis (Domestic)



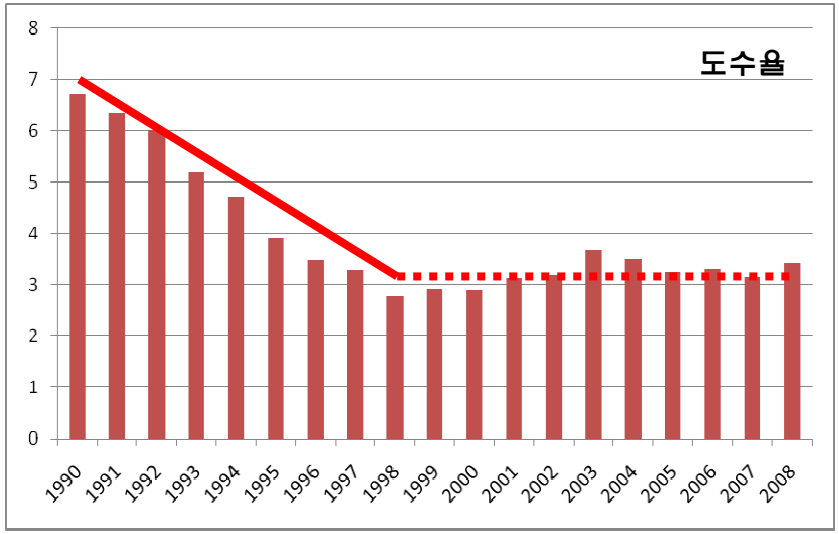


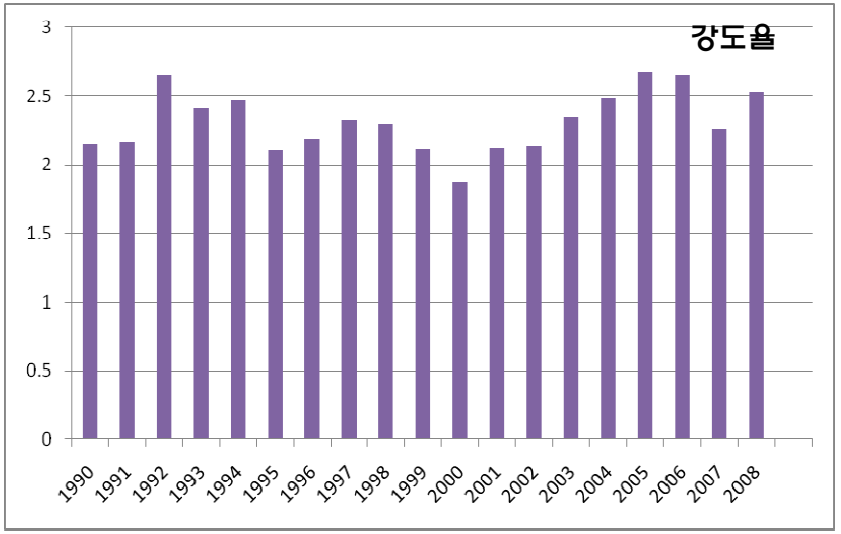


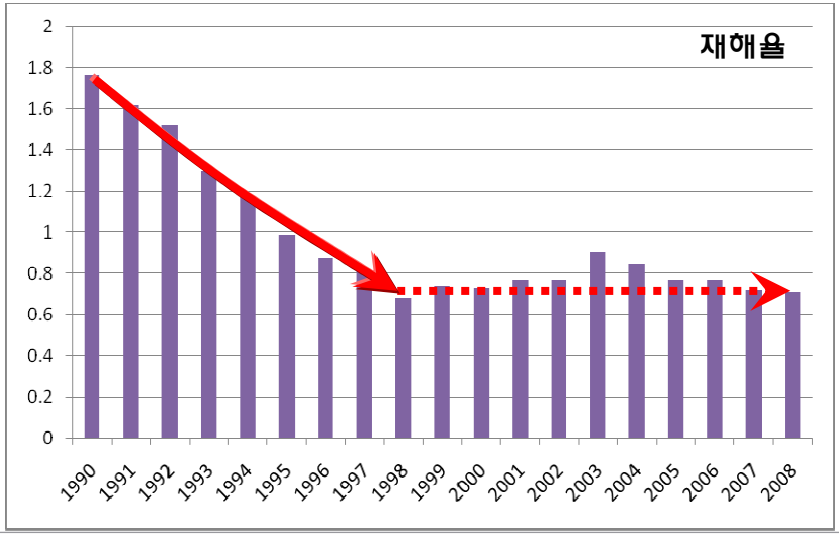


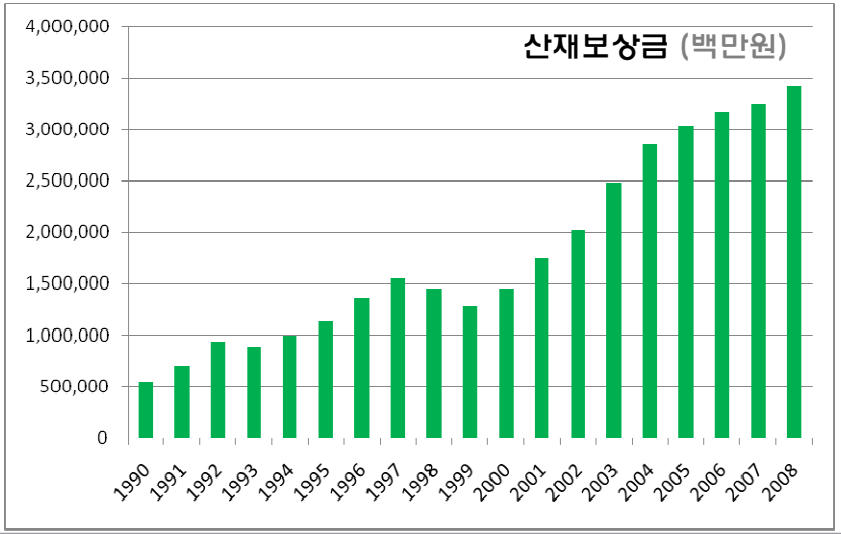
출처 : 고용노동부 2009년 산업재해조사 통계

Accidents : Statistical Analysis (Domestic)

