

OIL & GAS

Vedligehold og vedligeholdelsesplaner set fra tredje parts inspektion – hvor trykker skoen?

EX Forum

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07 May 2019

Hvem er jeg?

- Claus Ingemann Nielsen
 - Stærkstrømsingeniør
 - **Senior Principal Surveyor**
 - **Head of Section, Facilities**
 - Process safety
 - Risk mangement
 - Electical and instrument
- With a team of 30 Engineers

Agenda

- DNV GL
- Olie og Gas, performance baseret vedligehold
- Hvor trykker skoen!

Global reach – local competence



150+
years

100+
countries

100,000+
customers

12,500
employees

Our vision: global impact for a safe and sustainable future

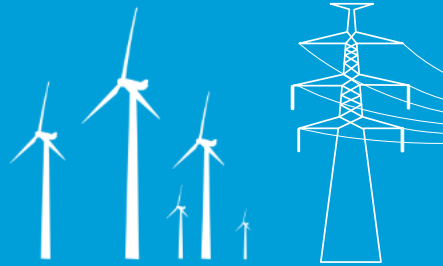
MARITIME



OIL & GAS



ENERGY



**BUSINESS
ASSURANCE**



**DIGITAL
SOLUTIONS**



Technology & Research



Global Shared Services



Vedligehold og vedligeholdelsesplaner set fra tredje parts inspektion



Spadeadam Large-scale explosion

Vedligehold og vedligeholdelsesplaner set fra tredje parts inspektion

Oplæg:

Med implimentering af EU Offshore sikkerheds direktivet EU 2013/30, ser vi i DNV GL Danmark en ændring i vedligholdssystemerne til at være performance drevet på de sikkerhedskritiske funktioner.

Jeg vil med min gennemgang sætte fokus på lovgivningen og hvordan den strategisk kan sætte rammen for gennemskulighed. Metoden er vel udviklet i England hvor den har været brugt i årevis og hvorfor kontinental europa skal omstilles til at efterleve lovgivningen.

En del af mine slides vil derfor også være på engelsk.

Major accidents (Oil and gas industry)

- Major accidents:
 - an incident involving an explosion, fire, loss of well control, or release of oil, gas or dangerous substances involving, or with a significant potential to cause, fatalities or serious personal injury
 - an incident leading to serious damage to the installation or connected infrastructure involving, or with a significant potential to cause, fatalities or serious personal injury
 - any other incident leading to fatalities or serious injury to five or more persons who are on the offshore installation where the source of danger occurs or who are engaged in an offshore oil and gas operation in connection with the installation or connected infrastructure

Arbejdstilsynets lovbekendtgørelse nr. 125 af 6. februar 2018

§3 stk. 28) Større ulykke: I forbindelse med et anlæg, tilsluttet infrastruktur eller en rørledning

a) en hændelse, der omfatter en eksplosion, brand, tab af brøndkontrollen eller udslip af olie, gas eller farlige stoffer eller materialer, som involverer eller har et betydeligt potentiale til at forårsage dødsfald eller alvorlig personskade, jf. også stk. 2,

b) en hændelse, som medfører alvorlig beskadigelse af anlægget eller tilsluttet infrastruktur, og som involverer eller har et betydeligt potentiale til at forårsage dødsfald eller alvorlig personskade, jf. også stk. 2,

c) enhver anden hændelse, der medfører dødsfald eller alvorlig personskade for fem eller flere personer, der befinder sig på offshoreanlægget, hvor kilden til faren opstår, eller som udfører en olie- og gasaktivitet i forbindelse med anlægget eller tilsluttet infrastruktur, eller

