HSE

Health and Safety Executive

# Analysis of inspection reports from Asset Integrity Key Programme 3

Prepared by the **Health and Safety Laboratory** for the Health and Safety Executive 2009

RR748
Research Report

# Analysis of inspection reports from Asset Integrity Key Programme 3

**John Hare, Diane Kerr & Colin Chamber**
Health and Safety Laboratory
Harpur Hill
Buxton
Derbyshire
SK17 9JN

Key Programme 3 was a three year inspection project carried out by HSE Offshore Division between 2004 and 2007. Inspections were recorded using standard templates both Onshore (Appendix A) and Offshore (Appendix B). Topics were scored: Red (Non-compliance/Major Failing), Amber (Isolated Failure/Incomplete system), Green (In compliance/OK) or White (Not tested/No evidence). A team of three inspectors, comprising of two specialists (generally from different disciplines) and a regulatory inspector (IMT), would award the traffic lights depending on the duty holder's responses to the questions provided in the Appendices and their own comments and required actions. Some topics would have both an onshore and offshore template. Other topics would have only one template. The OSD KP3 committee would later examine the completed inspection reports and award, for each topic and platform, one overall traffic light. Inspections of system tests of individual safety-critical elements (eg ESD Valves or HVAC dampers) and the condition of the plant were also recorded using traffic lights (see Appendix B).

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

**HSE Books**

*First published 2009*



**ACKNOWLEDGEMENTS**

The authors wish to thank Ralph Braddock and Michael Johnson for their help in producing the tables and graphs for the report.

## CONTENTS

# EXECUTIVE SUMMARY


## Objectives

Key Programme 3 was a three year inspection project carried out by HSE Offshore Division between 2004 and 2007. Inspections were recorded using standard templates for both Onshore (Appendix A) and Offshore (Appendix B). Topics were scored: Red (Non-compliance/Major Failing), Amber (Isolated Failure/Incomplete system), Green (In compliance/OK) or White (Not tested/No evidence). A team of three inspectors, comprising two specialists (generally from different disciplines) and a regulatory inspector (IMT), would award the traffic lights depending on the duty holder's responses to the questions provided in the Appendices and their own comments and required actions. Some topics would have both an onshore and offshore template. Other topics would have only one template. The OSD KP3 committee would later examine the completed inspection reports and award, for each topic and platform, one overall traffic light. Inspections of system tests of individual safety-critical elements (e.g. ESD Valves or HVAC dampers) and the condition of the plant were also recorded using traffic lights (see Appendix B).

Previous work done by HSL helped with the OSD3 input to the internet report 'Key Programme 3: Asset Integrity Programme' published by HSE in November 2007.

This HSL report provides a detailed analysis of the KP3 data relating to maintenance activities. The detailed objectives for this report were analysis of the following aspects:

- Template elements where poor performance is evident in terms of large numbers of reds/ambers;
- Areas of good performance;
- Common themes – reasons for good and poor performance;
- Change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;
- Consistency of approach by the teams;
- Information sharing across/between companies;
- Levels of backlog (in relation to obtaining an industry standard definition and the issue of 'acceptable' levels);
- Temporary repairs (in relation to comparison of KP3 results to SN4/2005 Weldless repair of safety critical piping systems, July 2005);
- Data on planned and corrective backlog/ratio issues;
- Two safety-critical elements, namely ESD Valves and HVAC dampers;
- Physical state of plant.

## Main Findings

The worst performing topics (percentage of red traffic lights) were maintenance of SCEs, backlogs, deferrals, and measuring compliance with performance standards. Maintenance of SCEs, backlogs and deferrals are of most concern (number of reds).

The best performing topics (percentage of green traffic lights) were key indicators for maintenance effectiveness, reporting to senior management on integrity status, defined life repairs and communication onshore/offshore. Maintenance effectiveness indicators, reporting to senior management, and defined life repairs are of least concern (number of greens).

Mobile installations appear to be the best performing type of installation in terms of maintenance topics. Floating production installations appear to have a problem with backlogs.

In terms of the percentage of greens, it appears that 2005/06 is the best year, followed by 2006/07, with 2004/05 worst. The situation has not improved. Re-inspected installations showed no significant changes over three years. Most inspections, however, were of platforms which had not previously had a KP3 inspection. In the first year, installations considered “not bad” were selected, in the second year mobile installations were introduced, followed by the remainder of installations in the third year. In the third year, the inspectors may have expected improvement and were marking slightly more harshly. Consistency of approach is also an issue. Some amber installations can be ‘nearly’ green or ‘nearly’ red. The distinction between ambers and greens is also subjective.

There were seven better performing companies with more than 80% green. There were three poor performing companies with less than 40% green. There does not seem to be a correlation between the number of platforms (related to company size) and the percentages of each traffic light type. Observations on companies with fewer platforms will be more subjective as they are based on a smaller sample of traffic lights.

In terms of consistency of approach, inspection teams have different expertise and will be more concerned over some inspection topics or issues than others. Some topics are more contentious than others in terms of changes in traffic light made by the KP3 committee. Reds are easier to identify, as generally there is associated enforcement action. No platform is perfect; some minor non-compliance may not influence the traffic light allocation, so there will be some overlap between green and amber. Red traffic lights demonstrate stronger consistency than ambers/greens. Differences are moderated by questions set and final analysis by the same team on the KP3 committee.

**Management System Topics:**

The poor performing topics were found to be:

- Technician / Supervisor competence (42% amber);
- Maintenance recording (51% amber);
- Maintenance system evaluation (36% amber);
- Measuring compliance with performance standards (25% amber 11% red).

The better performing topics were:

- Maintenance basics (64% green);
- Communication onshore/offshore (71% green);
- Supervision (68% green);
- Measuring quality of maintenance work (59% green);
- Review of ICP Recommendations/Verification (62% green);
- Reporting to senior management on integrity status (77% green);
- Key indicators for maintenance effectiveness (77%).

**Engineering Topics:**

The very poor performing topics were:

- Maintenance of safety-critical elements (48% amber, 22% red);
- Backlogs (42% amber, 19% red);
- Deferrals (28% amber, 13% red);
- Physical state of plant (37% amber, 14% red);
- HVAC damper tests (19% amber, 25% red);

The poor performing topics were:

- Corrective maintenance (36% amber);
- ESD valve tests (37% amber).

