

Process Safety Webinar Series - Part 3

15 April 2021

Ageing Assets Management



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Ageing assets

Like sand through the hour glass so....



What Are We Going to Cover

- ▶ Case Study – Acetylene cylinder explosion
- ▶ Understanding ageing assets
- ▶ How to manage ageing assets
- ▶ Statistics for ageing assets incidents
- ▶ Common cause failures for aging assets
- ▶ Q&A



Case Study – Acetylene Cylinder Explosion



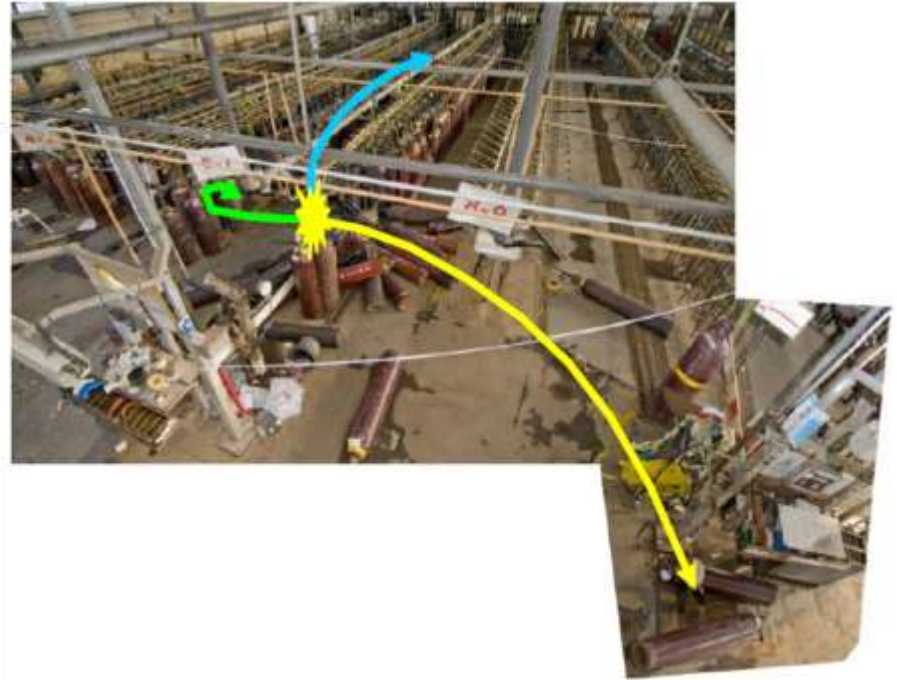
- ▶ Fires of leaking acetylene following initial cylinder explosion
- ▶ 14:50, Thursday 7th January 2010
- ▶ Plant built in 1920 – Remote location at the time
- ▶ One employee suffered life changing injuries
- ▶ 2 other employees suffered temporary hearing loss and shock

Case Study – Acetylene Cylinder Explosion



- ▶ 75-year-old cylinder
- ▶ 800 full cylinders
- ▶ 4000 cylinders of various fill levels, 3000 were full

Case Study – Acetylene Cylinder Explosion



Investigation

- ▶ Metallurgists
- ▶ Forensic scientists
- ▶ Process safety specialist
- ▶ Human factors specialists
- ▶ Mechanical engineers
- ▶ Cylinder experts
- ▶ Plant ageing experts
- ▶ Explosive specialist

