HSE’s AGEING & LIFE EXTENSION KEY PROGRAMME (KP4)

Andy Duncan, CEng
KP4 Manager
Energy Division - Offshore

KP4 website: www.hse.gov.uk/offshore/ageing.htm
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THE OFFSHORE INSTALLATIONS
SAFETY CASE

• UKCS operates a Safety Case Regime
  – Literally “The Case for Safety”
• Offshore Installations (Safety Case) Regulations 2005
• The offshore installation Duty Holder must submit a Safety Case to HSE for acceptance
• Recommendation from Lord Cullen's inquiry into the Piper Alpha Disaster (6th July 1988)
  – 167 men died
  – 61 survivors
• Aim is to reduce risks from major accident hazards to the health and safety of offshore workforce
• Safety Case is a demonstration the duty holder has the ability and means to control major accident risks effectively
WHAT IS AGEING?

AGEING
It’s about deterioration of work equipment which increases the likelihood of failure

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

MANAGEMENT OF AGEING?
• It’s about condition management
• Understanding the factors causing degradation
• Developing mitigation strategies
• Implementing strategies

Across the European Union’s hazardous industries ageing is implicated in:

30% of incidents
28% of loss of containment
WHAT IS LIFE EXTENSION?

• Typical design life for production assets ~25 years
• When assets exceed design life = Life Extension
• Then refer to Cessation of Production (CoP)
• About half of the UKCS production platforms are in the life extension phase
• Some platforms now anticipate 50-70 years
• Plus 5-10 years until complete removal from the sea bed
WHAT IS KP4/ALEP?

• Raising awareness of consequences of ALE
• Understanding & forecasting degradation mechanisms & rates of SCEs
• SCE obsolescence management
• Continuous health & safety improvement
• Reducing Hydrocarbon Releases
• HSE working with the Offshore Industry for a common goal
• Sharing ALE knowledge for the benefit of all
ALE MANAGEMENT WORKS WELL WHEN:

- Senior management are fully engaged and supportive
- Duty Holders have ALE focal points/ Life of Field Managers
- There is good inter-departmental communication
- There are KPI dashboards
- There are Independent ALE audits
- There is succession planning
- High AIM workloads are prioritised according to risk
- ALE policies are embedded into existing AIM policies and procedures

### Asset ‘X’ Example Dashboard

**Lagging Indicators**
- No barrier breaches during June 2012

**Leading Indicators**
- Corporate Tolerance Levels exceeded are:
  - Approved Temporary repairs reduced from 18 to 14 repairs
  - 8 are on Hydrocarbon / Process Systems \([\text{CTL}=6]\)
  - Deviations and ORAs increased from 7 to 8 \([\text{CTL}=6]\)

**Enduring issue (>2 Months)**
- MAHE system inhibits
- Static at 2 inhibits

**Key Events from graph**
- Maintenance backlog increased from zero to 6 tasks (48 Hrs)
- Temporary repairs reduced from 18 to 14 repairs. Permanent repairs carried out.
HYDROCARBON LEAKS: INFLUENCE OF PEOPLE AND PLATFORM AGE

Studies by Prof Jan Erik Vinnem (Preventor) for PSA Norway found:

• 60% of leaks due to human interventions:
  • Significant issues were:
    – Failure to check pre-work isolations, and
    – Failure to check isolations & integrity after re-instatement

• “It is not possible to demonstrate a correlation between leak frequency and the age of an installation”
  – other factors are more important

• “Technical degradation caused ~21% of HC leaks


PROCESS SAFETY

ALE MANAGEMENT WORKS WELL WHEN:

• Operating & Maintenance systems identify the Process Safety issues
• There are tools to identify SCEs acting collectively as barriers to prevent loss of containment
• SCEs and Safety Integrity Levels are mapped
• Effective HAZOPs and HAZIDs
• Offshore red-line mark-ups are contemporaneous
• Hardware and software obsolescence is managed
FIRE & EXPLOSION

ALE MANAGEMENT WORKS WELL WHEN:

• HAZOPS/HAZIDS/QRAs are aligned to the 5 yearly Thorough Review Summary
• Performance trending of SCEs
  – Go/no-go checks are insufficient
• Relationships between SCE failure and Major Accident Hazard risks are identified
• Effective Root Cause Analyses
• Long term integrity management of Temporary Refuges
• Reliability of obsolete gas detection systems is managed effectively
• Audits of Operational Risk Management systems
• Long term planning
STRUCTURES

ALE MANAGEMENT WORKS WELL WHEN:

• Structural analyses are up to date and identify ALE risks
• Failure and deterioration models address both Ageing and Life Extension
• Barriers to failure are suitable for ALE
• Failure trends are analysed and extrapolated
• MoDU jack-up fatigue assessments are up to date and identify ALE risks
• The risks associated with un-inspectable components are resolved
• Air gaps for the 10,000 year wave are re-assessed
MECHANICAL

ALE MANAGEMENT WORKS WELL WHEN:

• ALE management is integrated into AIM programmes
• DHs take control of integrity and maintenance management
• Temporary repairs are replaced with permanent solutions
• ALE gap analyses are undertaken
• Effective anomaly management tools
• ALE is included in HAZOPS
• ALE effects and consequences are understood
• Inspection of static parts of rotating equipment
• Long term maintenance strategies
CORROSION

