



# Plant Lifetime Management: Ageing Assets Issues

DNV Conference - Process & Asset Risk Management

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# What is ageing?



**Ageing is not about how old your equipment is; it's about its condition and how it's changing over time**

**(Petroleum Safety Authority, 2008)**

**Ageing is a process of degradation related to the progression of time and/or the use of the facility and the systems related to the facility**

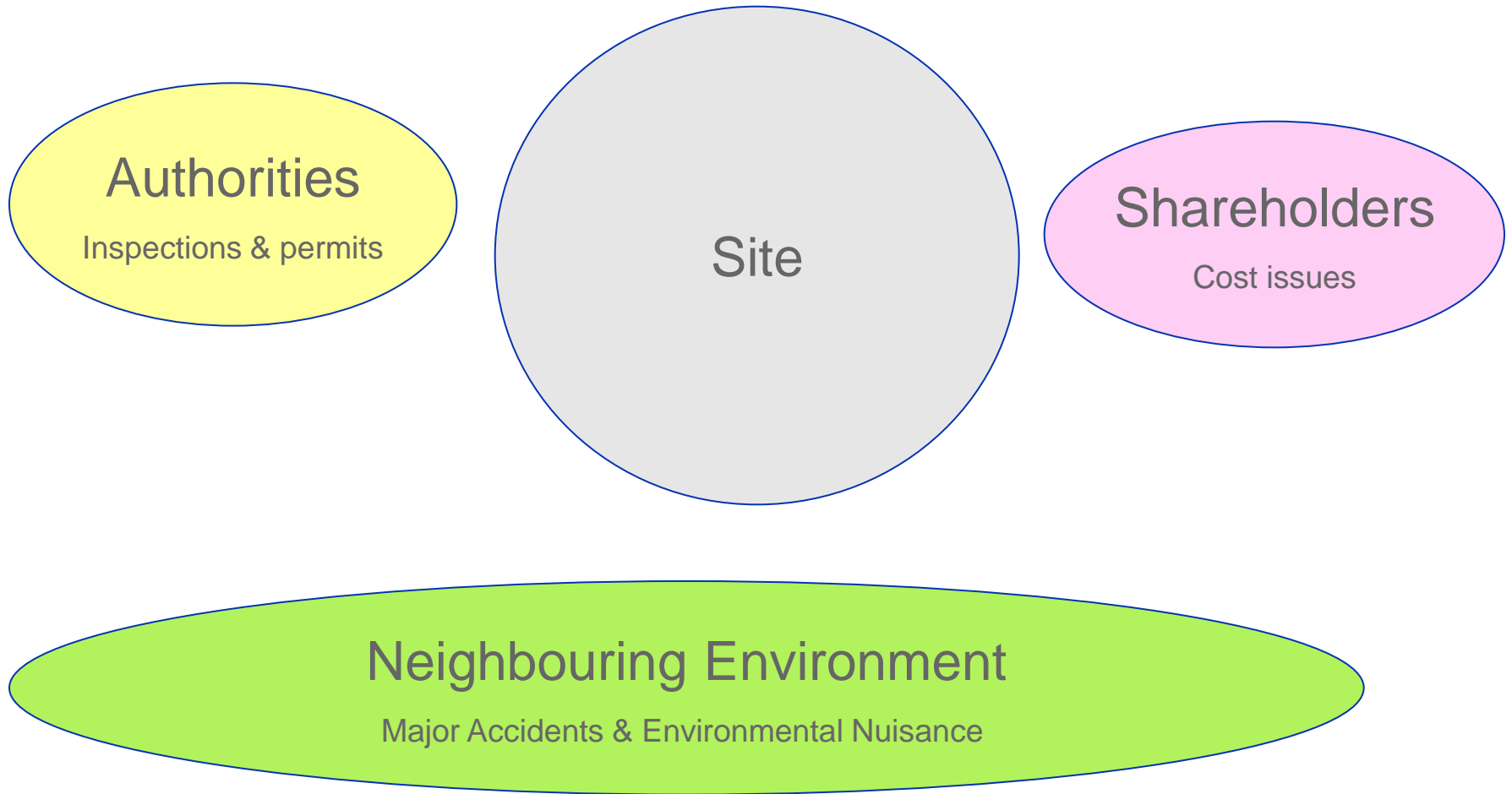
**(OLF, 2008)**

Ageing plant is a plant which is, or may be, no longer considered fully fit for purpose due to age related deterioration in its integrity or functional performance