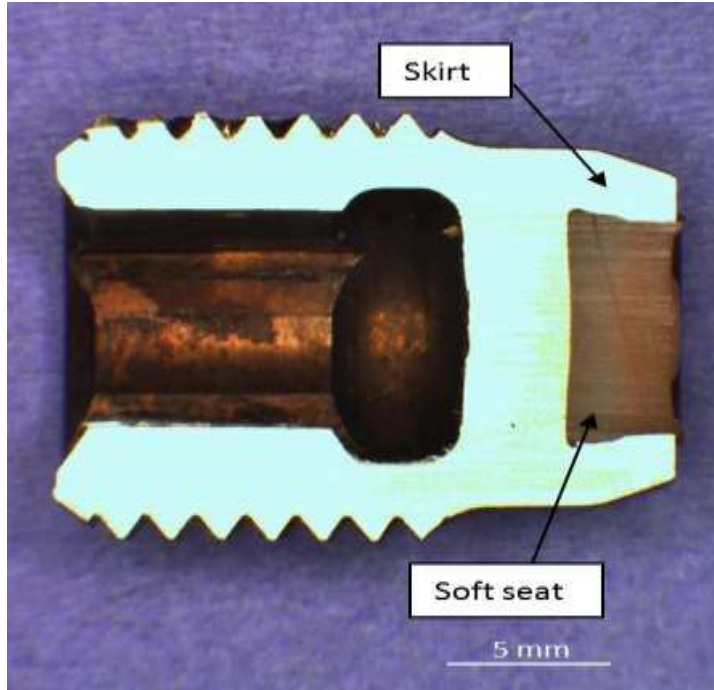
Results

- ▶ 22 specialist reports
- ▶ 48 witness statements
- ▶ 2000 pieces of evidence

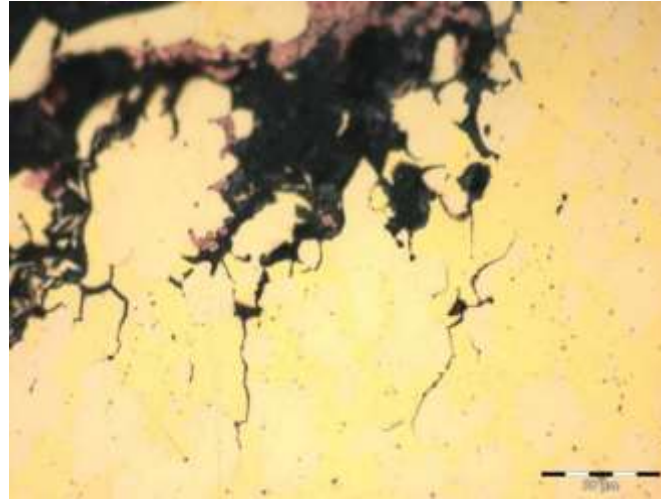
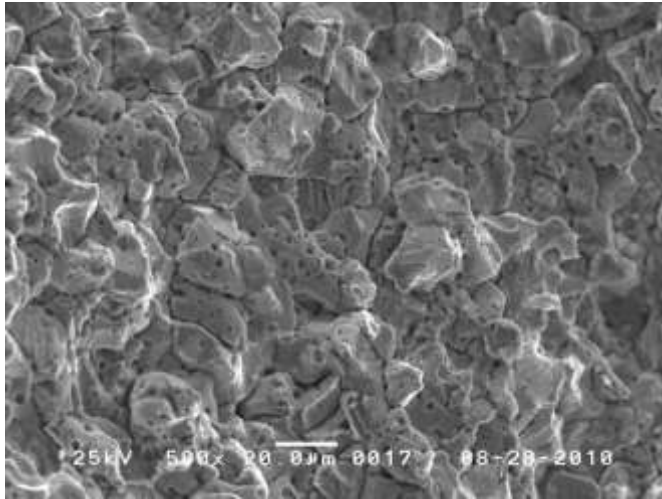
Case Study – Acetylene Cylinder Explosion

Causes	<ul style="list-style-type: none">Defective porous massToo little acetone, too much acetyleneInspection did not consider age of cylinder for fit for useHuman factors not considered for safety critical task
Corrective Actions	<ul style="list-style-type: none">Replaced all top entry cylinder – side entry valvesRemove charcoal mass cylinders from serviceCeased operations at incident siteBuilt a new automated DA bottling plant

Investigation



Investigation



Lessons Learnt

Design	Design review for high hazard plant
Process control	Review safety critical equipment Review assumptions made Cumulative errors – minor changes
Managing of ageing equipment	Industry knowledge Improvements to old facilities Operator training Culture of reporting and recording faults “fit for service” assessments Understand incidents from similar facilities Methodology for determining fit for use KPI for aging assets

Lessons Learnt

Human Factors	Identify safety critical task Conduct Human Error Identification and Analysis for critical tasks Cylinder inspection Cylinder receipts Cylinder filling
Regulators	Agree on investigation plan Regular investigation reviews

What Do You Understand by Aging Assets?