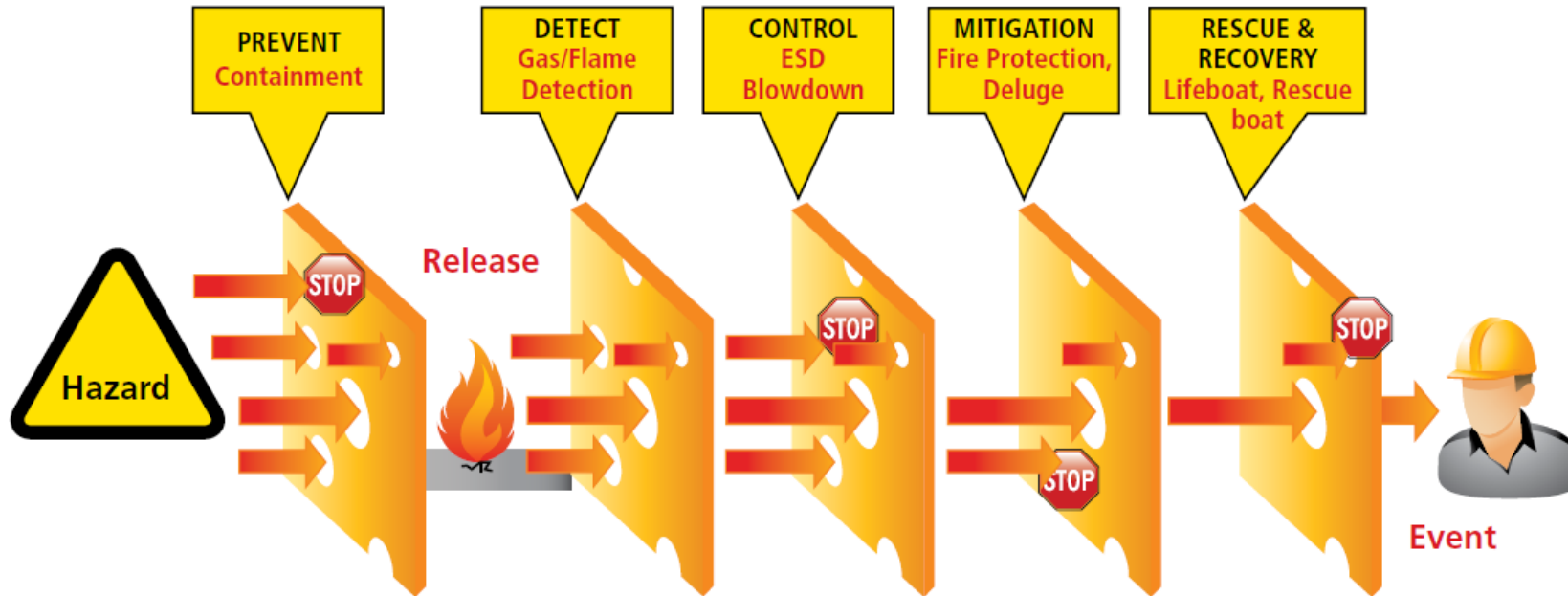
d) enhver større miljøhændelse, der skyldes hændelser omhandlet i litra a, b og c, jf. også stk. 2.

MAH "Major Accident Hazard"

SCEs "Safety Critical Elements"

SECEs "Safety and Environmental Critical Elements"

SECEs/BARRIERS MODEL



Step Change in Safety - Assurance & Verification Practitioner's Guide

DEGRADATION OF BARRIERS/SECEs

An example of how degradation of barriers (illustrated as holes) might provide a path to cause a Major Accident is explained below,