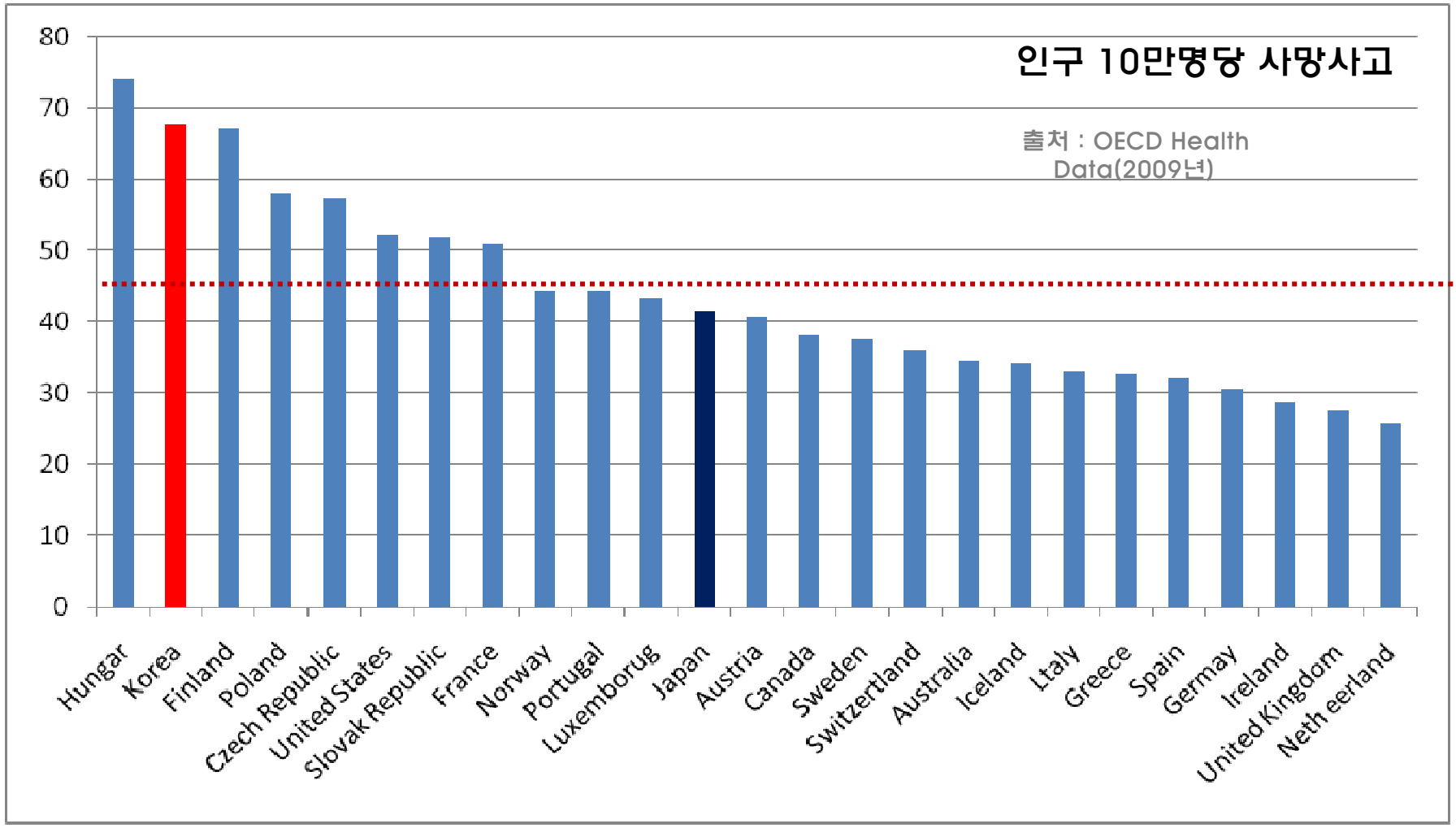








Accidents : OECD (’08)



Accidents : OECD

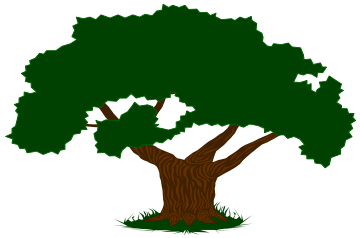
사망만인율 : OECD 국가 중 최고

- ✓ 대한민국 : 1.8 ('08)
- ✓ 미국 : 0.48 ('07)
- ✓ 일본 : 0.26 ('07)
- ✓ 영국 : 0.07 ('07~'08)