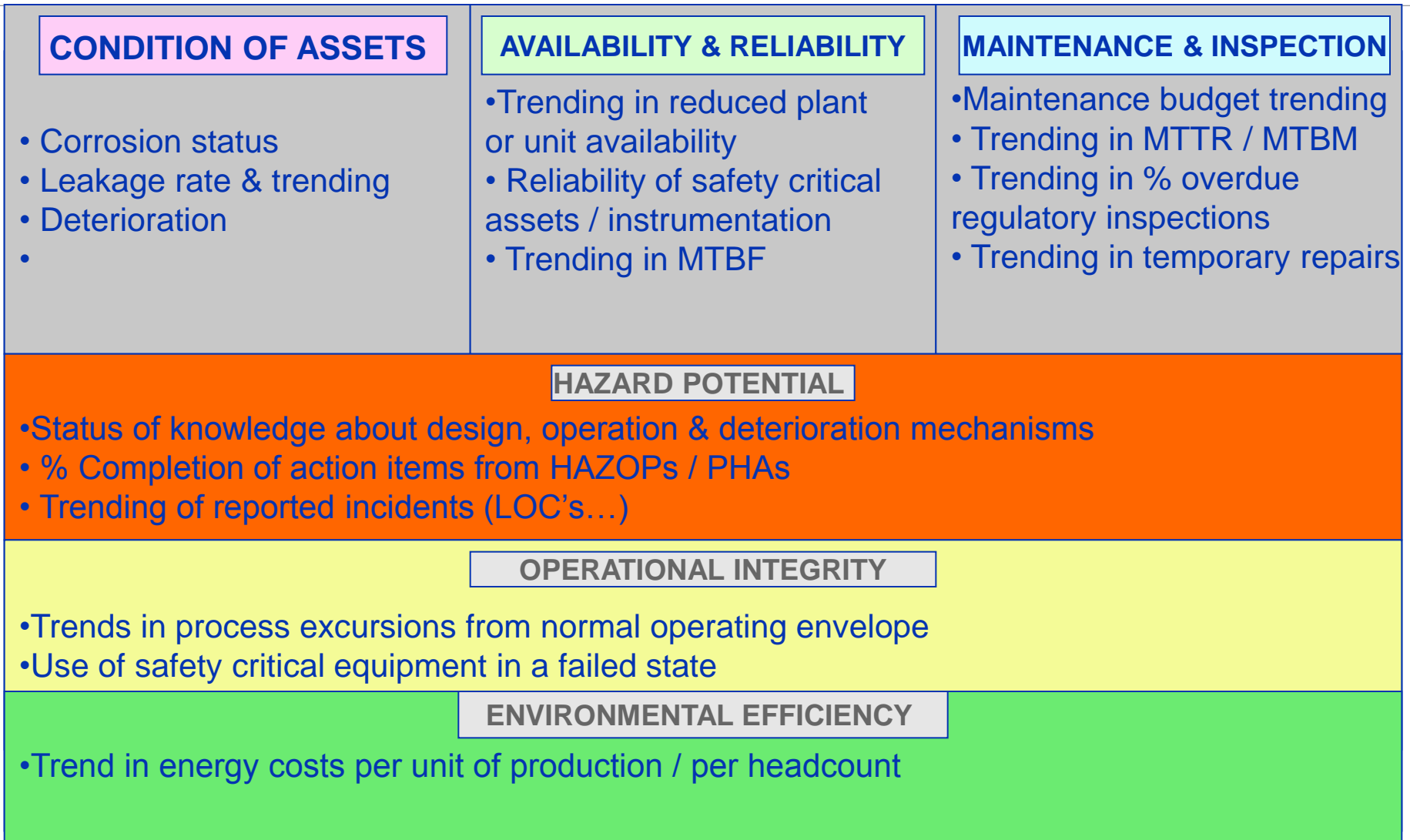
**More than 4500 high-tier Seveso plants in Europe are subject to ageing**

