HSE’S KP4
AGEING AND LIFE EXTENSION PROGRAMME

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www.intertek.com
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• Overview.
• KP4 findings - areas for additional focus.
• Lessons from Nimrod MR2 disaster.
• KP4 recommendations.
Our extensive global network

- FTSE 100 company in the support services sector.
- Market capitalisation approximately £5 billion.
- Revenue generation of over £2 billion in 2013.

More than 1,000 laboratories and offices

More than 100 countries

Over 36,000 people
Production & Integrity Assurance overview

Our offices and labs

- Aberdeen
- Manchester
- Tripoli
- Oxford
- Dubai
- Kuala Lumpur
- Houston
- Fujairah

- Intertek locations

P&IA locations
Our core team

Production & Integrity Assurance

Asset Integrity Management
Reservoir Services
Analytical Labs
Materials Labs

Production & Integrity Assurance

Production Chemistry & Microbiology
Corrosion & Materials Testing
Consultancy
Instrumentation & Monitoring
WHAT IS AGEING? (RR509)

“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”

Wood Report: Asset Stewardship is crucial
• Many assets older than design life.
• HSE’s KP3:
  o AIM problems offshore.
• HSE’s External Corrosion Project:
  o serious FM problems offshore.
• Continued drive to reduce HCRs.
• Risk of long term skills shortages.
• AIM and A&LE are HSE priorities.
AGE PROFILE OF UKCS ASSETS
(DECC data)
Figure 10: Number of Hydrocarbon Releases Occurring Offshore

Source: Health and Safety Executive
UKCS NORTH SEA LEAK FREQUENCIES

BY SYSTEM

Source: HSE website

BY EQUIPMENT

Source: HSE website
HSE report RR823 (2010) on ageing-related accidents in the onshore chemicals industry:

- European Union Major Accident Reporting System (MARS), 1980 to 2006 (26 years), statistics related to ageing plant:
  - 96 major accident hazards,
  - 28% of all loss of containment incidents,
  - 11 fatalities,
  - 183 injuries,
  - €170 million losses.
It was about:

• Understanding *long term rates of degradation* SCEs and SREs,
• Proactively managing *obsolescence*,
• Improving offshore health & safety,
• Reducing hydrocarbon releases,
• Sustained Regulatory compliance,
• Raising A&LE awareness within AIM,
• Senior management leadership on A&LE.
HOW DID HSE UNDERTAKE KP4?

Onshore & offshore inspections using template.

Different to previous Key Programmes:

• HSE worked with duty holders and Oil & Gas UK,
• Collected good practices,
• O&GUK developed A&LE guidance,
• Energy Institute developed A&LE guidance,
• HSE issued interim report at halfway stage.

• HSL assisted with template data analysis,
• Final report & presentation 28th May 2014.
Ageing and life extension of offshore installations

The maintenance of asset integrity and control of the significant risk to asset integrity presented by ageing processes is a key priority for HSE (see OSD Business Plan). This page has been introduced to provide information on Ageing and Life Extension (ALE) issues relevant to offshore installations and the work of Energy Division in this area.

Energy Division inspection programme of ageing and life extension, known as KP4, was launched to the offshore industry on 28 July 2010. KP4 will run to December 2013 and involves both onshore and offshore inspection of duty holders’ management systems.

The KP4 Report

HSE has published its report into the findings of the KP4 programme. It has identified areas of industry strengths, and areas for additional focus, which will deliver improvements for the long-term management and assurance of workforce safety on offshore installations on the UKCS through to cessation of production and into decommissioning.

Working with industry has brought a high level of positive engagement, resulting in the development of industry-leading ALE practices. Further work is required by industry to continue to improve these practices, and hence offshore safety.
Pipeline integrity