Positive proof of global warming.
18th Century
1900
1950
1970
1980
1990
200

Risk = Probability x Consequences

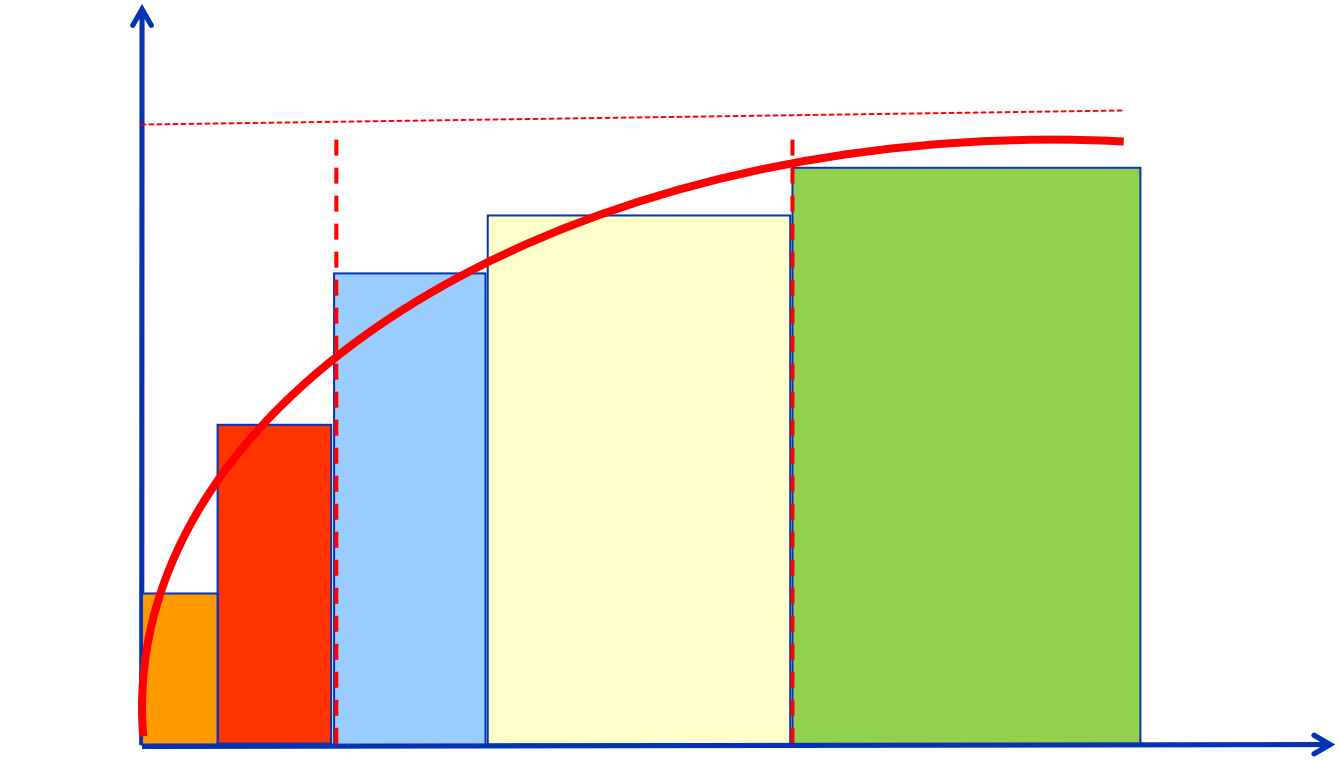
- Personnel Fatality / Injury



- Asset Damage
- Production Loss
- Environmental Impact

- Loss of Reputation
- Social / Political Impact

General Phenomena : Rate vs. Driving force

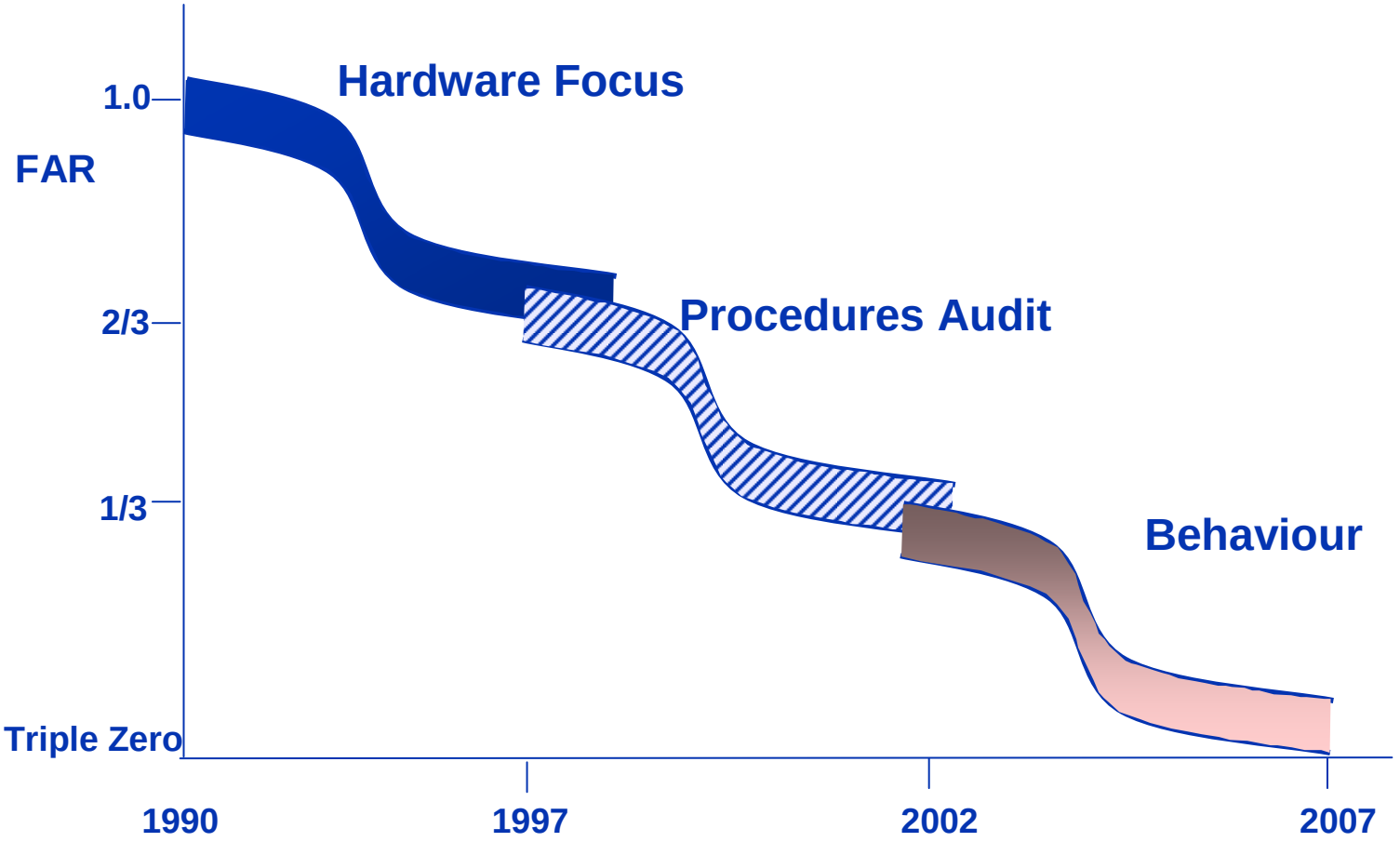


Y = f(a, b, …, n)
≒f(a)

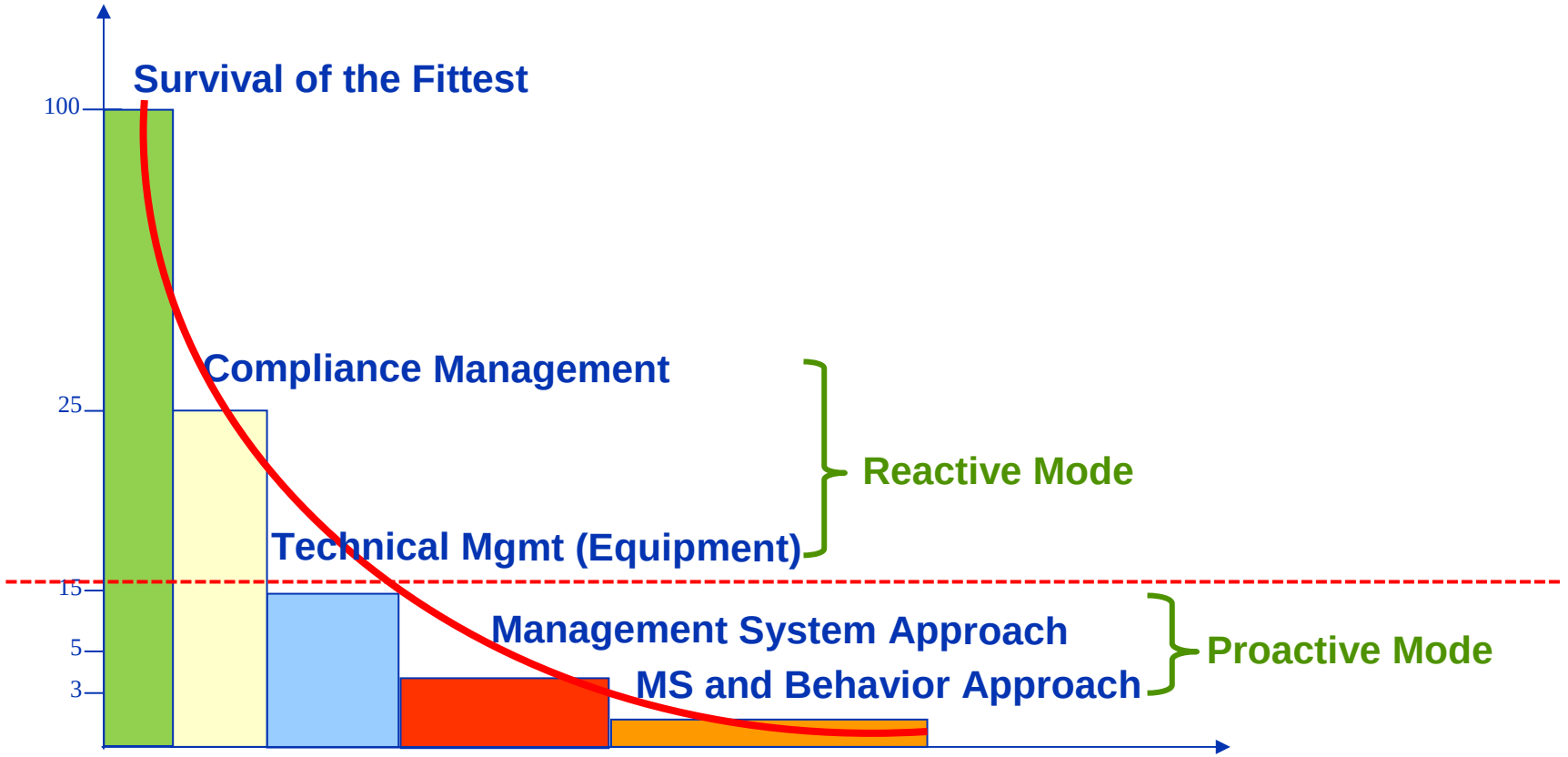
Y = f(a, b, …, n)
≒f(a,b)

Y = f(a, b, …, n)