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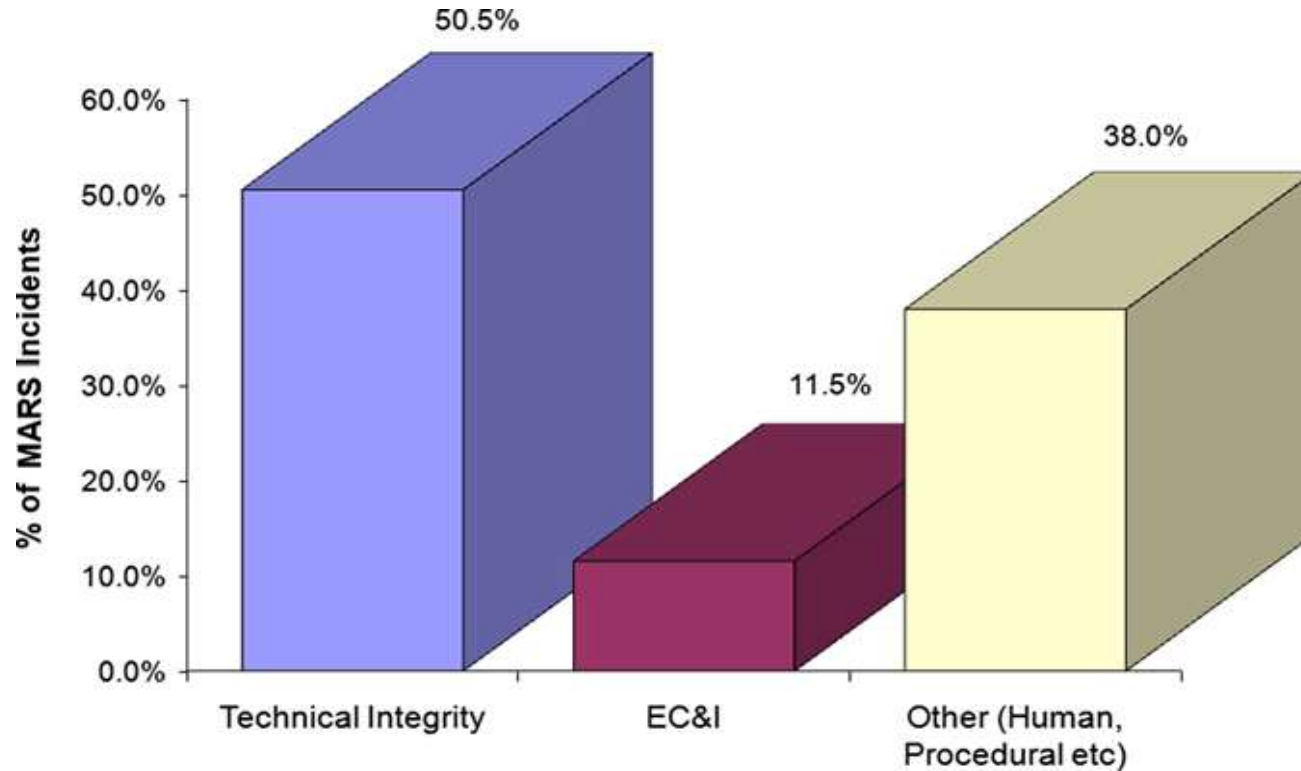
“Ageing is not about how old your equipment is; its about what you know about its condition and how that’s changing over time”

Why Do We Have To Be Concerned?