- API RP 17A Design and Operation of Subsea Production Systems, Third Edition
- API RP 17B Recommended Practice for Flexible Pipe
- API RP 17J Specification for Unbonded Flexible Pipe
- API RP 579 Fitness for Purpose
- API TR 171R2 Ageing in oil pipes
- BS PD 8010 part 2 Subsea Pipeline
- BS PD 8010 part 4 Integrity Management Guidelines
- DNV OS F101 Submarine Pipeline Systems
- DNV OS T201 Dynamic Risers
- DNV RP F114 Combined Pipeline
- DNV RP F116 Integrity Management Sub Sea Pipelines
- DNV RP F204 Riser Fatigue
- DNV RP F206 Riser Integrity Management
- DNV RP G504 Produce Wells
- HSE Research Report RR509 - Plant ageing: Management of equipment containing hazardous fluids or pressure
- HSE Research Report RR663 – Plant Ageing Study Phase 1 Report 2010
- Energy Institute: Guidance for Corrosion Management in Oil and Gas Production and Processing
- Energy Institute SP13 Guideline on the Integrity Management of Subsea Facilities
- SINTEF Report (Clients PSA, Norway): Ageing and life extension for offshore facilities in general and for specific systems
- ISO/EN TS 12747: 2011 Petroleum and natural gas industries - Pipeline transportation systems - Recommended practice for pipeline life extension
- UK Oil & Gas: Oil 100 – State of the Art Report on Flexible Pipe Integrity and Guidance Note on Monitoring Methods and Integrity Assurance for Unbonded Flexible Pipes (2010)
- UK Oil & Gas HS071: Guidance on the Conduct and Management of Operational Risk Assessment for UKCS Offshore Oil and Gas Operations Issue 1, January 2012
- UK Oil & Gas HS073: Guidance on the Management of Aging and Life Extension for UKCS Oil and Gas Installations Issue 1, April 2012
KP4 FINDINGS: SAFETY MANAGEMENT SYSTEMS

Additional focus required:

- SCE equipment lists & engineering drawings,
- A&LE policies & strategies,
- Obsolescence strategies,
- SCE performance data trending,
- A&LE-specific management audits,
- A&LE-specific leading KPIs,
- Early preparation for life extension,
- Availability of long term technical competence.
IS THE BATH TUB CURVE VALID FOR OFFSHORE PLANT AND EQUIPMENT?

KP4 Discussions with industry suggest:

- It is applicable for electrical and control equipment,
- Probably applicable to primary structures,
- Is not applicable to PRVs,
- Is not applicable for plant & equipment with significant human intervention.
Studies by Prof Jan Erik Vinnem (Preventor) for PSA Norway found:

- **60% of leaks** were 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


KP4 FINDINGS: STRUCTURES

Additional focus required:

• Structural analyses must be up to date,
• **Data trending** & extrapolation to forecast Criteria of Non Conformance (CONC) date,
• Difficult to inspect/un-inspectable(?) components,
• Suggest Classification Societies review jack-up fatigue assessments to consider:
  ▪ Installations designed to older rules
  ▪ Long tows
    ▪ legs jacked high
    ▪ large bending moments
  ▪ Smaller support jack-ups
  ▪ frequent relocations
PROCESS INTEGRITY

Additional focus required:

• Integrate predictive reservoir data with topsides process safety and integrity management planning,
• Minimise ORAs by improving repair and maintenance strategies,
• ≥2 ORAs on SCE – re-assess combined risk profile – ALARP principle,
• Review ORAs - avoid creeping changes (‘normalisation of deviance’),
• Remove potential for human tolerability,
• Generate leading A&LE KPIs for:
  – operational dysfunction, process isolations,
  – gap analyses, impaired performance
• Improve records of re-rated or downgraded plant.

Lord Haddon-Cave
Additional focus required:

- **Temporary refuges:**
  - Future degradation management,
  - Clear identification of risks and consequences,
  - Leading KPIs needed for TR testing, & their monitoring systems,
  - Review reliability and obsolescence status of monitoring devices.

- **Firewater deluge systems:**
  - Internal corrosion damage,
  - Widespread use of temporary repairs,
  - Nozzle blockages,
  - Need permanent repairs,
  - Need forward planning to minimise corrosion.
MECHANICAL INTEGRITY

Additional focus required:

• Strengthen PMRs with A&LE risks & consequences,
• Include all SCEs and SREs in A&LE reviews and audits,
• Fatigue risks of rotating equipment beyond service life,
• Recommend RBA of rotating machinery, beyond OEM advice & historical performance:
  —Near, mid-, and long-term risks,
  —Effects of changes in fluid properties and quantities, pressures, souring, as the reservoir declines.
Additional focus required:

- **Equipment obsolescence:**
  - Need lists of equipment & components at risk of obsolescence,
  - Problems sourcing spares for older equipment,
  - Rapid changes in digital equipment,
  - Need close working ties with suppliers to help identify solutions for:
    - Cessation of support,
    - Spares availability,
    - Spares storage,
    - Cost effective alternatives.

- **Move away from ‘fix-on-fail’ approach:**
  - DHs often upgraded equipment and systems based on past failure data,
  - Should trend performance data to predict future problems,
  - Need leading KPIs.