Safety Management : Levels

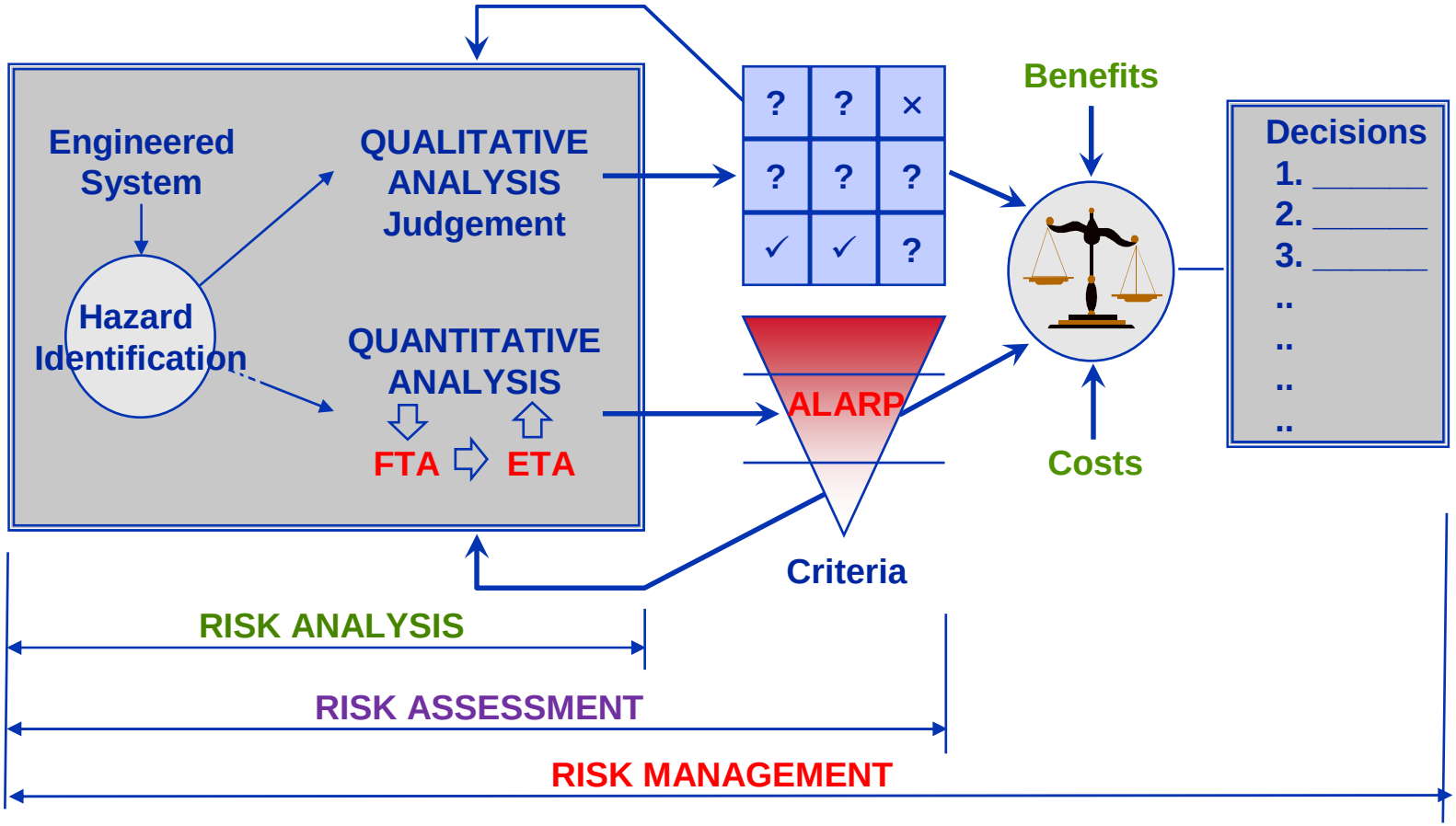


Safety Management : Steps



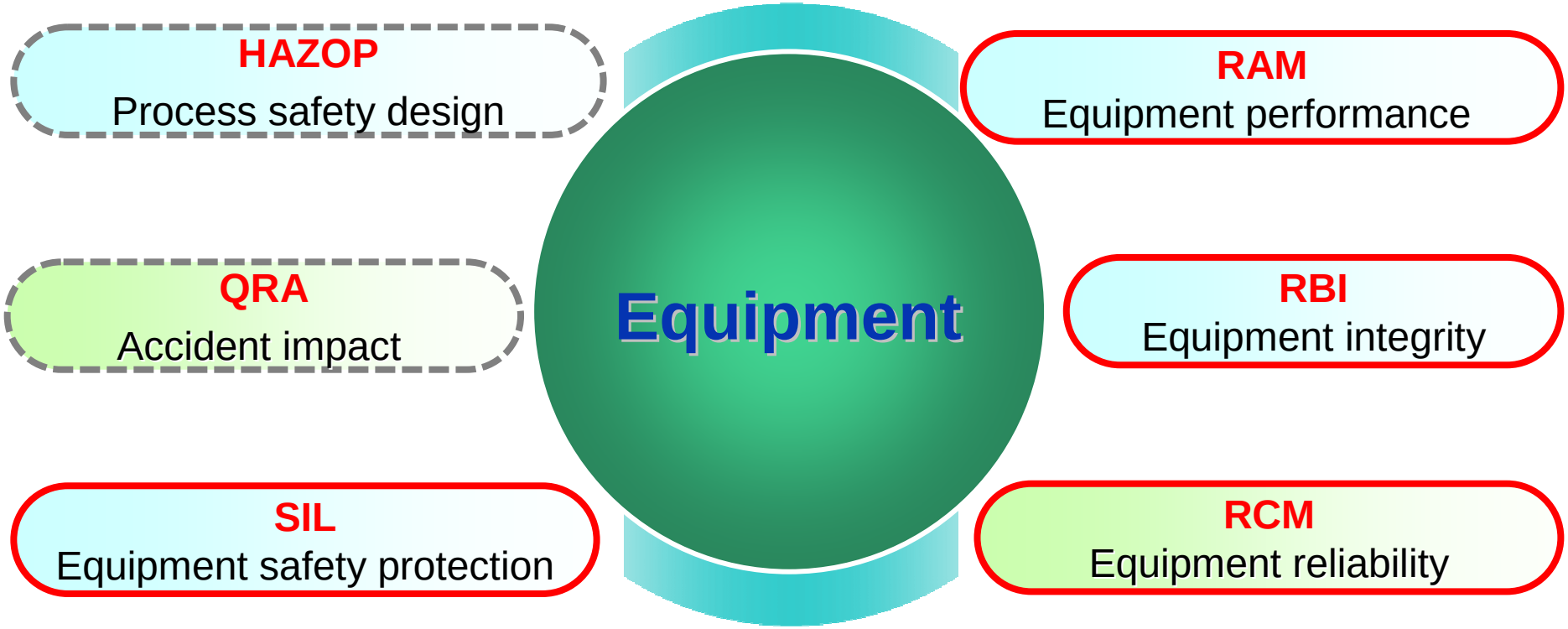
Why Manage Risk ?