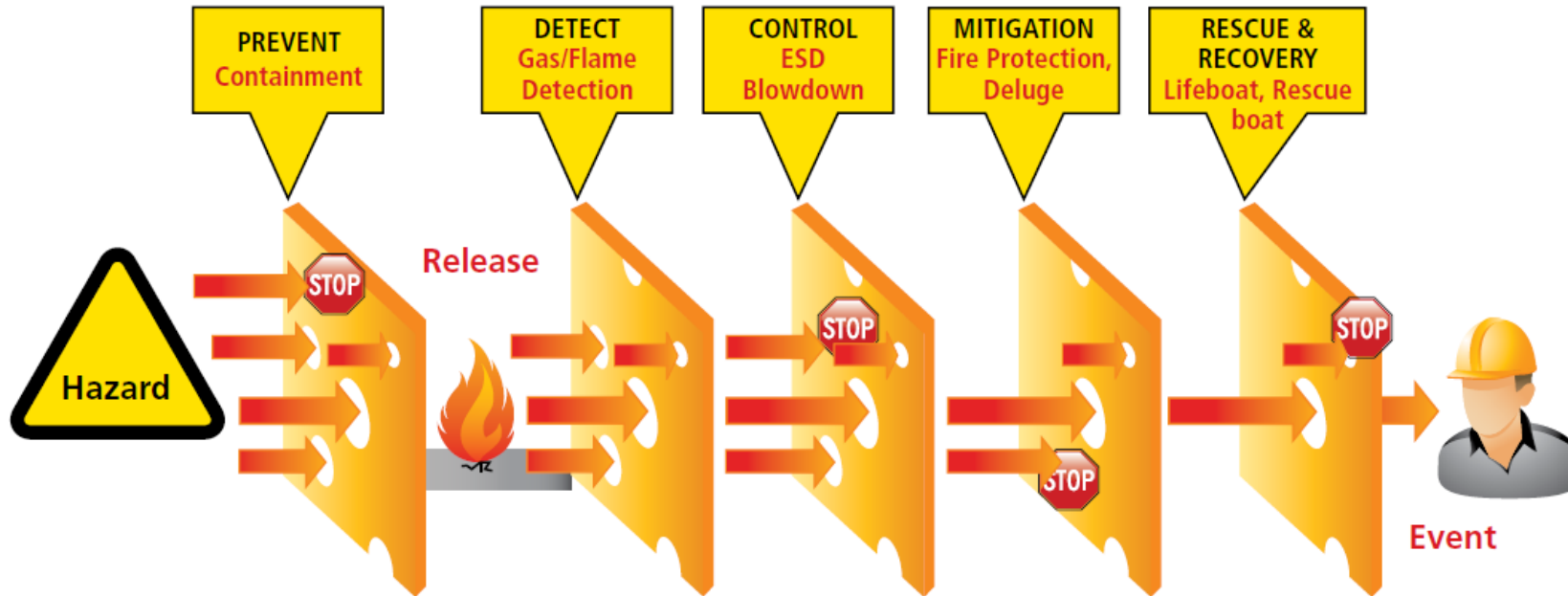
I) A gas flow line was incorrectly assessed to identify likely areas where corrosion might occur and the area where corrosion actually occurred was not examined. Following completion of the inspection, the Engineer assessing the results did not have the competence / experience to recognise this. The corrosion eventually led to a breakout of gas (**PREVENTION barrier failure**).

II) A number of gas detectors in the area had been inhibited due to ongoing work in the area. Persons responsible for assuring temporary battery-operated detectors did not adequately check their function (**DETECTION barrier failure**).

II) Electrical equipment normally designed to avoid electric discharges had not been maintained or incorrectly maintained, leading to a spark which ignited the gas in the area (**CONTROL barrier failure**).