- **Improved recording of presence & status of degraded EC&I equipment,**
- **Improve preventative maintenance of electrical containers, esp. Ex boxes.**
Additional focus required:

- **Corrosion** - main ageing mechanism of jack-ups,
- Need quantitative rejection criteria of marine SCEs,
- Need to improve inspection & monitoring of:
  - Secondary marine systems,
  - Drilling rig sea fastenings,
  - Anchor chains.
- Clarify responsibilities for:
  - Approving condition assessments,
  - Life-extension studies,
  - Determining limitations on future use,
- Projects: start what you finish!
Additional focus required:

- Reassess safe operation well before planned service life date,
- Validate corrosion modelling algorithms with NDT data and intelligent pigging:
  - Use all available data to forecast date for CONC,
  - Timely proactive maintenance,
- Cleaning pig frequencies should match KPIs,
- Need A&LE-specific audits,
- Need more ESDV data trending to forecast likely date for failure of KPIs to allow pre-emptive maintenance, repairs or replacement:
  - Closure times,
  - Leakage rates.
CORROSION

Additional focus required:
- Need complete SCE lists & up-to-date engineering drawings & iso’s,
- RBAs must include:
  - OEM packages,
  - Air receivers,
  - Hydraulic accumulators.
- Suggest more future looking:
  - Corrosion mechanism predictions,
  - Corrosion management strategies,
  - Greater integration of predictive reservoir data with CTAs.
- Need to develop accurate NDT equipment:
  - CUPS, CUI, nuts and bolts,
- The contribution of corrosion to HCRs must be reduced.
14 men died – disaster was avoidable,
Immediate cause: fuel leak – ignition from exposed element of hot air duct,
Contributory factors:
– Age of non-structural components,
– Unsuitable maintenance regime policy,
– Lack of fire detection and suppression system,
– SC failed to identify the potential threat,
– SC a “paper exercise” – worthless as a safety tool
– Failure to identify implications of changes to fuel system,
– Acceptance that fuel leaks were inevitable,
– “Normalisation of deviance”.
– No trending of leak frequencies
– Overheat detection system in the wrong place
– Did not learn lessons from previous incidents
– 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
O&GUK leading development of A&LE technical guidance documents:

- HS073 - Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations (2012)
• Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations (2012)

• Guidance on the Management of Ageing and Life Extension of Offshore Structures;

• Guidance on the Management and Ageing and Life Extension for UKCS Floating Production Installations;

• Guidance on the Management of Ageing and Life Extension Aspects of Electrical, Control & Instrumentation Equipment;

• More guidance being developed.
• Technical Guidance and Information Relating to Ageing and Life Extension of Installations in the Upstream Energy Sector (with Guidance Gap Analysis),
• Technical Guidelines for Life Extension of Offshore Installations,
• Guidelines to address Ageing and Life Extension Issues for Offshore Structures and Structural Components,
• Research Report on Risk Management of Ageing Facilities in the Oil and Gas Industry.
OVERVIEW OF THEMES ARISING FROM KP4

• Need to understand A&LE effects on long term H&S,
• Need to improve project planning,
• Bow wave of legacy work to be overcome,
• Producing leading & lagging KPIs for A&LE is problematic,
• Need to improve A&LE-specific auditing,
• ORAs being used to overcome equipment deficiencies,
• Need to improve ownership and reporting of opportunistic observations, and their close out, to help with maintenance,
  • *eg Chicago/New York “broken window” approach*,
• Very positive reaction from industry to KP4 programme,
• Many of the KP4 findings are mirrored in the Wood Report.
1. Embed A&LE into future inspections,
2. Work with the Workforce Engagement Support Team (Step Change in Safety) to encourage work force involvement,
1. Continue developing industry-leading A&LE management practices,
2. Encourage corporate culture which embeds A&LE into AIM for the long term,
3. Improve focus on obsolescence management,
4. Early preparation for Life Extension to identify key issues will help safety and cost effectiveness,
5. Incorporate decommissioning into A&LE management.
6. Develop leading A&LE KPI’s,
7. Periodic A&LE management audits,
8. Improve data management,
9. Improve data trend analysis,
10. Continue work force involvement,
11. Continue encouraging and training people with the required skills to join, and stay in, the oil and gas industry
THANK YOU FOR LISTENING

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Production & Integrity Assurance

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• Wealth of experience
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