The better performing topic was:

- Defined life repairs (68% green).

## Recommendations

If future traffic light based inspection programmes are planned, then the original markings and any changes suggested by any overseeing committee need to be carefully recorded. The reasons for the change also need to be recorded. Topics with both onshore and offshore templates inevitably involve an overall compromise marking. Thus the recommendation is that a single spreadsheet be used to record onshore, offshore and overseeing committee traffic light activity and changes.

# 1 INTRODUCTION

Key Programme 3 was a three year inspection project carried out by HSE Offshore Division between 2004 and 2007. Inspections were recorded using standard templates both Onshore (Appendix A) and Offshore (Appendix B). Topics were scored: Red (Non-compliance/Major Failing), Amber (Isolated Failure/Incomplete system), Green (In compliance/OK) or White (Not tested/No evidence). A team of three inspectors, comprising of two specialists (generally from different disciplines) and a regulatory inspector (IMT), would award the traffic lights depending on the duty holder’s responses to the questions provided in the Appendices and their own comments and required actions. Some topics would have both an onshore and offshore template. Other topics would have only one template. The OSD KP3 committee would later examine the completed inspection reports and award, for each topic and platform, one overall traffic light. Inspections of system tests of individual safety-critical elements (e.g. ESD Valves or HVAC dampers) and the condition of the plant were also recorded using traffic lights (see Appendix B).

Previous work done by HSL helped with the OSD3 input to the internet report ‘Key Programme 3: Asset Integrity Programme’ published by HSE in November 2007.

This HSL report provides a detailed analysis of the KP3 data relating to maintenance activities. The detailed objectives for this report were analysis of the following aspects:

- Template elements where poor performance is evident in terms of large numbers of reds /ambers;
- Areas of good performance;
- Common themes – reasons for good and poor performance;
- Change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;
- Consistency of approach by the teams;
- Information sharing across/between companies;
- Levels of backlog (in relation to obtaining an industry standard definition and the issue of 'acceptable' levels);
- Temporary repairs (in relation to comparison of KP3 results to SN4/2005 Weldless repair of safety critical piping systems, July 2005);
- Data on planned and corrective backlog/ratio issues;
- Two safety-critical elements, namely ESD Valves and HVAC dampers;
- Physical state of plant.

Figure 1 shows the percentage of each traffic light for maintenance activities only.

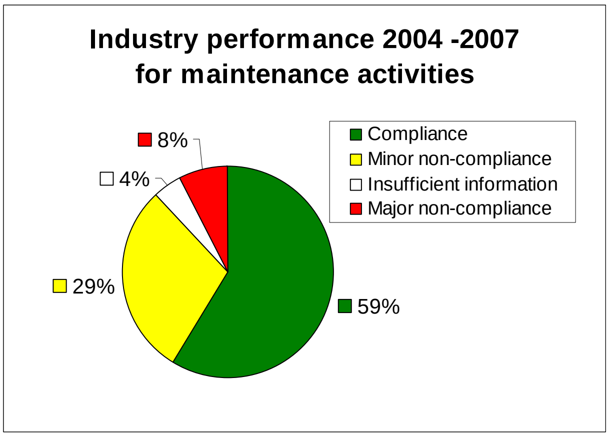


**Figure 1** Maintenance only Traffic Light %

# 2 GENERAL OVERVIEW

This section includes a report on the following detailed project objectives:

- Template elements where poor performance is evident in terms of large numbers of reds /ambers;
- Areas of good performance;
- Change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;
- Consistency of approach by the teams;
- Information sharing across/between companies;

## 2.1 POOR AND GOOD PERFORMANCE

Table 1 shows the number of each traffic light for each of the maintenance topics recorded during the period 04/07. Topics with many reds are poor performers and those with many greens are good performers.

**Table 1** Poor and Good Performance

| Topic | No of reds | No of ambers | No of greens |
|---|---|---|---|
| A - Maintenance basics | 6 | 19 | 53 |
| B - Communication onshore/offshore | 5 | 19 | 59 |
| C – Technician /Supervisor Competence | 1 | 35 | 47 |
| D - Maintenance of SCEs | 18 | 40 | 24 |
| E - Supervision | 2 | 24 | 56 |
| F - Maintenance recording | 1 | 42 | 38 |
| G - Backlogs | 16 | 35 | 32 |
| H - Deferrals | 11 | 23 | 47 |
| I - Corrective maintenance | 7 | 30 | 42 |
| J - Defined life repairs | 3 | 20 | 57 |
| K - Maintenance system evaluation | 2 | 30 | 50 |
| L - Measuring compliance with performance standards | 9 | 21 | 45 |
| M - Measuring quality of maintenance work | 6 | 19 | 49 |
| O/N -Review of ICP recommendations/ Verification | 7 | 18 | 51 |
| P - Reporting to senior management on integrity status | 3 | 11 | 64 |
| Q - Key indicators for maintenance effectiveness | 3 | 5 | 64 |

Figure 2 shows red topics for the period 2004-07. The poorest performing topics were maintenance of SCEs, backlogs, deferrals, and measuring compliance with performance standards. Figure 3 shows green topics for the period 2004-07. The best performing topics were key indicators for maintenance effectiveness, reporting to senior management on integrity status, defined life repairs, and communication onshore/offshore. Figure 2 and 3 highlight poor and good performance respectively on the left of the graph. Figure 4 shows all three traffic lights for the same period. The graphs show the percentage of each traffic light for each topic. Particular topics showed the same trends in traffic light colours through each of the three years of the KP3 programme.