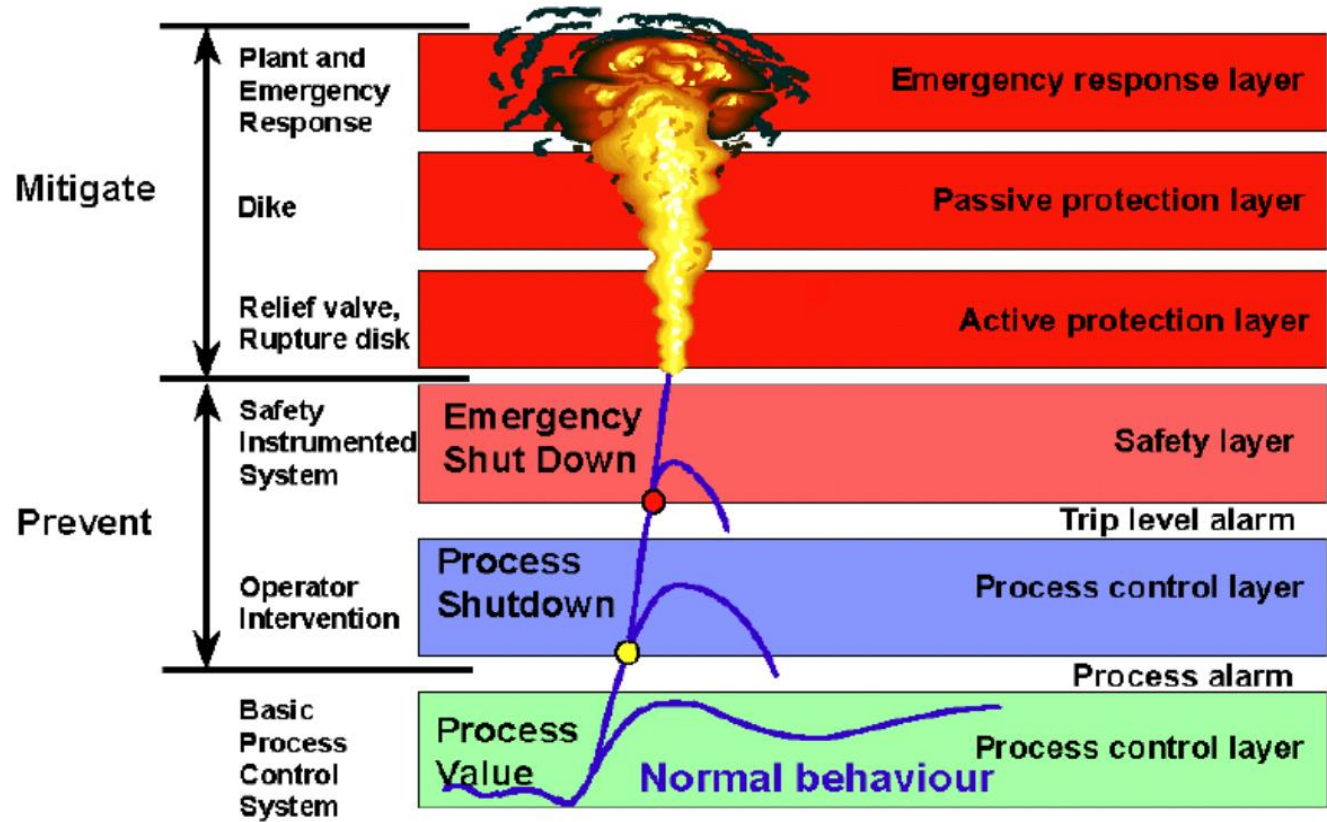
IV) The ensuing fire escalated because the water deluge piping and nozzles provided were blocked by rust and scaling, and failed to perform as intended (**MITIGATION barrier failure**).