# Stakeholders of Ageing Plants

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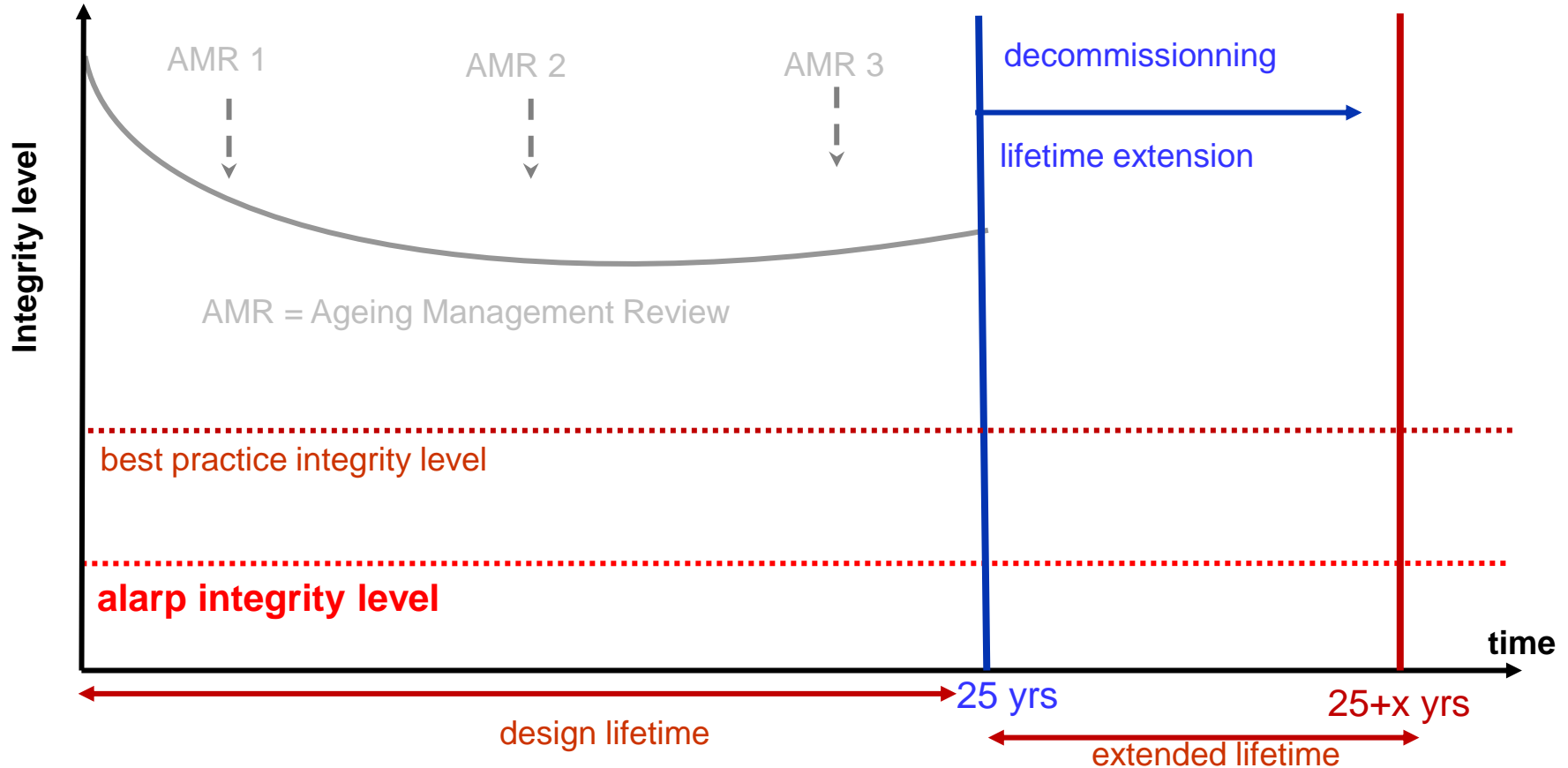