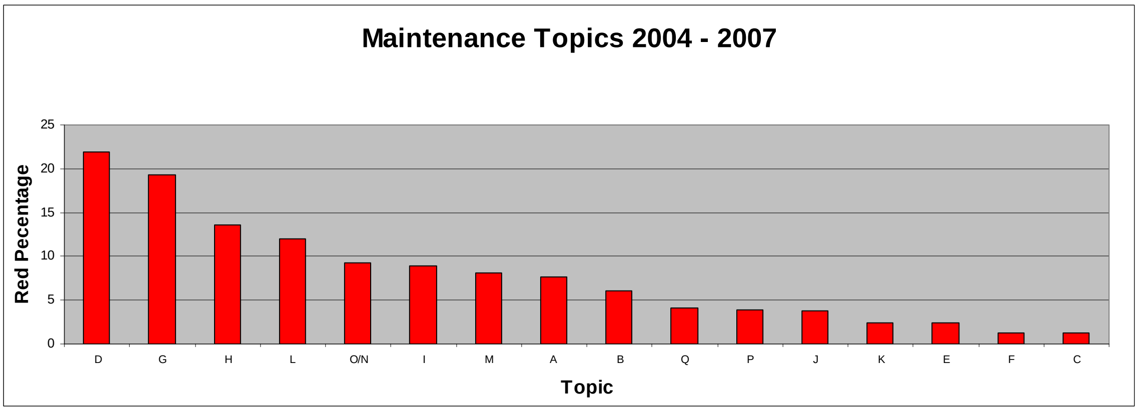


**Figure 2** Red Traffic Lights

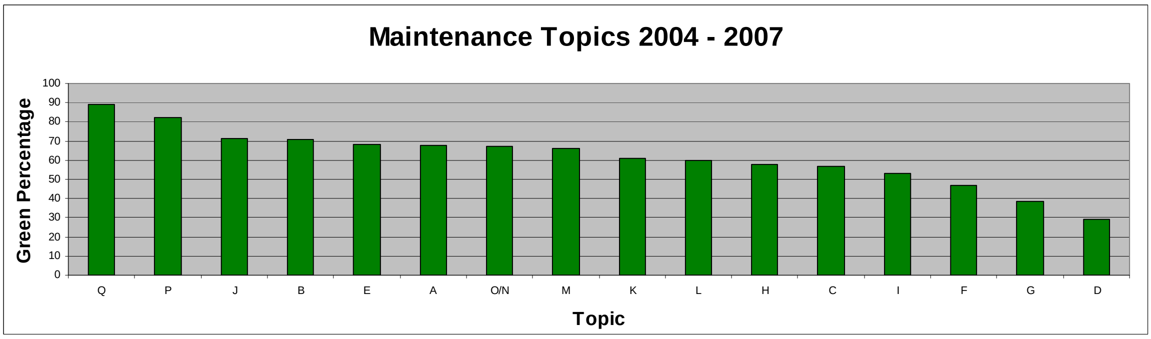


**Figure 3** Green Traffic Lights

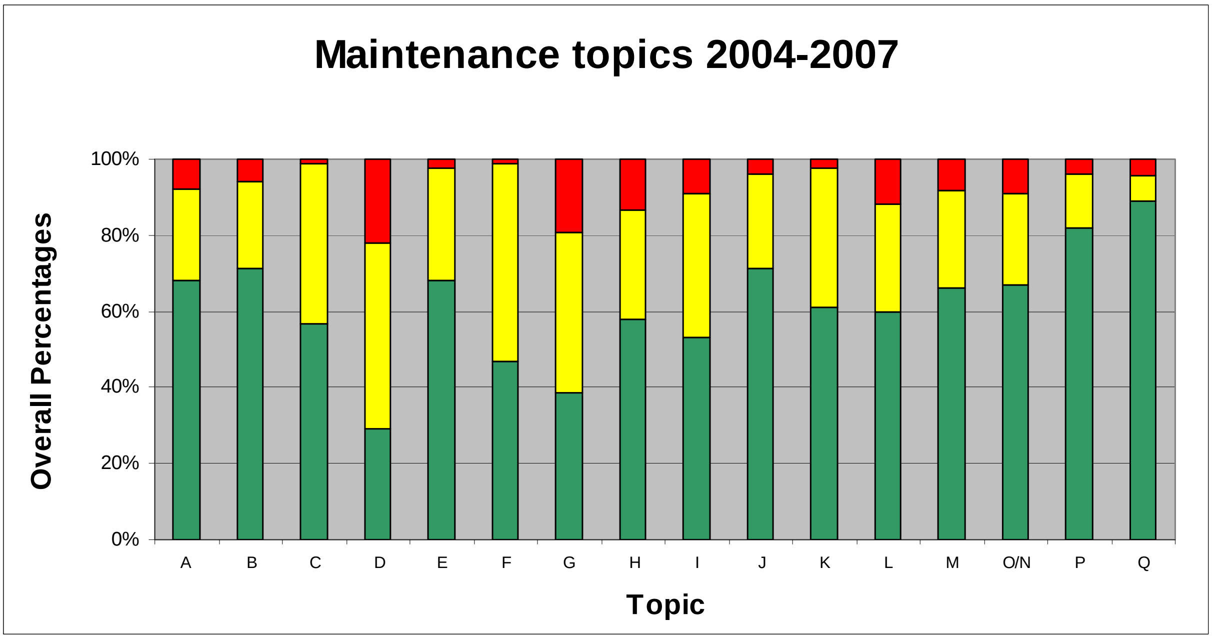


**Figure 4** All Traffic Lights

Table 2 is the sorted matrix for maintenance topics for the period 04-07. Maintenance of SCEs, backlogs and deferrals are of most concern (number of reds). Maintenance effectiveness indicators, reporting to senior management and defined life repairs are of least concern (number of greens). Mobile installations appear to be the best performing type of installation in terms of maintenance topics. Floating production installations appear to have a problem with backlogs. During the course of KP3, some installations changed duty holder and others changed installation type. Any information in this report reflects duty holder and type at the time of inspection. Table 2 shows an anonymous installation number, the installation type and the inspection year as grey (2004/05), turquoise (2005/06) and lavender (2006/07). Figure 5 shows the effect of installation type on the percentage of each traffic light.