SECEs/BARRIERS MODEL



Step Change in Safety - Assurance & Verification Practitioner's Guide

PROCESS SAFETY



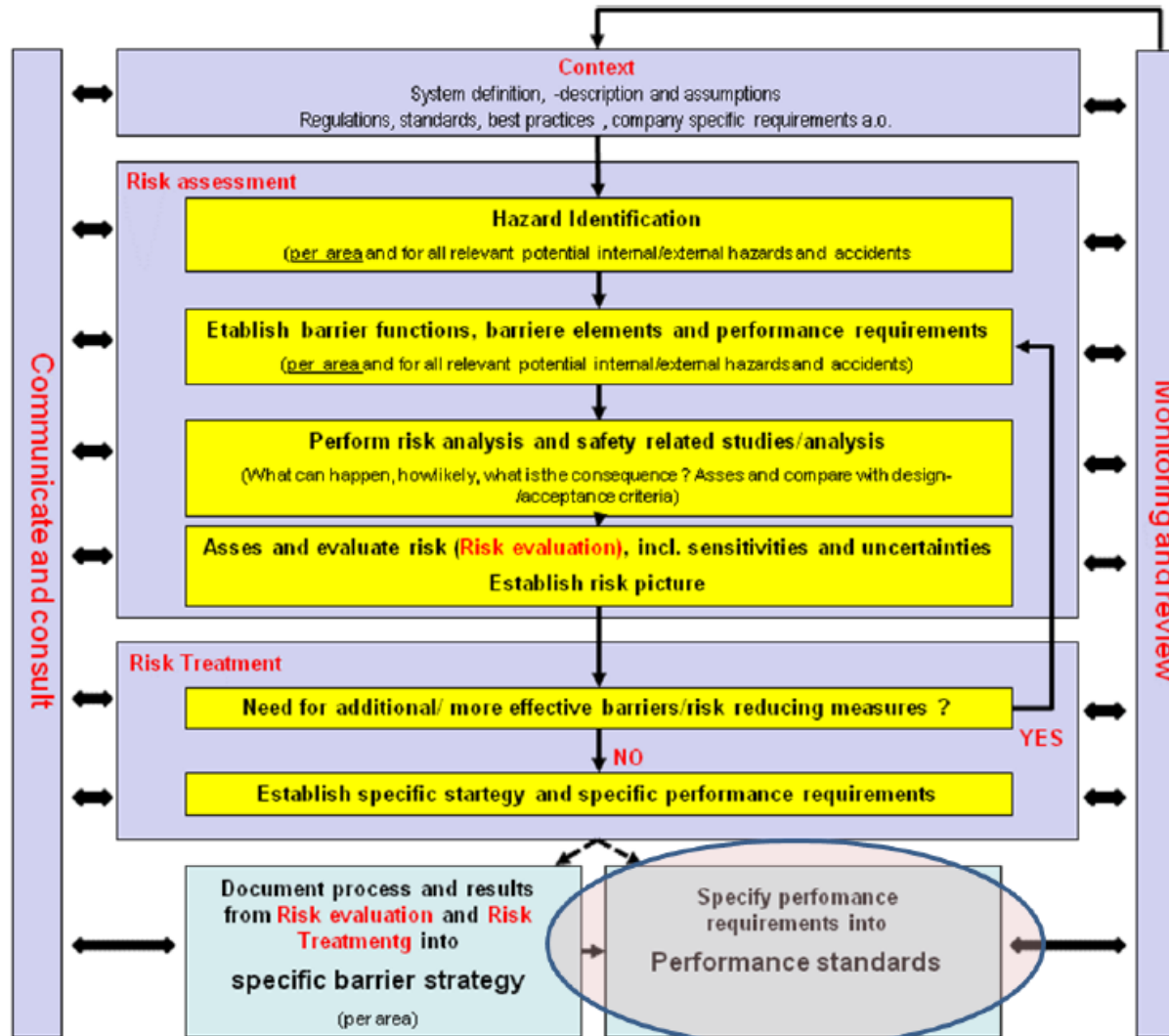
Emerson

BARRIERS/SECEs

- Typically barriers/SECEs includes requirements for the following:
 - Layout
 - Structural integrity
 - Containment
 - Open drain
 - Process safety
 - Emergency shut down (ESD)
 - Blow down (BD) and flare/vent system
 - Gas detection
 - Fire detection
 - **Ignition source control (ISC)**
 - Human – machine interface (HMI)
 - Natural ventilation and heating, ventilation and air conditioning (HVAC)
 - Public address (PA), alarm and emergency communication
 - Emergency power and lighting
 - Passive fire protection (PFP)
 - Fire fighting systems
 - Escape and evacuation
 - Rescue and safety equipment
 - Marine systems and position keeping
 - Ship collision barrier

Listen er ikke komplet

SECES/BARRIER MANAGEMENT



PSA (2013) Norway Petroleum Safety Agency, Principles For Barrier Management In The Petroleum Industry, Jan 29 2013.

WHAT IS PERFORMANCE STANDARD (PS/PR)

- A performance standard is a statement, expressed in **quantitative** terms, of the minimum level of performance required of a piece of equipment, person or procedure, and which can be expressed on the basis for **measuring, controlling, verifying or providing on demand**. It is the basis for **assessing** performance through the **life cycle** of the equipment, person or procedure. The regulation does not specify what is for the Duty Holder to decide, taking account of the hazard – e.g. *planning, installation*. The regulation does not specify what is for the Duty Holder to decide, taking account of the hazard – e.g. *planning, installation*. The regulation does not specify what is for the Duty Holder to decide, taking account of the hazard – e.g. *planning, installation*.

PR's are an essential set of documents that will serve as a basis for the barrier assurance program and verification activity. The PR describes the essential conditions that a barrier must maintain or provide on demand.