Risk Assessment & Management



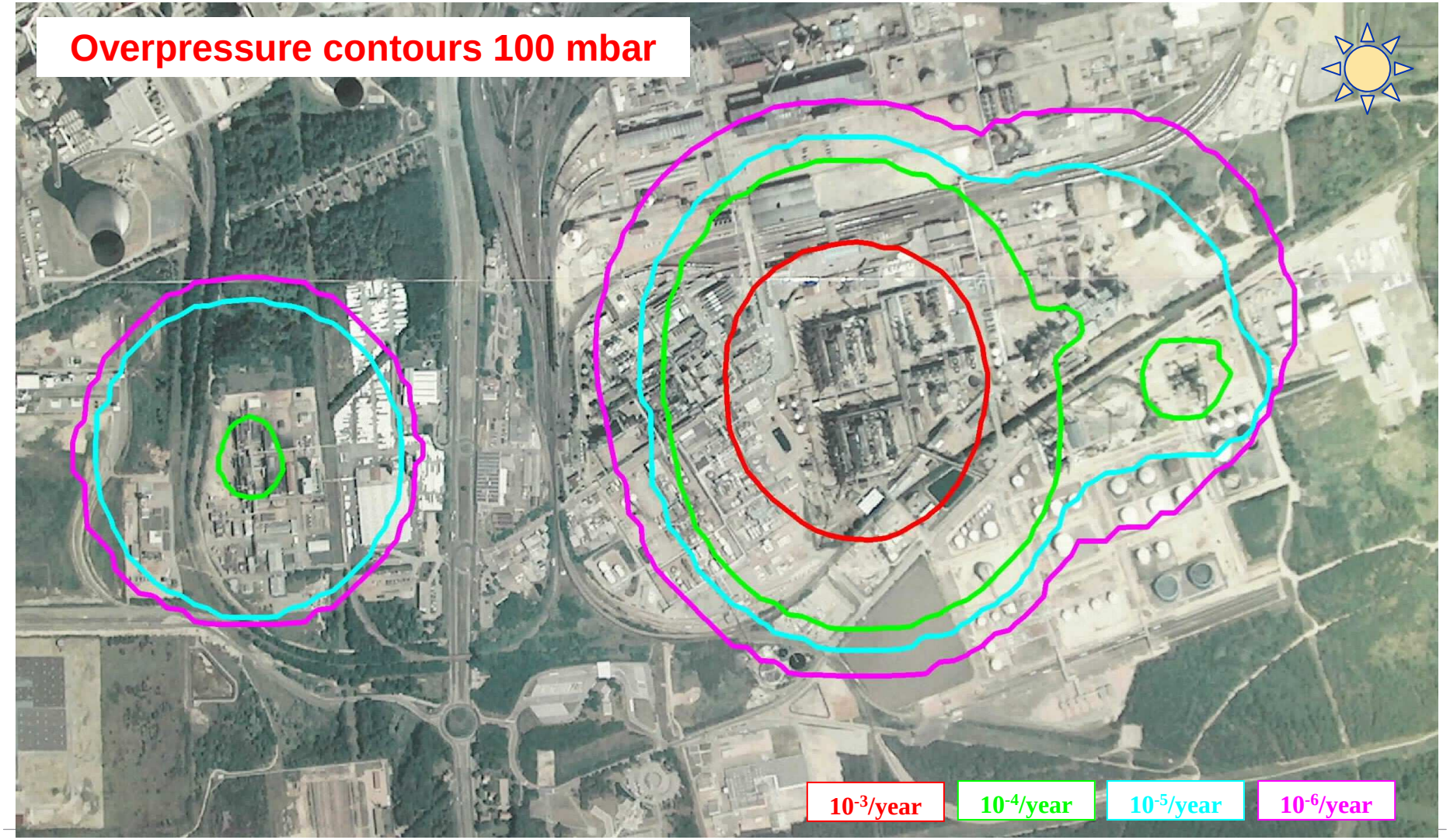
Hazard Identification	Development of Options	Decision
Risk Estimation	Option Analysis	Implementation
		Monitoring and Evaluating
		Review

Risk Assessment : Methodology



RCM (Reliability Centered Maintenance), RBI (Risk Based Inspection)
RAM (Reliability Availability Maintainability), SIL (Safety Integrity Level)

Risk Assessment : Case Study (QRA)



Risk Assessment : Case Study (SIL)

SIL Classification → **SIL Verification** → **Develop SRS**

Select SIF
- Establish Design Intent

↓

Identify Initiating Causes
- Estimate Initiating Cause Frequency (IC)

↓

Determine Scenario / Consequences Level
- People, Environment, Economy
- Determine Target Mitigated Event Likelihood (TMEL)

↓

List IPL
- Assess IPL Type and IPL Integrity

↓

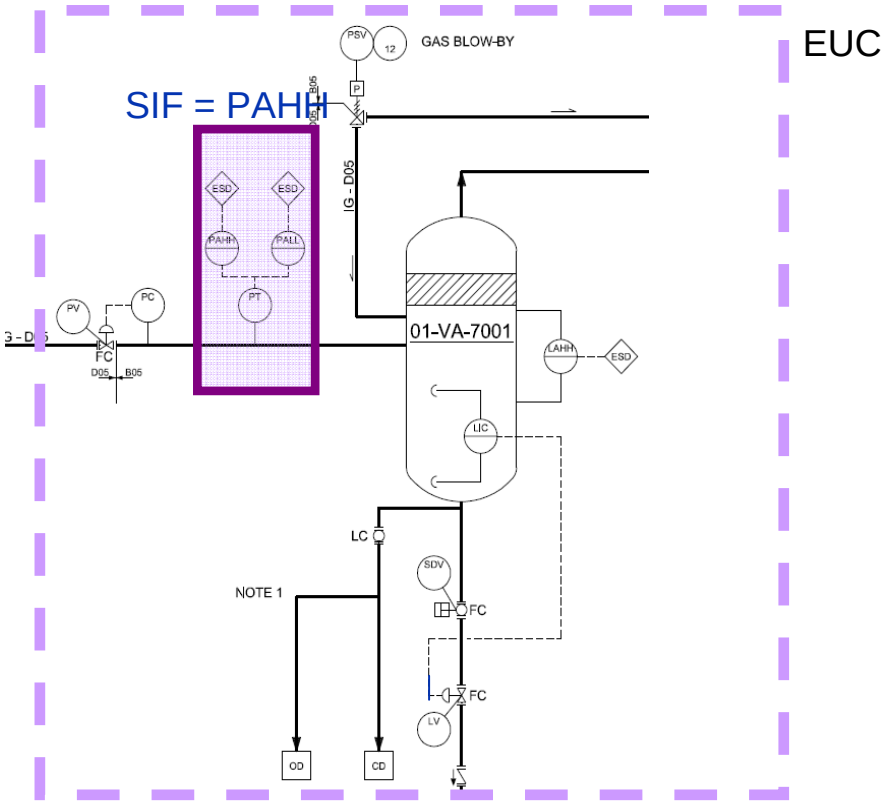
Determine Intermediate Event Likelihood (IEL)
or Frequency of Unmitigated Consequences