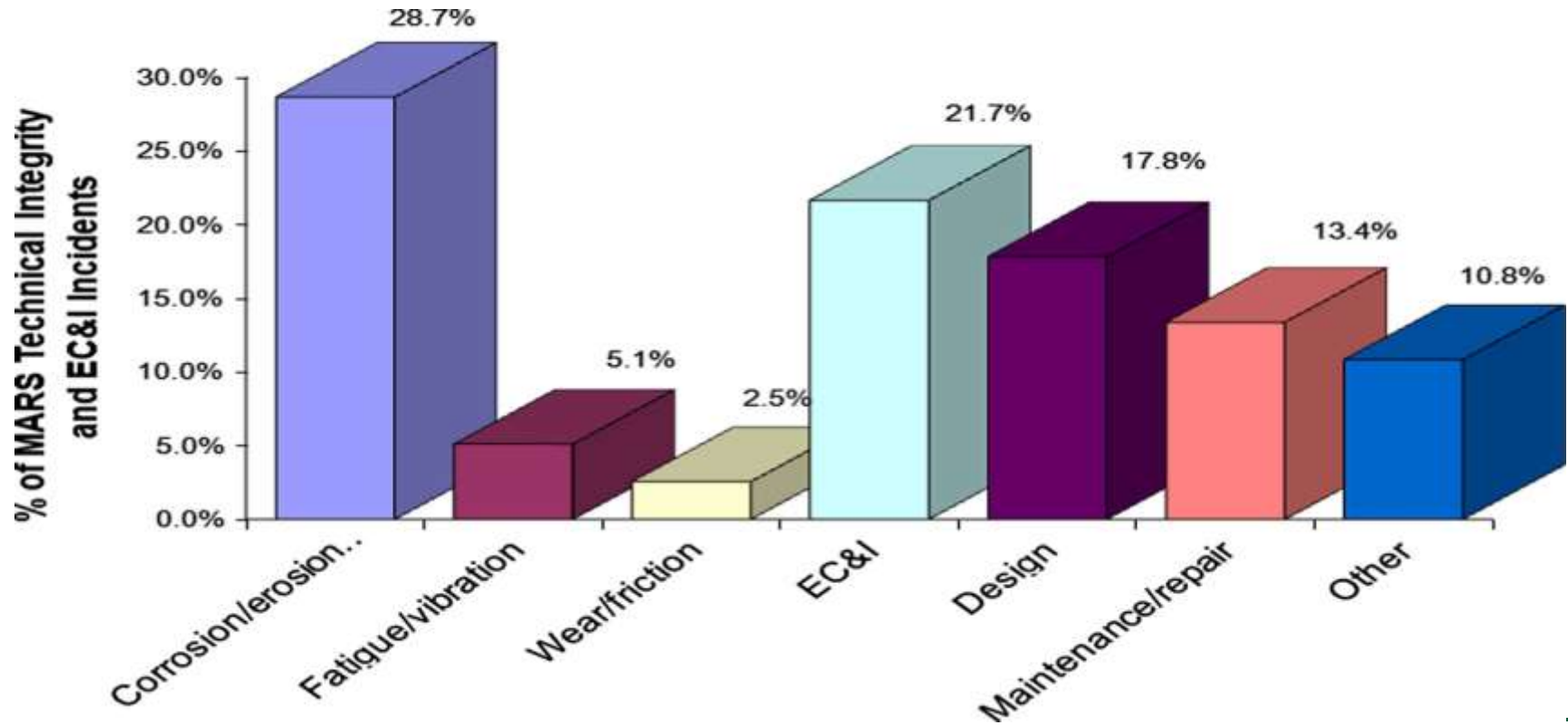
- ▶ 1980 to 2006
- ▶ 96 incidents reported in Europe – MARS database
- ▶ Loss of containment
- ▶ Due to ageing assets
- ▶ 28% of all major incidents reported
- ▶ 11 Fatalities
- ▶ 183 Injuries
- ▶ 170 million euros loss