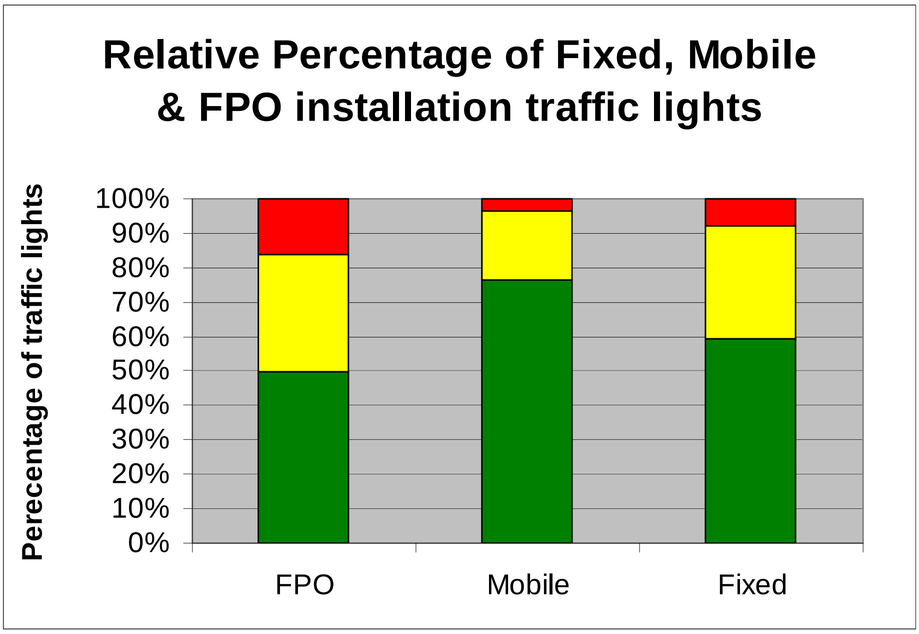


**Figure 5** Traffic Lights by Installation Type (Floating Production, Mobile and Fixed Installations)

**Table 2** Sorted Matrix for Maintenance Topics

## 2.2 CHANGE IN PERFORMANCE OVER TIME

Figure 6 shows the number of each traffic light type for each year of KP3. Figure 7 shows the percentage of each traffic light type for each year of KP3.

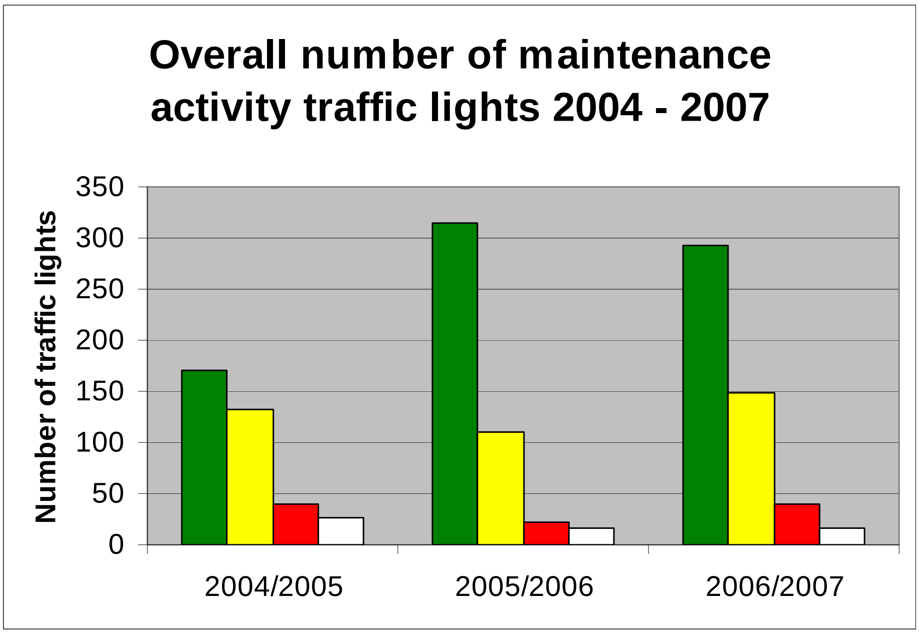


**Figure 6** Number of Traffic Lights per Year

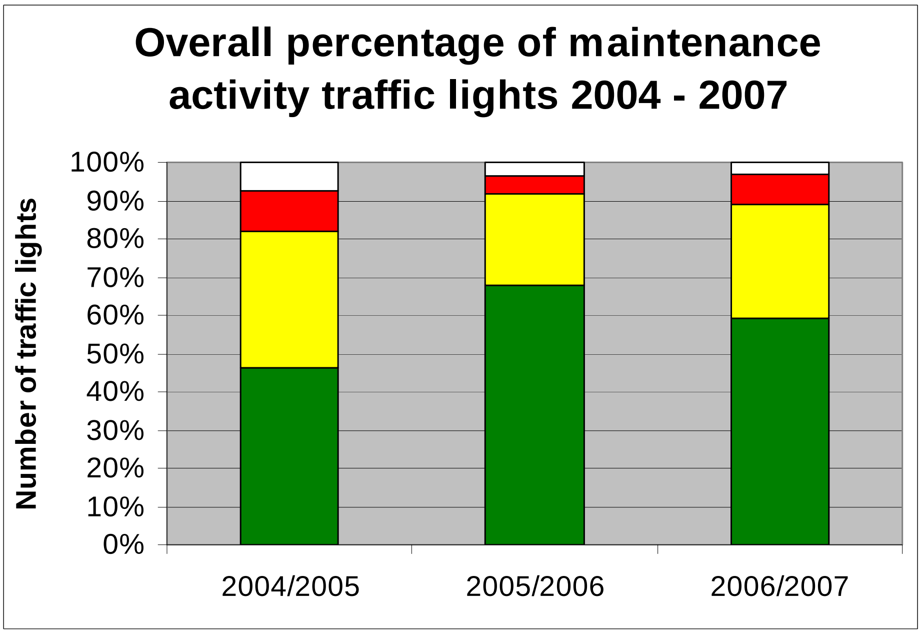


**Figure 7** Percentage of Traffic Lights by Year

In terms of the percentage of greens, it appears that 2005/06 is the best year, followed by 2006/07, with 2004/05 worst. There is little evidence that the situation has improved. In the first year some of the better installations were selected, in the second year mobile installations were introduced, followed by the remainder of installations in the third year. In the third year the inspectors may have expected improvement and were marking slightly more harshly. Also, the same platforms are only re-inspected in a small number of cases. Re-inspected installations showed no significant changes over three years. It could be that inspector expectations were high for the first year, less for the second and a little high for the third. Consistency of approach is also an issue. Some amber installations can be ‘nearly’ green or ‘nearly’ red. The distinction between ambers and greens is also subjective.

The general performance of platforms was assessed over the three years of KP3. In the first year (04/05), the performance varied between 20% and 80% green. In the second year (05/06), the performance was better, with between 20% and 100% green, and more platforms showing more than 80% green. In the third year (06/07), the performance was between 20% and 90% green, with fewer platforms showing more than 80% green.