# Mapping the impact of ageing assets at site level

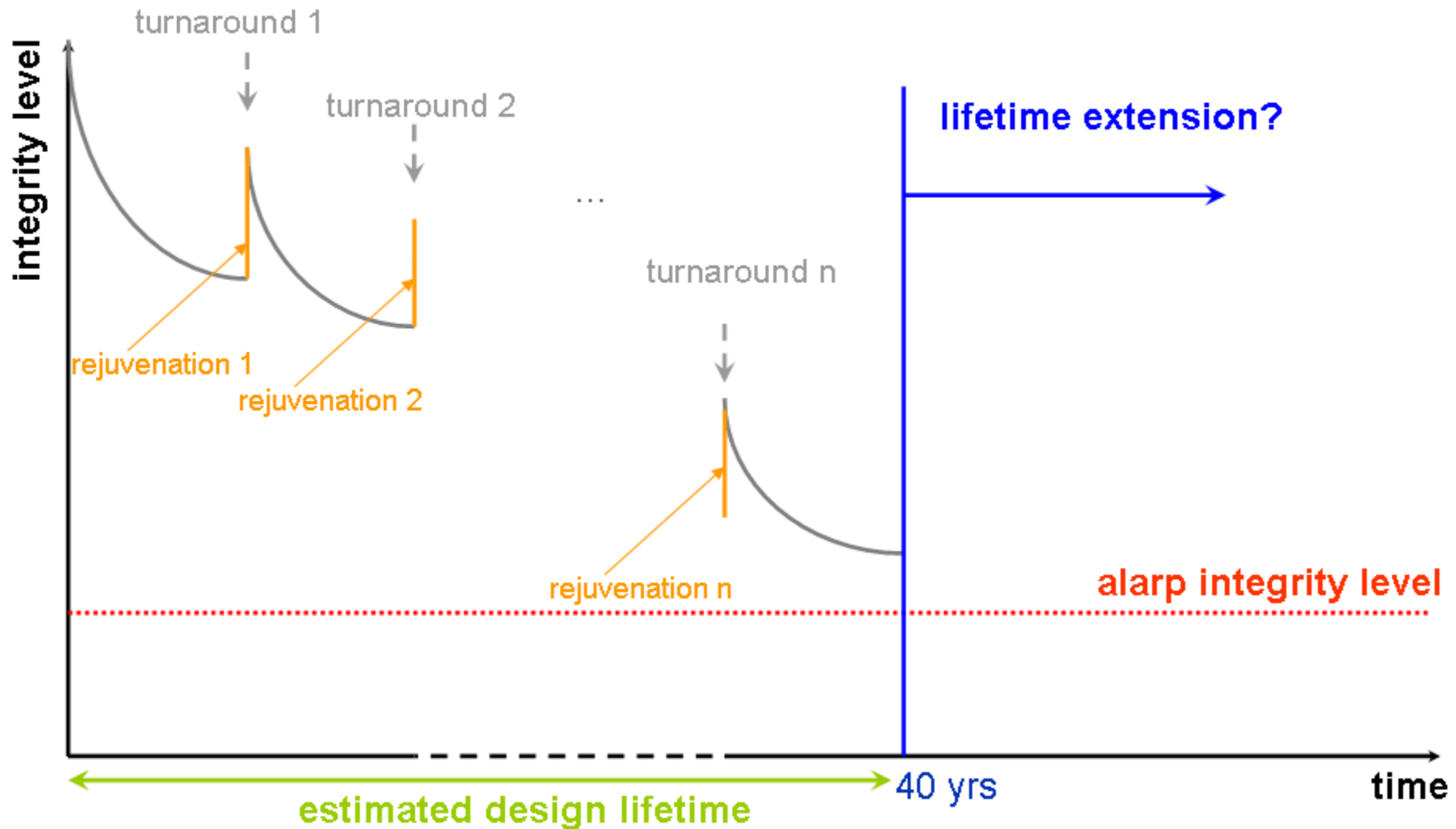


# Lifetime Management

## Best Practices in the offshore & nuclear sector



# Managing ageing assets in the process industry



# Link between Major Accidents & Ageing Plants

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## Conclusions from the HSE Plant Ageing Study – RR823 (2010)