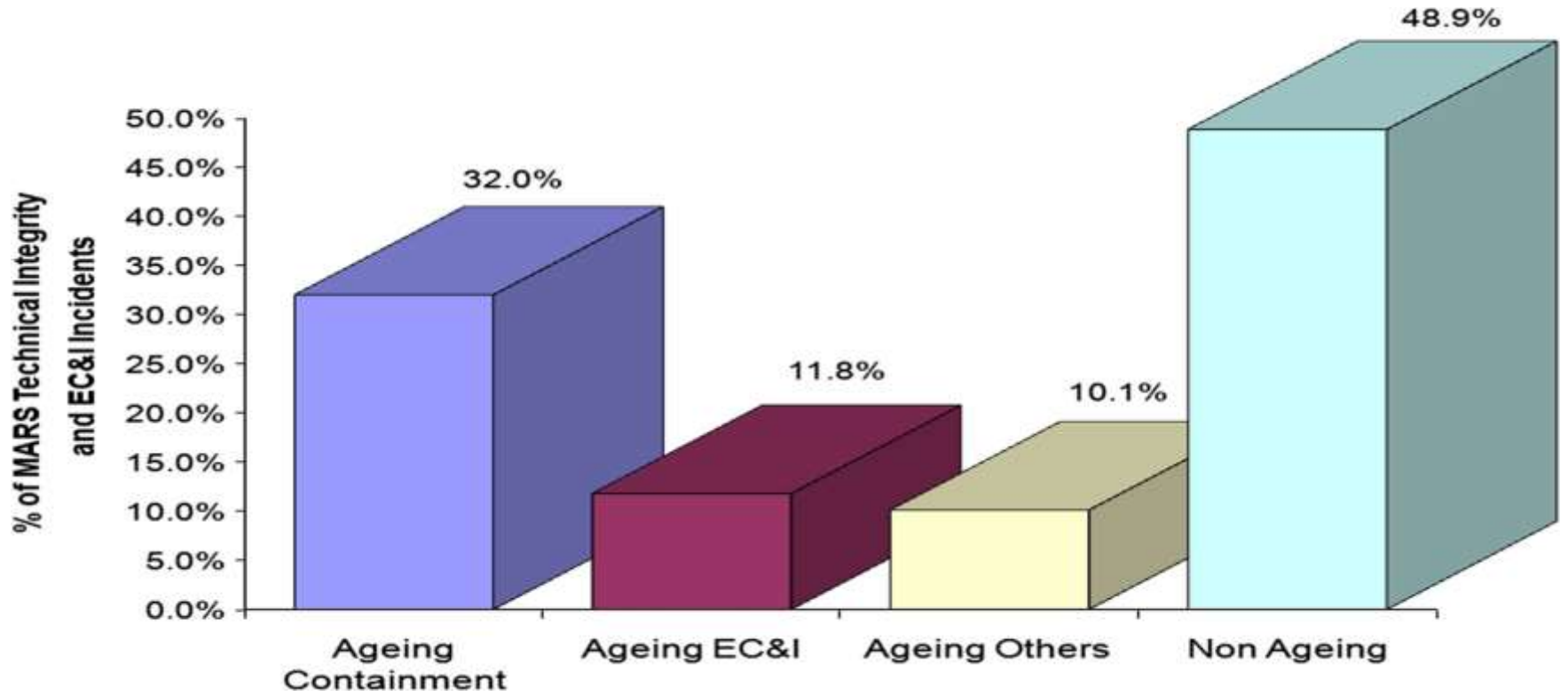
Why? The Data Analysis



Why? The Data Analysis



Why? The Data Analysis



Learnings From the Incidents

- ▶ State of the plant not fully understood
- ▶ Poor understanding of how non-safety critical equipment could impact safety critical equipment
- ▶ Role of Asset integrity in hazard risk control not fully understood
- ▶ Incorrect use of integrity management data
- ▶ Insufficient priority to ongoing maintenance
- ▶ Testing and inspecting safety critical equipment not fully understood