- Define the minimum level of performance required by the SCE to ensure it performs as intended.
- Define the process in place to ensure that the required level of performance is achieved (assurance process).

WHAT SHOULD BE CONSIDERED FOR AN EFFECTIVE PERFORMANCE STANDARD

- It is likely that more than one parameter will be needed to detail the required performance of the SECE:
- The “**codes, standards and specifications**” used in the original design of SECEs should be identifiable from the Performance Standards so that suitability can be maintained throughout the asset’s life. Any other related key documents should also be referenced in the Performance Standard.
- The PS criteria can follow the SMART Princip (Specific, Measurable, Assignable, Realistic and Time Related) e.g. numerical criteria for simple pass/fail assessment.

REQUIREMENTS FOR DIFFERENT ASPECTS

- For each barrier element there are often three aspects that are covered by the requirements

Aspect	Functionality	Integrity (Availability/ reliability)	Survivability
Type of requirement	<ul style="list-style-type: none"> Are the systems designed to meet the respective risk picture? 	<ul style="list-style-type: none"> Will it function when required? 	<ul style="list-style-type: none"> Will it withstand the impact of the accident it is required to protect against?
Example: Ignition Prevention	<ul style="list-style-type: none"> Selection and condition of 'Ex' certified electrical equipment Sizing, condition and continuity of anti-static devices, grounding and bonding Location and condition of insulation to limit surface temperatures Condition and security of spark and flame arrestors 	<ul style="list-style-type: none"> Ignition prevention functionality to be available while electrical equipment in hazardous areas is energised. Power supplies to be isolated in non-hazardous areas on confirmed gas detection or loss of pressurisation Sample sizes for 'Ex' equipment inspections to be reviewed in accordance with IEC 60079-17 	<ul style="list-style-type: none"> 'Ex' Electrical Equipment is not required to survive a fire or explosion in the area where ignition will already have occurred.