Overall it can be concluded that plant ageing does constitute a threat to health and safety performance of hazardous installations onshore. Within the uncertainties of the review conducted a reasonable statement to describe the size of the ageing issue is that

**“approximately 60% of major hazard loss of containment incidents are related to technical integrity and, of those, 50% have ageing as a contributory factor”.**

It therefore concluded that plant ageing mechanisms are a significant issue in terms of major hazard accidents.

# Legal framework (1/3) – Focus by inspection authorities

	USA	Belgium	Netherlands
<b>Primary containment process equipment</b>			
Process pressure vessels (steam)	Yellow	Green	Green
Process pressure vessels (liq. gases)	Green	Green	Green
Process pressure vessels (other)	Green	Red	Green
Utilities	Red	Green	Green
Storage tanks (below ground)	Green	Green	Green
Storage tanks (above ground)	Green	Green	Green
Small bore piping & fittings	Green	Red	Red
Pipework onsite & connections	Green	Green	Green
Mobile hoses	Red	Green	Green

 no legislative context




 mandatory inspections

 no formal legislative context, procedures available



# Legal framework (2/3) – Focus by inspection authorities

	USA	Belgium	Netherlands
<b>Rotating equipment</b>			
Pumps & compressors	Green	Red	Red
Turbines	Red	Red	Red
Electric generators	Red	Red	Red
Fans	Red	Red	Red

-  no legislative context
-  mandatory inspections
-  no formal legislative context, procedures available

	USA	Belgium	Netherlands
<b>Electrical &amp; control</b>			
Level indicators	Green	Red	Red
Pressure transmitters, switches	Green	Red	Red
DCS	Red	Red	Red
Fixed hazard detection & control systems	Green	Green	Yellow
Mobile hazard detection & control systems	Red	Green	Yellow
Blowdown & flare systems	Red	Red	Green
Electrical power distribution systems	Red	Red	Red
Computer hardware	Red	Red	Red
Instrumentation in general	Red	Red	Red

# Legal framework (3/3) – Focus by inspection authorities

	USA	Belgium	Netherlands
<b>Process safeguarding systems</b>			
Relief systems (PSV, relief valve,...)	Green	Yellow	Green
Safety instrumented systems	Green	Green	Green
Electrical systems and circuits	Green	Green	Green
Control of ignition	Red	Green	Green
Emergency back-up systems	Red	Green	Yellow
Alarms	Green	Green	Red
Communication systems	Red	Red	Red
Other safeguards (overfill protection, inerting system,...)	Green	Red	Yellow
Hazard mitigation equipment	Red	Green	Red

	USA	Belgium	Netherlands
<b>Civil structures</b>			
Supporting structures	Red	Red	Red
Structures & foundations for secondary & tertiary containment	Red	Red	Red
Structures & foundations for secondary & tertiary containment	Red	Red	Red
Temporary buildings & housing for contractors	Red	Red	Red
Structures & civil features against impact	Red	Red	Red
Flooding protection arrangements	Red	Red	Red
Loading & unloading spots	Red	Red	Red

# Setting the scene - Conclusions

- Ageing increases the production cost
- Ageing increases the MAP (Major Accident Potential)
- The trend of LOC incidents worldwide is not pending downward, but is rather stable in contrast with Lost Time Accidents related to personal safety.
- The legal framework & focus of inspection authorities is at present insufficient to control the ageing process and the related risks.