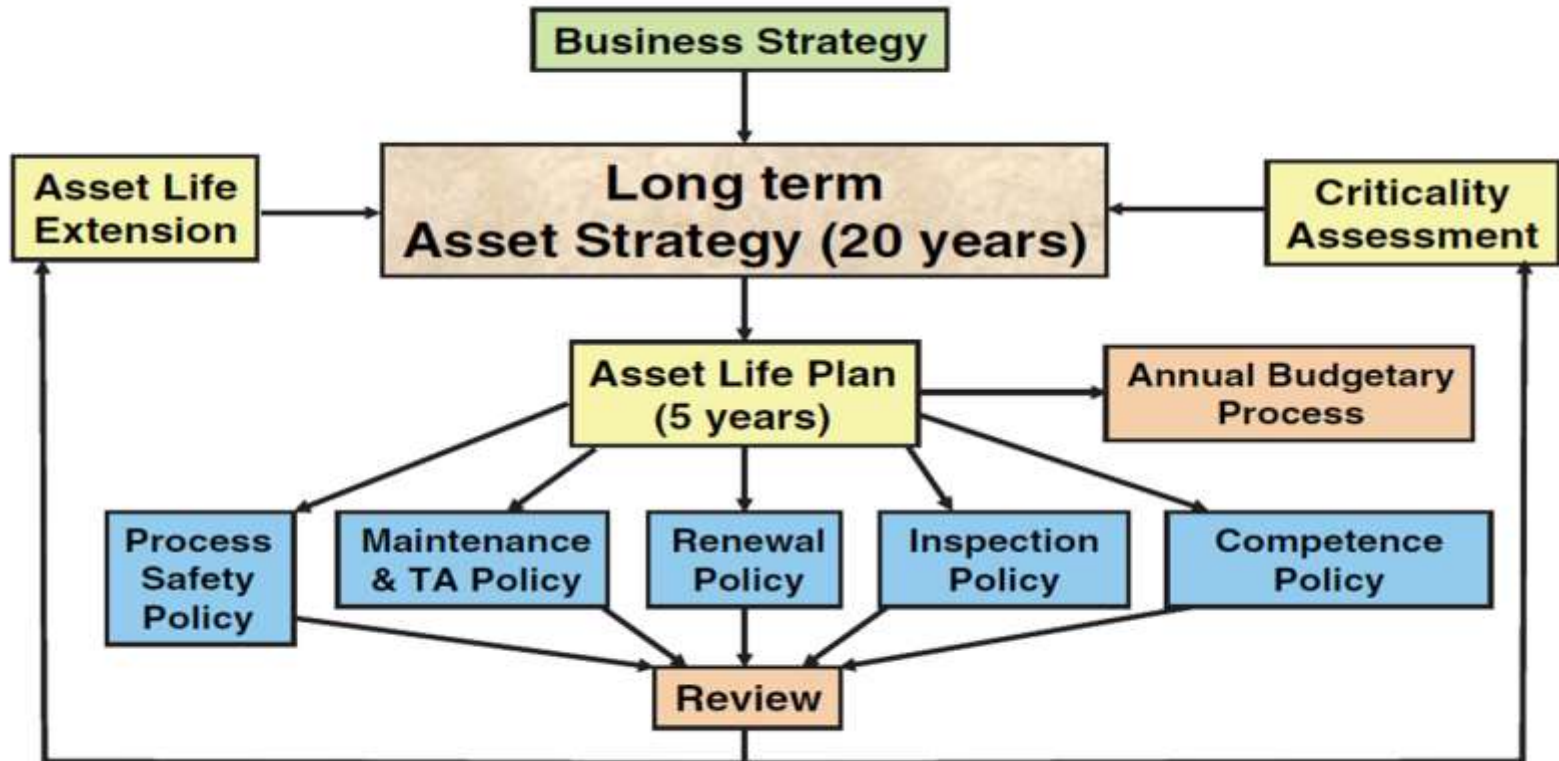
How Do You Approach Ageing Assets?

- ▶ Strategy
- ▶ Fire protection systems – detection, pumps, valves, piping, supply
- ▶ Pressure safety valves
- ▶ Emergency shut down valves
- ▶ EX equipment

The Approach – Ageing Assets

- ▶ Primary containment systems
- ▶ Electrical control and instrumentation systems
- ▶ Structures
- ▶ Safeguards
- ▶ Management systems

How? – Business Strategy



How? Asset Life Plan

Focus on biggest impact issues	<ul style="list-style-type: none">• Risk Based• Cost, fatalities, environmental
Life limiting issues	<ul style="list-style-type: none">• Obsolete equipment• Wear out issues• Deterioration - creep, corrosion, erosion etc
Asset care practices	<ul style="list-style-type: none">• Operations procedures• Maintenance programs• Inspection programmes• Improvement programs
Spares	<ul style="list-style-type: none">• Critical spares holdings• Spares maintenance
Legislation compliance	<ul style="list-style-type: none">• Prosecution• Fines
Costs	<ul style="list-style-type: none">• Maintenance vs renewal• Optimum time for replacement

Typical Failures – ECI Systems

- ▶ 44% Maintenance
- ▶ 26% Design
- ▶ 15% level detection, maintenance
- ▶ Loss of site power
- ▶ Software problems – DCS upgrades

Typical Failures - Safeguards

- ▶ Inoperable, blocked , jammed or passing isolation valves – ESDs, ROSOV
- ▶ Leaking bunds
- ▶ Cracked/leaking drains



Typical Failures – Safeguards

- ▶ Poor earthing bonding systems
- ▶ Faulty vent and pressure/vacuum relief valves
- ▶ Cooling water system failures



Typical Failures – Safeguards

- ▶ Ineffective sprinkler and water deluge spray systems
- ▶ Emergency generator failed to start/delayed start –loss of power
- ▶ Failure of fire water pumps
- ▶ Inoperable site sirens/alarms
- ▶ Failure of Monitoring systems (EC&I Related)

Thank you

Any questions?