↓

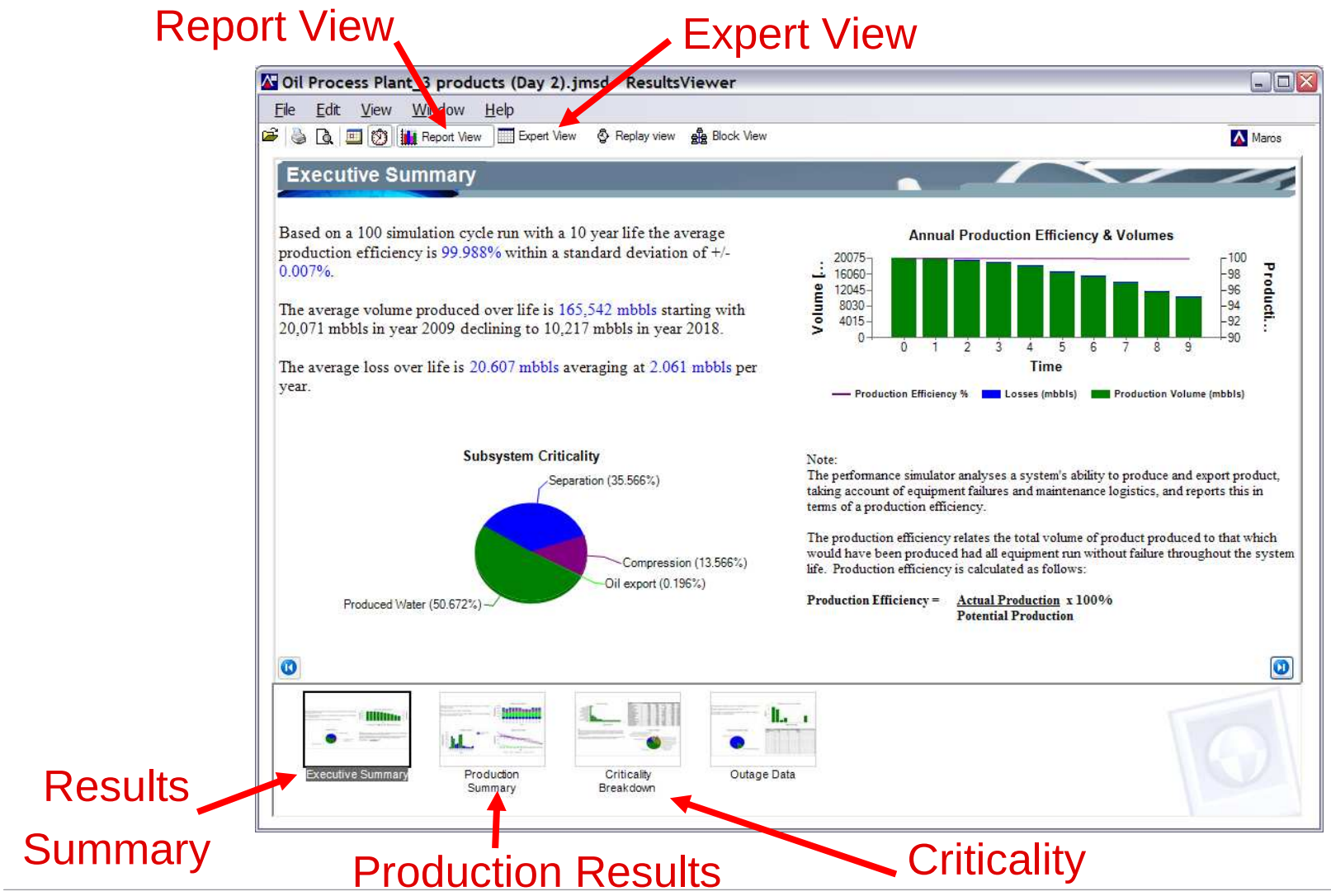
Calculate Risk Reduction Factor (RRF) Required

↓

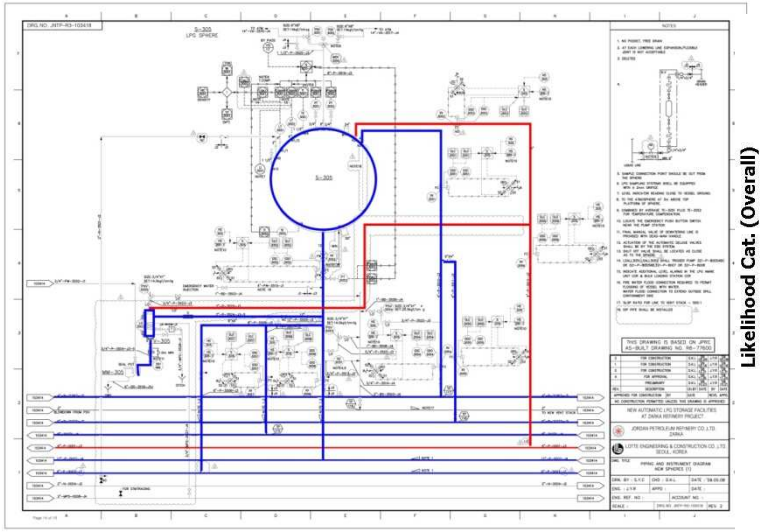
Missing Risk Reduction (if any), gives the target SIL of an SIF



Risk Assessment : Case Study (RAM)



Risk Assessment : Case Study (RBI)



Likelihood Cat. (Overall)	A	B	C	D	E
5	0	0	0	0	0
4	0	0	0	0	0
3	0	0	0	0	4
2	0	2	0	0	0
1	5	1	19	62	27
	5	3	19	62	31

Conseq. Cat. (Overall) [USD]

	Total	Percentage
4. HIGH	4	3.33%
3. MEDIUM HIGH	27	22.50%
2. MEDIUM	81	67.50%
1. LOW	8	6.67%
Not Calculated	0	0.00%
Screening Level	0	0.00%
Detailed Level	120	100.00%

2

114

	1	2	3	4	5
Before RBI	29%	26%	13%	23%	9%
After RBI	2%	14%	24%	36%	24%

Risk Assessment : Case Study (RCM)