## 2.3 CONSISTENCY OF APPROACH BY THE TEAMS

The two specialist inspectors on the inspection teams would have different expertise (e.g. process integrity, structural engineering and human factors) and will be more concerned over some inspection topics or issues than others. Some topics are more contentious than others in terms of changes in traffic light made by the KP3 committee. Section 3 on Management System Topics gives more information on this. Knowing both the traffic light and the text, the amber or green marking generally seems reasonable. However, it is difficult to guess the traffic light just knowing the text. Section 3 on Management System Topics also gives more information on this. Reds are easier to identify, as generally there is associated enforcement action. The definitions are green (compliance), amber (minor non-compliance) and red (major non-compliance). No platform is perfect; some minor non-compliance may not influence the traffic light allocation, so there will be some overlap between green and amber. Red traffic lights demonstrate stronger consistency than ambers/greens. Differences are moderated by questions set and final analysis by the same team on the KP3 committee.

## 2.4 INFORMATION SHARING ACROSS/BETWEEN COMPANIES

As the different operating companies have different numbers of platforms, any comparison between them has to take account of this. In Figure 8, the number of each type of traffic light is shown for each operating company in percentage terms.  The operating company names are replaced by randomly generated two-letter codes, which are ordered alphabetically and bear no relationship to the actual company names.

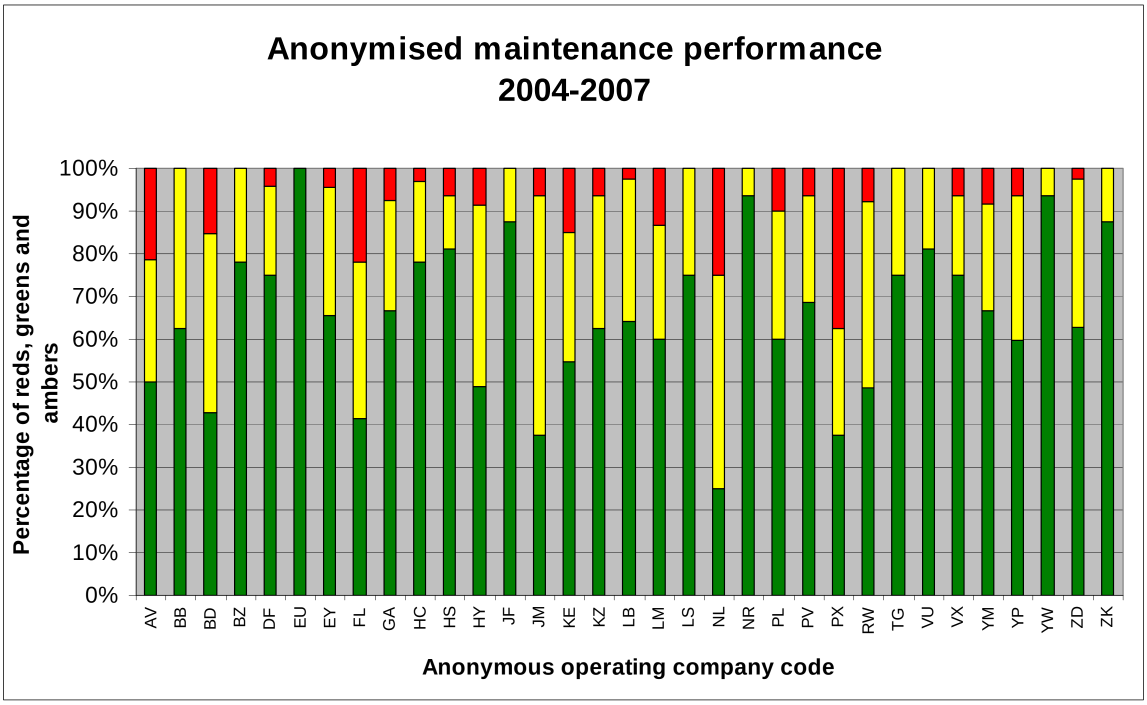


**Figure 8** Anonymous Operating Company Performance

There were seven better performing companies with more than 80% green (NR, ZK, VU, EU, YW, HS and JF). Indeed one of these seven (EU) obtained 100% green. There were three poor performing companies with less than 40% green (JM, PX and NL). There does not seem to be a correlation between the number of platforms (related to company size) and the percentages of each traffic light type. Observations on companies with fewer platforms will be more subjective as they are based on a smaller sample of traffic lights.

# 3 MANAGEMENT SYSTEM TOPICS

This section includes a report on the following detailed project objectives:

- Template elements where poor performance is evident in terms of large numbers of reds /ambers;
- Areas of good performance;
- Common themes – reasons for good and poor performance;
- Change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;
- Consistency of approach by the teams;
- Information sharing across/between companies.

Management system topics, which will be considered in detail, are:

A - Maintenance basics;
B - Communication between onshore support staff and offshore maintenance technicians;
C - Competence assurance of maintenance technicians and their supervisors;
E - Supervision;
F - Recording of completed maintenance work;
K - Measuring the effectiveness of the maintenance system;
L - Measuring compliance with performance standards;
M - Measuring quality of maintenance work;
O / N - Review of ICP recommendations/Verification;
P - Reporting to senior management on integrity status; and
Q - Key indicators for maintenance effectiveness.

The total number of installations is 83, of which 23 installations were inspected in the first year, 29 in the second year and 31 in the final year. The number of ambers and reds for each topic by year is given as an indication of the performance in that topic. The distinction between ambers and greens was not always clear-cut for topics B, C, E and Q as greens would show some of the same problems as ambers, and ambers would show some of the same good practices as greens. Only management system topics will be considered here; other topics will be examined in section 4 on mechanical engineering.