**Seveso companies are therefore the key actors  
to manage the risks and challenges of ageing plants**

## Key questions to answer :

- ▶ **How to operate a Seveso plant safely in a sustainable way ?**
- ▶ **How can major accident hazards be prevented & controlled in a proactive way ?**
- ▶ **How can costs be controlled to acceptable levels?**
- ▶ **How to avoid “surprises”**

# What are the options to manage ageing plants?

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## **OPTION 1 ; BUSINESS AS USUAL**

- ▶ Rejuvenation of specified assets via periodic turnarounds
- ▶ **THREATS:** Increasing costs of production – Increasing Major Accident Potential – No insight on remaining plant lifetime and inadequate prioritisation process for future investments – “Surprises” may be waiting on the corner

## **OPTION 2 : APPLYING RISK-BASED INSPECTIONS & RCM TECHNIQUES + TURNAROUNDS**

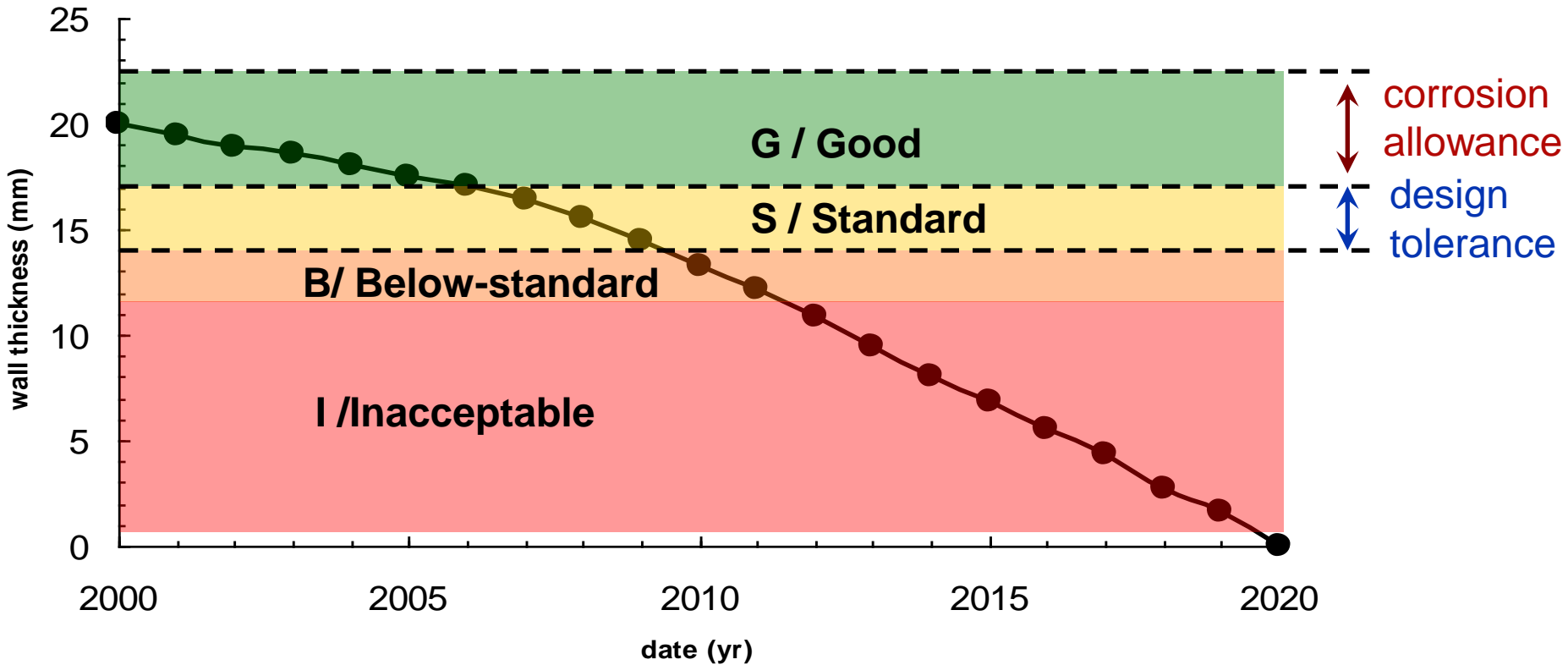
- ▶ Rejuvenation of specified assets via periodic turnarounds
- ▶ More focused inspections & better insight on remaining lifetime of specified equipment
- ▶ **THREATS:** Increasing costs of production & Increasing Major Accident Potential  
No insight on remaining plant lifetime  
Limited to specified equipment , but no comprehensive approach for entire range of assets  
Limited insight on future investments at plant level & “surprises” may be waiting on the corner