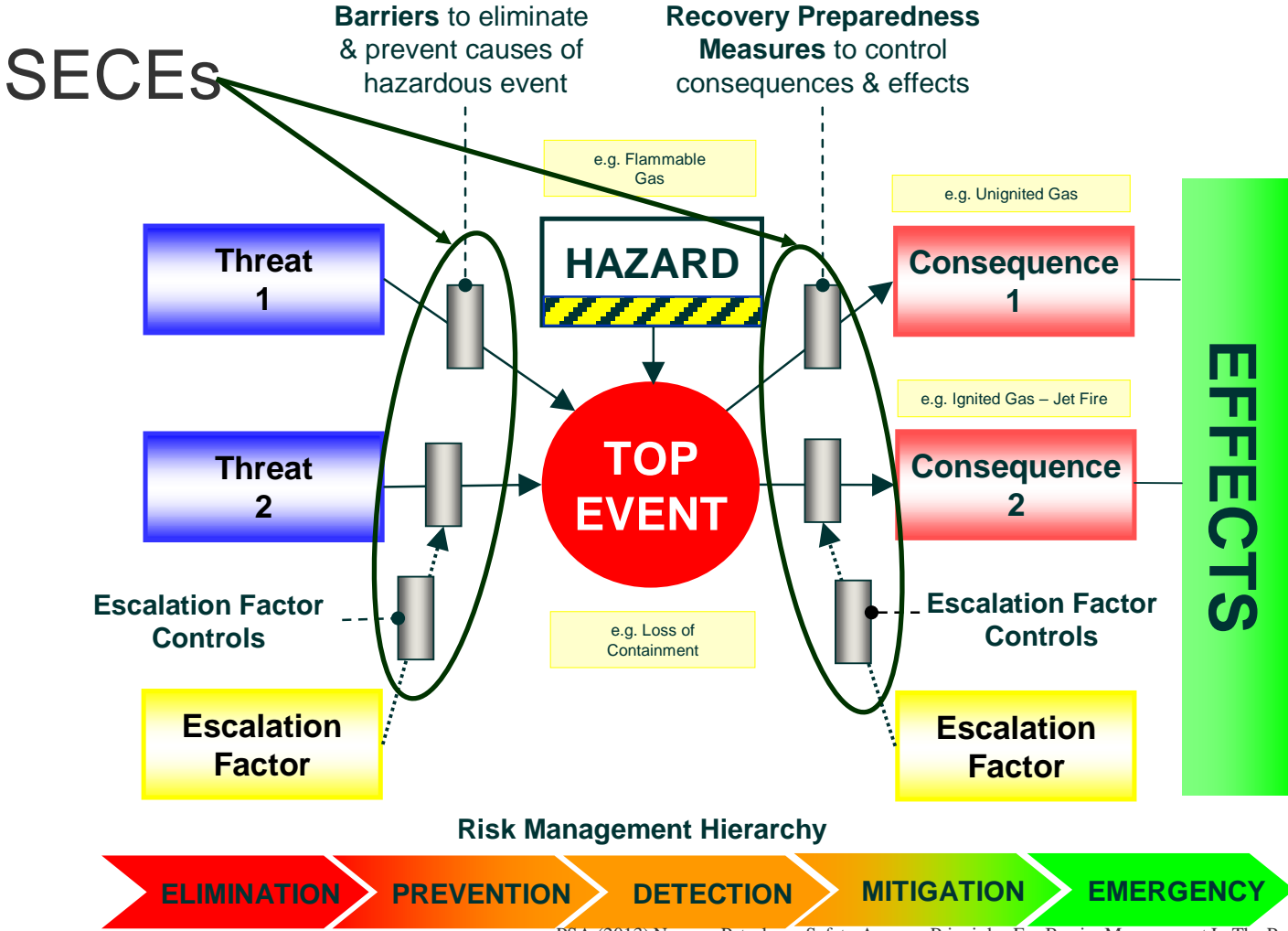
REQUIREMENTS FOR DIFFERENT ASPECTS

Aspect	Functionality	Integrity (Availability/ reliability)	Survivability
Example: Fire water pumps	<ul style="list-style-type: none">• The FW supply shall be sufficient to cover the area with the largest FW demand plus the adjacent fire area with largest demand	<ul style="list-style-type: none">• Except during testing, any alarms from pump monitoring systems should not automatically stop the fire pump	<ul style="list-style-type: none">• Fire-water pump units required to operate when gas is present should be designed to be suitable for such operation

Hvor kom vi fra?

- Risiko
 - Forståelse af processer og indsigt i deres natur.
 - Struktureret gennemgang af farer og deres konsekvens
 - *PREVENTION barrier*
 - *DETECTION barrier*
 - *MITIGATION barrier*
 - *Performance beskrivelse for hver barriere:*
 - **Functionality**
 - **Integrity (Availability/ reliability)**
 - **Survivability**
 - **Opsætning af tidsplan for kontrol/test af den enkelte SCE med udgangspunkt i performance standarden og husk nu! Positiv rapportering af resultater.**