## 3.1 A - MAINTENANCE BASICS

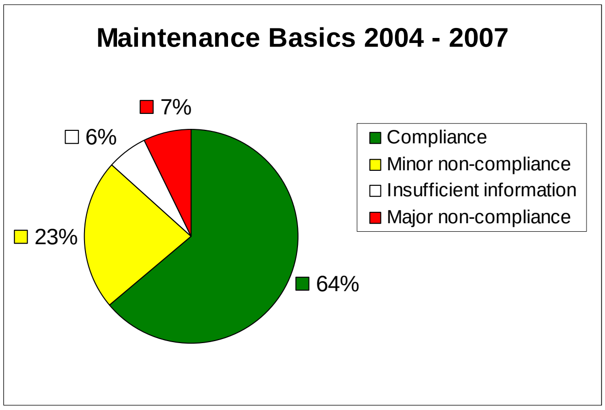


**Figure 9** Maintenance Basics

There is only an onshore template for this topic. This inspection topic was not contentious, as the KP3 committee made only minor changes in traffic light designation. There were three reds in 2004-05 and three in 2006-07. There were six ambers in both 2004-05 and 2005-06, and seven in 2006-07. Performance was generally good for this topic. The particular computerised maintenance management system used (SAP, Maximo etc) was not an issue. Ambers and reds showed the following problems:

- Lack of maintenance strategy;
- Problems with operation of management system;
- Incomplete implementations of new management systems;
- Poor strategy;
- Poor understanding of maintenance management systems;
- Not fully effective management systems.

Greens showed the following good practices:

- Good maintenance management system (computerised or register);
- Clear strategy available;
- Prioritisation was clear – safety-critical elements or risk-based.

## 3.2 B - ONSHORE/OFFSHORE COMMUNICATIONS

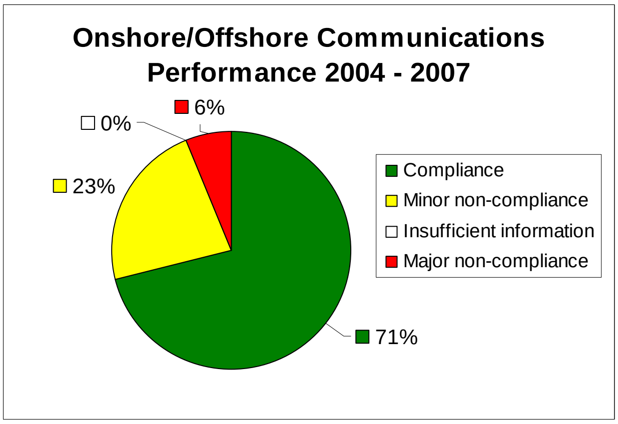


**Figure 10** Onshore/Offshore Communications

The onshore traffic light was not a good indicator of the offshore traffic light or the KP3 committee view. There were two reds in 2004-05 and three in 2006-07. There were 10 ambers in 2004-05, three in 2005-06 and six in 2006-07. Performance was generally good for this topic. Use of morning conference calls and emails were common amongst both ambers and greens. One of the onshore template questions asks if front line maintenance workers are consulted in risk assessments. Ambers and reds showed the following problems:

- Slow response to questions;
- Lack of or poor risk assessment;
- Lack of visits and hierarchy;
- Lack of monitoring;
- Problems with some technical authorities;
- Work checking was not formalised;
- Quality was not monitored; and
- Staff shortages or turnover.

Greens showed the following good practices:

- Fast response to questions;
- Risk assessments;
- Frequent visits from technical authorities;
- Good monitoring;
- Formalised checking and quality procedures; and
- Staff monitoring.

## 3.3 C – TECHNICIAN / SUPERVISOR COMPETENCE

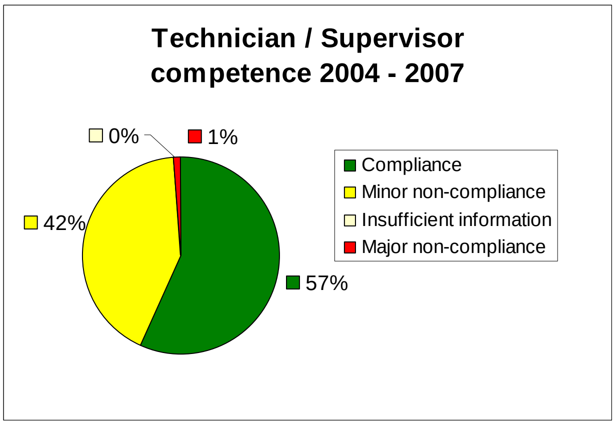


**Figure 11** Technician / Supervisor Competence

In some cases there was disagreement between the onshore and offshore traffic lights, with the KP3 committee having to decide on their overall view. There was one red in 2004-05. There were 14 ambers in 2004-05, 10 in 2005-06 and 11 in 2006-07. Performance was poor for this topic because of the significant amber percentage. Ambers and reds showed the following problems:

- No specific supervisor training;
- No formal selection procedures;
- No supervisor competence requirements;
- Need to ask for training;
- SAP/MMS problems and unfriendly;
- Lack of audits;
- Lack of competence scheme;
- Spreadsheets were confusing and lacked prioritization;
- No TA assessment of technicians;
- Problems in certain disciplines e.g. electrical and mechanical;
- Lack of maintenance training;
- Lack of structured training;
- Poor appraisals;
- Training baseline not copied onto new training matrix; and
- Problems with staff turnover, continuity and confidence.

Greens showed the following good practices:

- Use of NVQs and mentoring;
- Use of a training matrix;

- MMS training;
- Stable workforce;
- Use of various training courses;
- Competence assurance; and
- Maritime training.

### 3.4 E - SUPERVISION

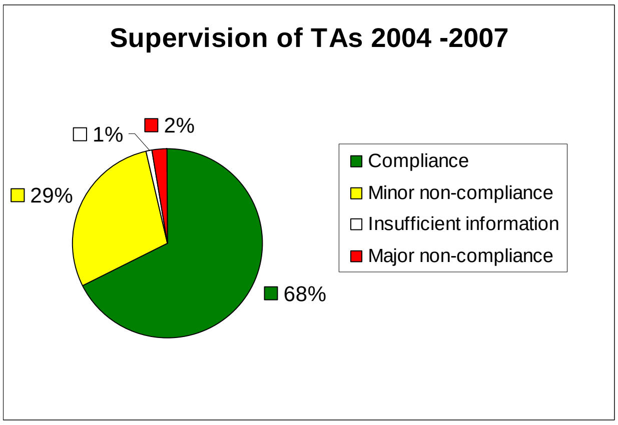


**Figure 12** Supervision of TAs

In some cases there was disagreement between the onshore and offshore traffic lights, with the KP3 committee having to decide on their overall view. There were two reds in 2004-05. There were eight ambers in 2004-05, six in 2005-06 and 10 in 2006-07. Performance was generally good for this topic. Ambers and reds showed the following problems:

- Technicians check their own work;
- Supervisors spend too much time in the office and not in the plant;
- Supervisors have too much bureaucracy and paperwork;
- New mechanical engineering and electrical engineering supervisor posts recruitment backlog;
- Supervisors do not audit technicians' work;
- Time taken for onshore MMS to record completion of maintenance tasks;
- Knowing who is reliable;
- Lack of formal assessment onshore; and
- Having vendor contractors report back on their work at the end without platform staff being involved previously.