## **OPTION 3 : PLANT LIFETIME MANAGEMENT**

- ▶ Clear insight of actual overall plant status
- ▶ Comprehensive life cycle based approach / all assets
- ▶ Criticality screening and risk ranking of assets ▶ ▶ Insight & transparency of future investments
- ▶ Remaining Plant Lifetime Assessment & Detailed Asset Life Plans ▶ ▶ Less “surprises”

# BIP Scorecard – Example for Corrosion Indicator

- **Scorecard Criteria:** there are 4 performance levels (G-S-B-I) for each leading / lagging indicator



# Option 3 - Plant lifetime management

**Customer** Owner/operator of Seveso company

**Service Area** Asset risk management

## Challenge

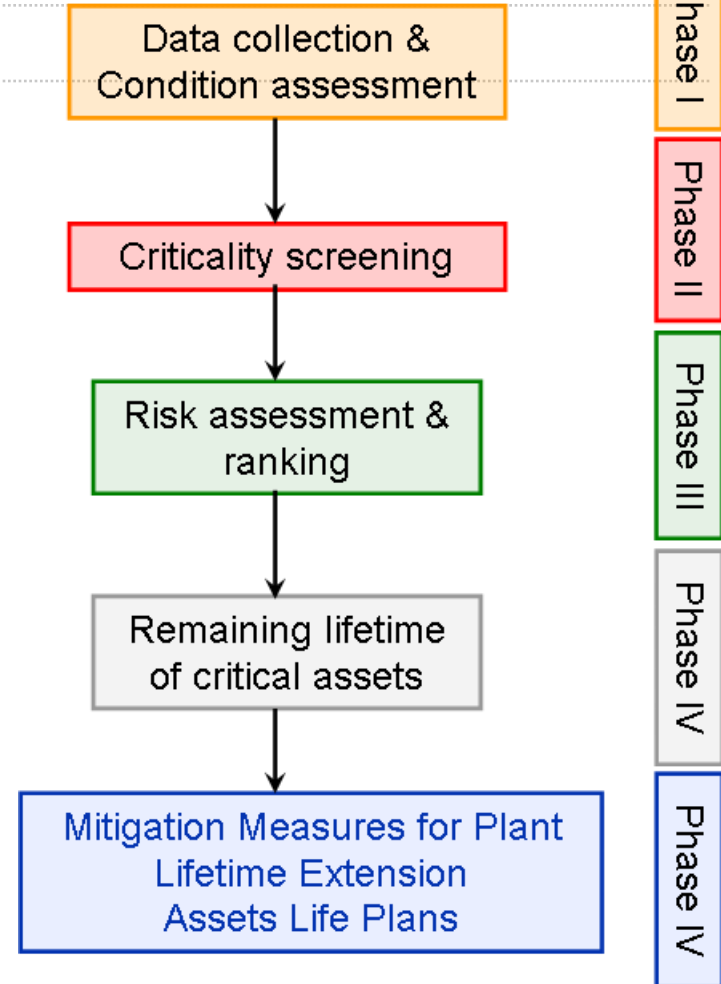
- Managing ageing assets

## DNV's approach

- Identify business impact of ageing in 6 key areas
- Perform a criticality screening
- Define measures to continue operations in a safe and sustainable manner

## Value to the client

- Get a clear view on future investments related to ageing
- trigger decision-makers aligning their capital investment proportionate to the observed risk levels
- trigger decision-makers aligning their maintenance / inspection efforts proportionate to the observed risk levels



# Safeguarding life, property and the environment

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MANAGING RISK **DNV**

# Business Impact Potential / BIP Scorecard

The BIP Scorecard incorporates more than 50 leading & lagging indicators of ageing assets