FMEA & Risk analysis

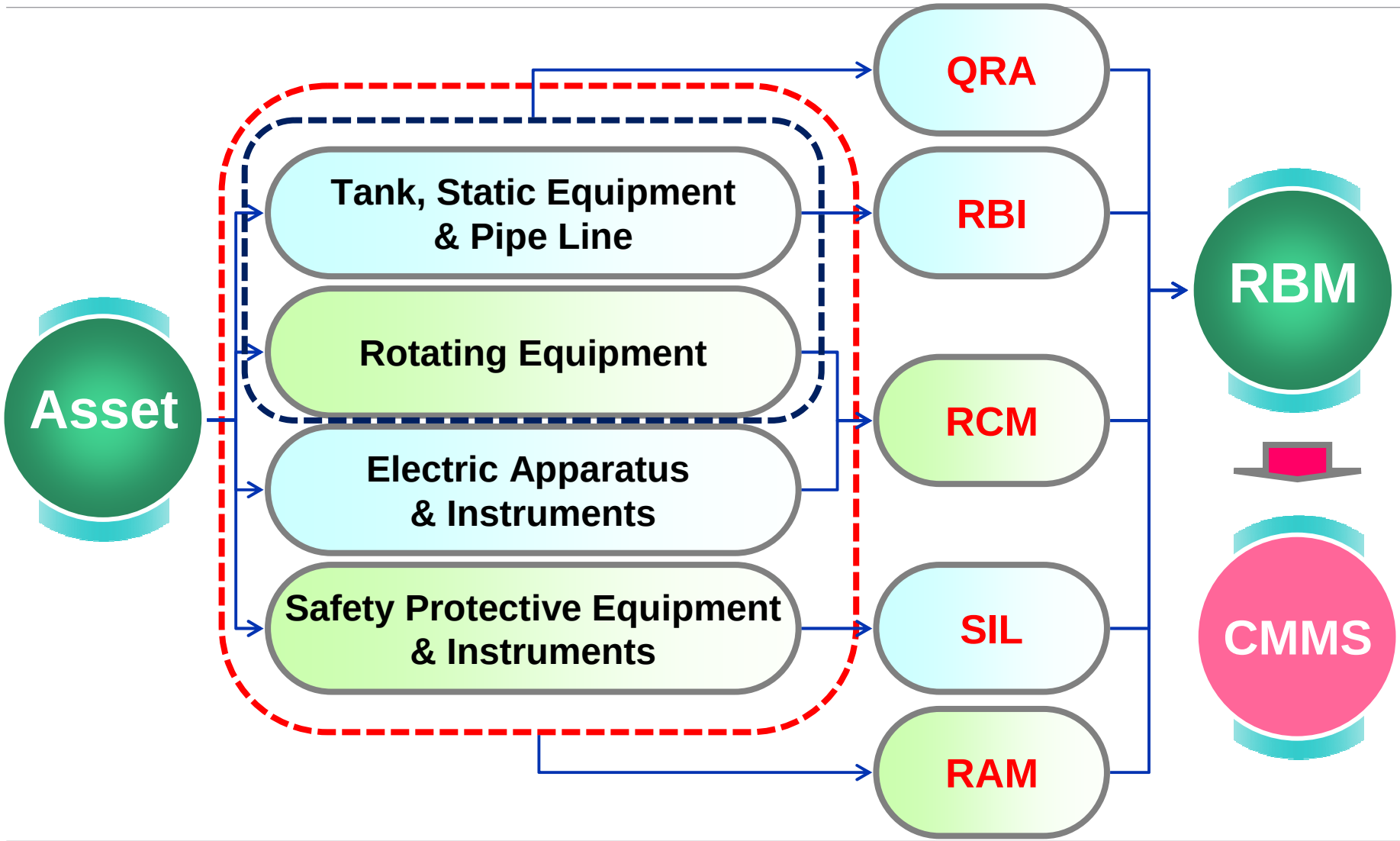
Risk Analysis

Plant Code: HULL **Plant Name:** Belanak FPSO Hull

Equipment: Ballast System Overview

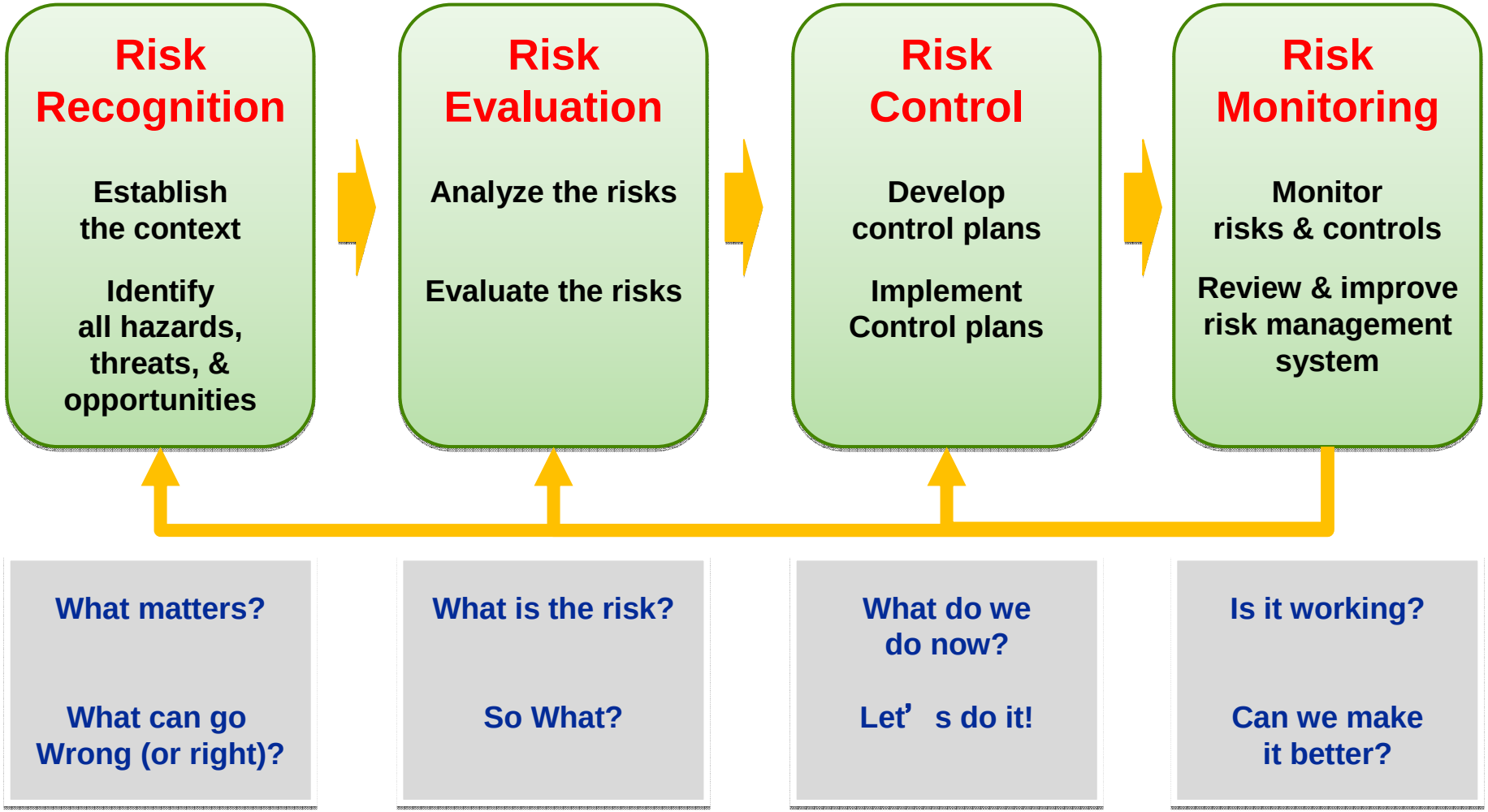
Tag No	Tag Type/Failure Mode	PoF/CoF	Safety	PoF/CoF	Env.	PoF/CoF	Prod Loss	PoF/CoF	Follow Cost	Failure Effects/ Comments
76ZSX-516	Not Analyzed	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	Not Analyzed
	Not Analyzed	No Injury		Slight Effect (<= 100L)		Slight Effect (<=2Hrs)		Slight Effect (<=0.1 Mill)		
76ZSP-517	Fire Extinguisher, CO2 Fixed	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	0.001-0.01 (prob 0.1-0.01)	L	Depletion of CO2 supply. Loss of reactive capability to subsequent fire.
	Spuriously activates	No Injury		Slight Effect (<= 100L)		Slight Effect (<=2Hrs)		Slight Effect (<=0.1 Mill)		
76ZSP-517	Fire Extinguisher, CO2 Fixed	0.01-0.1 (prob 0.8-0.1)	H	0.01-0.1 (prob 0.8-0.1)	M	0.01-0.1 (prob 0.8-0.1)	M	0.01-0.1 (prob 0.8-0.1)	H	Possible loss of control of fire
	Fails to activate on fire detection	Single fatality PLL<10-3/yr		Localised Effect (1000L-10000L)		Major Effect (8-24 Hrs)		Major Effect (10-25 Mill)		