Greens showed the following good practices:

- Night shift do bulk of administrative work;
- Experienced technicians ensure quality;
- Offshore administrative workload is reduced;
- Lead technician checks quality;
- Use of job cards;
- Creation of new mechanical engineering and electrical engineering supervisor roles and reliability team leaders;
- Staff are trusted;
- Use of electronic systems to reduce paperwork;
- Use of ICP and company audits;

- Platform technicians accompany vendor specialist contractors.

### 3.5 F - MAINTENANCE RECORDING

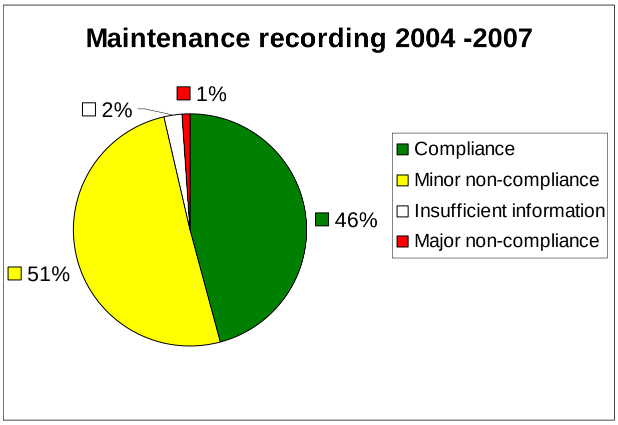


**Figure 13** Maintenance Recording

In some cases there was disagreement between the onshore and offshore traffic lights, with the KP3 committee having to decide on their overall view. There was one red in 2004-05. There were 13 ambers in 2004-05, 15 in 2005-06 and 14 in 2006-07. The performance was poor for this topic because of the significant amber percentage. Sometimes the technician recorded the data on an electronic MMS, otherwise the data was sent onshore to be entered into MSS. Ambers and reds showed the following problems:

- MMS did not reflect the plant;
- There was little prediction of future maintenance;
- Inconsistent data quality and quantity was observed;
- Historical data was poor;
- PS test data was not recorded;
- Poor functionality of MMS;
- Quality of data depends on technician involved;
- Incorrect or incomplete records;
- Lack of technical review of data;
- Trends were difficult to observe;
- Slow data transmission rates;
- Difficult to extract data;
- Poor quality and quantity of data;
- Poor templates.

Greens showed the following good practices:

- Team leaders check data;
- Performance standard test data is recorded;
- Safety envelopes for testing data;
- Quality control on data entry;
- Historical data easy to review;
- Rationalised fault codes;
- Standard forms for SCEs testing records;
- Use of templates;
- Deep intense searches are possible on particular pieces of equipment;

- Some records are reviewed periodically.

## 3.6 K - MAINTENANCE SYSTEM EVALUATION

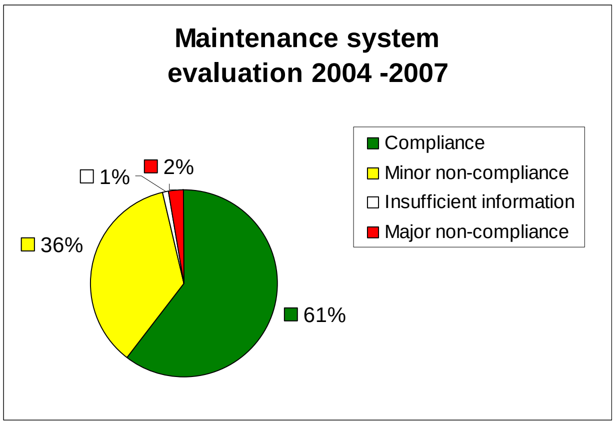


**Figure 14** Maintenance System Evaluation

In many cases there was disagreement between the onshore and offshore traffic lights, with the KP3 committee having to decide on their overall view. There was one red in 2004-05 and one in 2006-07. There were eight ambers in 2004-05, 12 in 2005-06 and 10 in 2006-07. Performance was poor for this topic because of the significant amber percentage. Ambers and reds showed the following problems:

- Prioritisation not clear;
- No targets;
- Lack of feedback;
- No formal trend analysis or tracking system;
- No performance analysis;
- No predictive failure analysis;
- Poor data;
- Limited failure rate data;
- Poor input data quality;
- Poor performance targets;
- SCEs not covered;
- Poor failure codes;
- Some corrective recorded as projects;
- Little information sharing onshore;
- Lack of reports;
- PIDs and maintenance manuals not up to date.

Greens showed the following good practices:

- Performance and integrity reports available;
- Status of SCEs tests clear;
- Equipment condition monitoring;
- Failure rate analysis available;
- Corrective and predictive maintenance balance noted;
- Deferrals and backlogs recorded;
- Targets are clear;
- Reports to senior management;

- Targets for company KPIs;
- KPIs are published;
- SCE records clear;
- Reports to high level management meetings.

### 3.7 L - MEASURING COMPLIANCE WITH PERFORMANCE STANDARDS

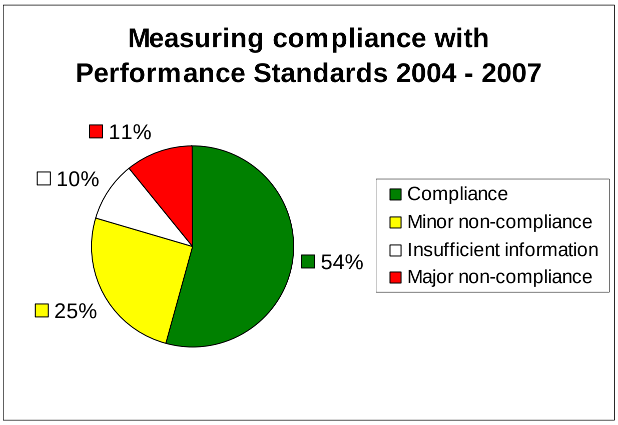


**Figure 15** Measuring Compliance with Performance Standards

There was one red in 2004-05, four in 2005-06 and four in 2006-07. There were nine ambers in 2004-05, two in 2005-06 and 10 in 2006-07.