ALE MANAGEMENT WORKS WELL WHEN:

• There is good cross industry knowledge sharing (EI docs)
• Well designed Corrosion Management Strategies, addressing A
  • Corrosion Threats Assessments
  • Risk Based Inspection programmes
  • Written Schemes of Examination
• Equipment lists are up to date
• Long term planning
• Fabric maintenance
• Audits on effectiveness of CMSs
• Inspection data is audited
• Experienced Offshore Inspection Engineer
• There are high reliability chemical injection systems
ELECTRICAL, CONTROL & INSTRUMENTATION

ALE MANAGEMENT WORKS WELL WHEN:

• Effective inspections
• Well planned maintenance
• Plan for timely purchasing of spares
• Obsolescence is planned for years in advance:
  – especially where vendor support may cease
  – sourcing spares
• Failure trend analysis for future repair/replacement needs
MARINE

ALE MANAGEMENT WORKS WELL WHEN:

• Effective policies for structural & marine integrity
• ALE KPIs and dashboards
• Up to date structural modelling
• Real time condition monitoring
• Five year Class Society inspections are undertaken
• Long term planning for equipment replacement
• Quantitative rejection criteria for SCEs
• Long term data trend analyses to plan for future maintenance
• Effective inspection programmes for secondary marine systems
ALE MANAGEMENT WORKS WELL WHEN:

• There are effective risk-based PIMS
• ALE is included in AIM policies
• There is specific consideration of the effects and consequences of ALE elements into specific pipeline AIM policies and procedures
• Pipeline AIM is re-validated to ensure integrity to CofP
• ALE issues of flexible risers are considered
• Audits are undertaken in accordance with the KPIs
• Cleaning and IP frequencies match KPIs
• IP frequencies are regularly reviewed to match degradation threats
ALE: EXTRAPOLATING DATA TO CESSATION OF PRODUCTION (+5?)

KPI

- Reservoir decline
- Managed degradation: data trend analysis: forecasting the future
- Improved economics
- Planned cessation of production
- New CoP
- Unmanaged degradation – living for now
- Criteria of non-conformance

Time/Years

CoP+5

- Remove redundant kit?
- Process simplification?
- New fields?
<table>
<thead>
<tr>
<th>SYSTEM/EQUIPMENT</th>
<th>CURRENT STATUS</th>
<th>STATUS IN 1 YEAR</th>
<th>STATUS IN 3 YEARS</th>
<th>LONG TERM HSE RISK</th>
<th>LONG TERM BUSINESS RISK</th>
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<tr>
<td>XMAS TREES</td>
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<td>CHOKES</td>
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<td>FLOWLINES</td>
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<td>MANIFOLD</td>
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<td>TEST FLOWLINE</td>
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<td>TEST MANIFOLD</td>
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<td>1ST STAGE SEPARATOR</td>
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<td>PRODUCED WATER SYSTEM</td>
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<td>OIL LINE TO EXPORT</td>
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<td>GAS LINE TO COMPRESSOR</td>
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<td>GAS LINE FROM COMPRESSOR TO COOLER</td>
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<td>GAS LINE FROM COOLER TO EXPORT</td>
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<td>MAIN OIL LINE EXPORT RISER</td>
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<td>MAIN GAS LINE EXPORT RISER</td>
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**LEGEND**
- MAWT + CA
- Criteria of non conformance > 3mm
- Criteria of non conformance > 2mm
- Criteria of non conformance > 1mm
- Criteria of non conformance
- Less than criteria of non conformance
- Status unknown

**HSE RISK & BUSINESS RISK**
- LOW
- MEDIUM
- HIGH
Haddon-Cave Review: loss of the RAF Nimrod MR2, Afghanistan 2006

- Immediate causation: leak during air-to-air refuelling – overfilling #1 fuel tank – ignition from exposed element of a hot air duct.

- Contributory factors:
  - Age of non-structural components
  - Unsuitable maintenance regime policy
  - Lack of fire detection and suppression system
  - Safety Case failed to identify the potential threat: ie co-location of fuel and hot air system
  - Safety Case process considered to be a “paper exercise” – worthless as a safety tool
  - Failure to identify implications of successive changes to the fuel system and associated procedures
  - Acceptance that fuel leaks were inevitable
  - No trending of leak frequencies
  - Overheat detection system in the wrong place
  - Did not learn lessons from previous incidents
NIMROD DISASTER REVIEW
ANY SIMILARITIES TO OFFSHORE?

- Management structure RAF Kinloss:
  - Engineering personnel come under non-specialist leadership - believed to have had a negative effect

- Training courses did not provide skills to maintain 40 year old aircraft

- Stretched engineering resource; loss of skilled personnel - dilution of engineering skills

- Lack of corporate memory
CONCLUSIONS

- HSE has seen evidence the offshore industry is investing considerable time and money improving ALE management
- Forward planning / anticipating the challenges will reap rewards:
  - improved long term H&S performance
  - extended production
- Need to continue effort to cessation of production

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