Barrier management Typical Bow-Tie Diagram



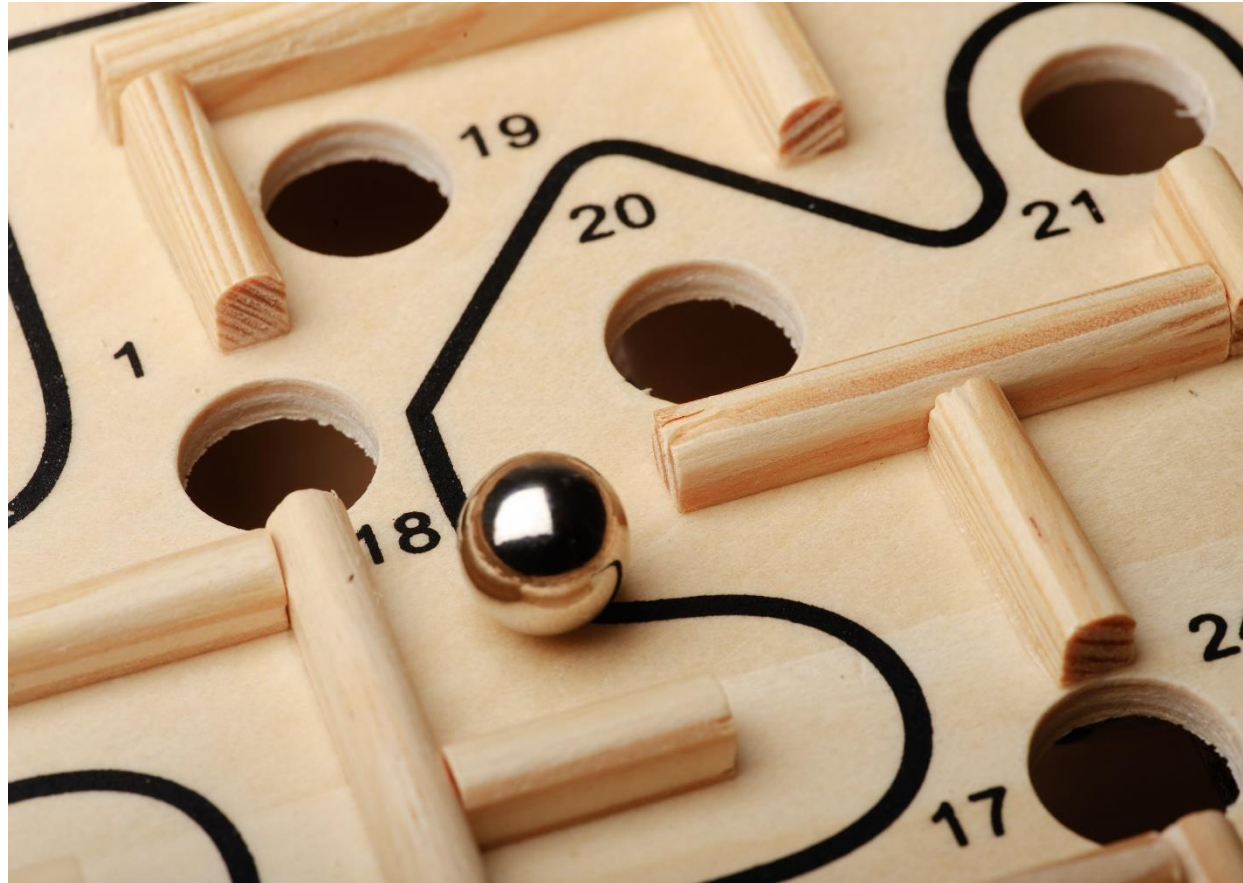
PSA (2013) Norway Petroleum Safety Agency, Principles For Barrier Management In The Petroleum Industry, Jan 29 2013.

Hvor trykker skoen?

- Risiko vurderinger
- Brug af standarder
- Områdeklassificering
- Reperationer/udskiftning

Risiko vurderinger

Se vejen, find hullerne og indsæt barriererne



Husk:

Kuglens størelse er også en faktor!

Brug af standarder

- Opfordring til at anvende de nyeste standarder fra projektstart!
- Undgå at "shoppe" mellem standarder.
- Husk dokumentation for afgrænsninger og instruktioner i brug.



Områdeklassificering

Den her er bare notorisk svær.... Der kommer forskellige svar fra forskellige eksperter, selvom de følger DS/EN 60079-10 så hvad skal der så til?

- Erfaring, viden, indsigt, scenarier (risiko), beviser, test.....
- Målet er altid at eliminere ex-zoner ved kilden. Følg god praksis og det er nødvendigt at acceptere lidt mere bøvl end man umiddelbart ville gøre udfra en økonomisk betragtning. ALARP* kan med fordel anvendes.
- Detaljeret dokumentation på forudsætninger og antagelser.
- Områdeklassificeringen **SKAL** følges og derfor skal den kunne kommunikeres til brugerne.
- Områdeklassificeringen skal også vedligeholdes med passende interval og opdateres ved ændringer!

*As low As Reasonably Practicable.

Reperationer/udskiftning

- Ændringer på udstyr!
 - Nyt produkt?
 - Dokumentation
 - Pas på med forudsætninger i risikoanalysen.

- Gammelt udstyr +10 år!
 - Certifikatet?
 - Standarder er udgået?
 - Installationen
 - Pas på med forudsætninger i risikoanalysen.





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