Risk Based Management



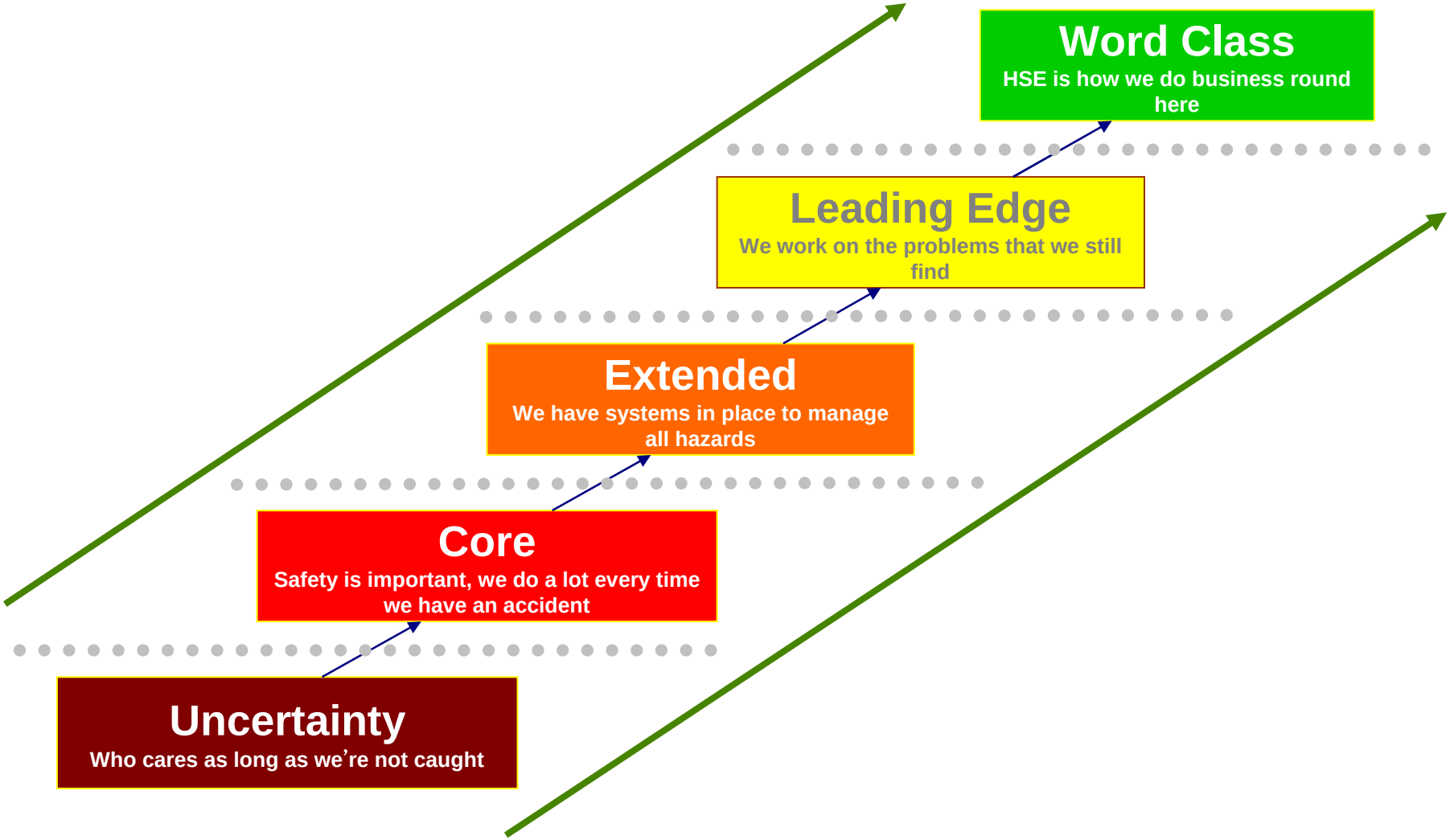
CMMS (Computer based Maintenance Management System)

Risk Based Management : Procedures

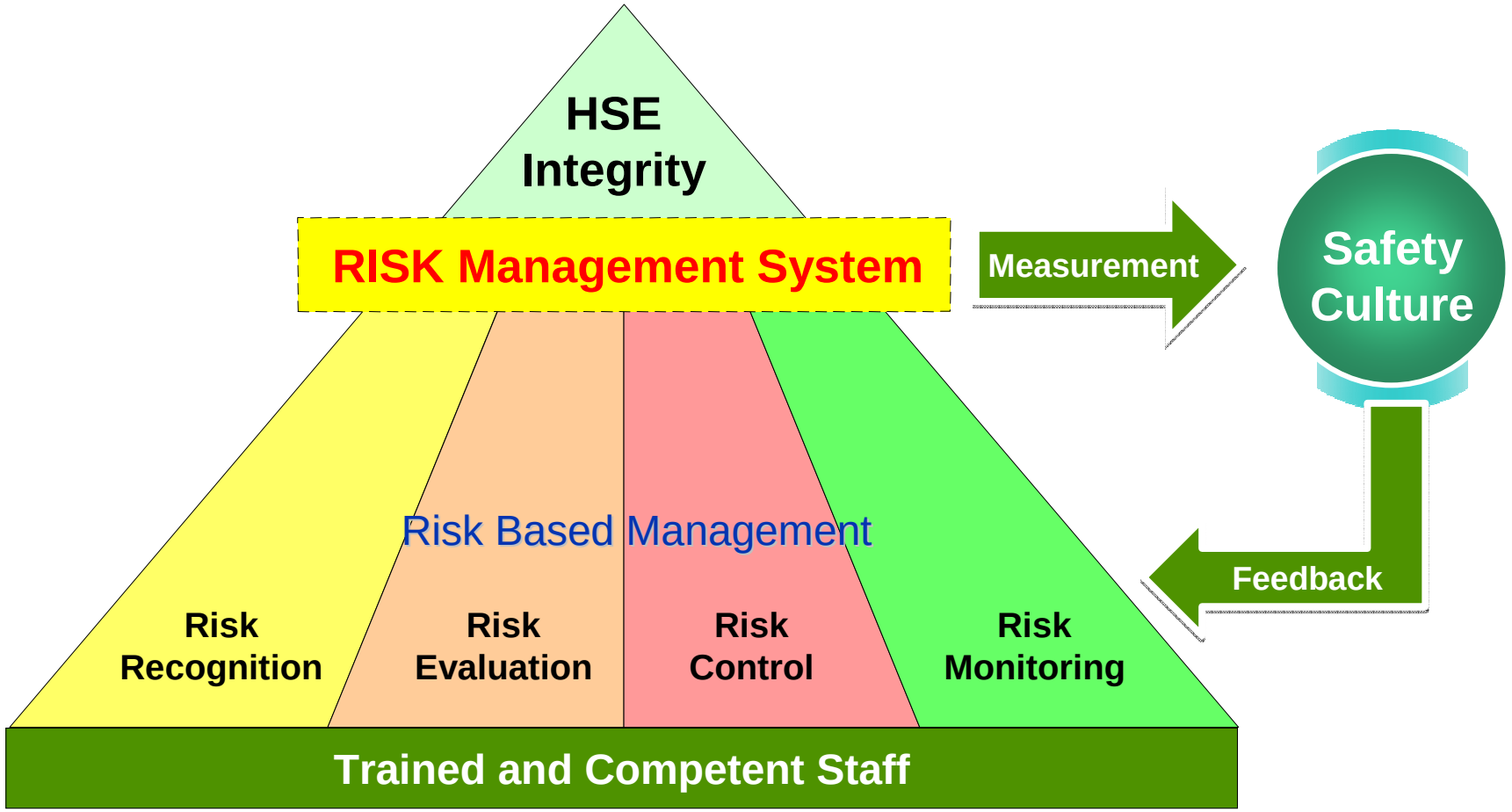



Management Audit Systems
Perception Assessment Process
Incident Investigation and Analysis
Management Systems Certification
SOP and Work Instructions Process
Regulatory Compliance Programs
Contractor Management Systems
Issues Identification Process
Supply Chain Management Process
Supervisory Development Programs
Community Right-to-Know Program
Risk Identification
Risk Assessment
Risk Strategy
Leadership
Risk Culture

Safety Management : Ladder



Safety Management : HSE Integrity & Safety Culture



Safety Management : Strategy

DNV's Services

- HAZID
- HAZOP
- Failure Mode and Effects Analysis (FMEA)
- Quantified Risk Assessment (QRA)
- SIMumtaneous Operations (SIMOPS)
- Fire Risk Analysis (FRA)
- Explosion CFD Study (ERA)
- Gas Dispersion Study
- RAM (Reliability, Availability, Maintainability) Study
- Safety Integrity Level (SIL) Analysis
- Risk Based Inspection (RBI)
- Reliability Centered Maintenance (RCM)
- Computer based Maintenance Management System (CMMS)
- International Safety Rating System (ISRS)
- Safety Culture

Safeguarding life, property and the environment

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MANAGING RISK