Reasons for amber and red were:

- Performance standards not available for scrutiny.
- Informal compliance with performance standards – often stated as being room for improvement.
- ICP relied upon to check that performance standards are met.
- Maintenance supervisor covers quality via job card review in an ad-hoc manner.
- Maintenance supervisor discusses and visually inspects maintenance jobs in an ad-hoc manner.
- No reports available offshore to show that performance standards had been met following maintenance.
- Poor performance measures, in need of updating.
- Checks against performance standards for SCE are only carried out if they are present on the computerised maintenance management systems (CMMS).
- Inadequate procedures fail to demonstrate whether performance standards are met.
- The CMMS provides a report without stating any evidence.
- Only SCE performance standards are reviewed.
- Poorly defined and unclear performance standards categories.
- Incomplete performance standards assessments, not including risk assessments.
- Tracking register shows long-term performance standards failures have not been addressed.
- CMMS not linked with performance standards.
- Onshore was not aware equipment not meeting performance standards.
- Onshore tends to monitor only SCEs and pressure envelope.
- No formal system for monitoring performance standards – OIM claims everyone knows what they are.

- No performance standards reports held onshore – it is claimed offshore will know what they are.
- Performance standards reports could not be provided onshore.
- Only comparison between performance measures and performance standards is by ICP.
- Inspection and job plan marked N/A in performance standards review.
- Inconsistent performance standards specification existed across assets.
- Performance standards specifications from another company applied to assets resulting in many of them being incorrect.
- HVAC data not analysed to show compliance with safety case.
- Priorities of safety actions altered based on inappropriate data.
- Not all performance standards are checked.
- Based on the verification scheme offshore personnel would not know whether failures reported by technicians relate to SCEs.
- ICP failed to report errors in SCE performance assurance routines as remedial action recommendations (RAR).
- Review against standards not done due to resource constraints.

Reasons for green were:

- Use of computerised maintenance management systems (CMMS) to monitor and demonstrate compliance with performance standards (where the CMMS used is designed to do this). Such systems typically indicating that equipment is either passed/ failed/failed and fixed.
- Reports were available both onshore and offshore showing where performance standards have and have not been met and where remedial action was necessary.
- Procedures are in place to quickly remedy equipment failures that resulted in performance standards failures.
- Periodical audit of maintenance system is carried out and a report showing compliance with maintenance standards is produced.
- Traffic light system used to track ICP inspection of compliance of SCEs with performance standards.
- Evidence provided of regular testing of SCE demonstrating its compliance with performance standards.
- Equipment performance assurance process used to measure compliance with performance standards.
- Onshore ISC team leader responsible for ensuring maintenance is carried out in conformance to the work order.
- Annual inspection results in a list of improvements that must be carried out.
- Risk-based inspection used.
- TAs check at least 10% of completed work orders.

## 3.8 M – MEASURING QUALITY OF MAINTENANCE WORK

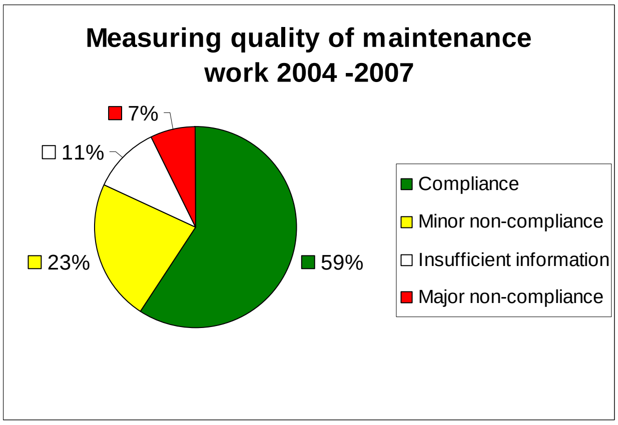


**Figure 16** Measuring Quality of Maintenance Work

There were three reds in 2004-05 and three in 2006-07. There were eight ambers in 2004-05, three in 2005-06 and three in 2006-07.

Reasons for amber and red were:

- No formal procedures for performing quality checks.
- Quality checks are not formally reported.
- Onshore staff do not review offshore maintenance reports.
- Details of onshore meetings not recorded.
- TA checks only involved in limited maintenance inspections in an ad-hoc basis.
- Work histories are difficult to obtain and records are in complete because the system is long-winded and cumbersome – there are no plans to improve recording of activities.
- Checks on maintenance activities are limited to a 'vertical slice'.
- No evidence of onshore phase of inspection activity.
- Company rely of contractors for quality of specialist work.
- TA inspection is ad hoc with no inspection agenda.
- Yearly audit done by questionnaire followed by going to look at maintenance.
- No formal process for TA visits offshore.
- Not all equipment was checked.
- Internal self-audit only.
- No formal audit process.
- No independent audit.
- No records of internal or external inspections were found onshore.
- TAs did not carry out checks on completed work orders to check quality of work.
- Lack of competent staff onshore.
- Quality of data in computerised maintenance management systems (CMMS) is poor.
- Maintenance quality checks were stated as being carried out by offshore supervisory staff. Onshore did not know.
- Audits not carried out periodically.
- Offshore performance measures monitored only during visits.
- TA rarely involved in inspection.
- No TA assigned for inspection.
- No external audit, some internal informal monitoring.

Reasons for green were:

- Periodic internal and external audits of work orders carried out.
- TAs and ICP involved in periodic inspection and audits of maintenance work.
- Defects found in inspections and audits recorded in database and where relevant timely actions rose.
- The maintenance supervisor checks work orders.
- Onshore staff audits work orders.
- Random work orders are inspected offshore.
- Maintenance supervisor discusses and visually inspects maintenance jobs.
- External technical audits of all equipment and the SAP system are carried out periodically (typically 6 to 10 times per year).
- OIMs externally audited every 3 years.
- Test witnessing and visual inspection of plant is carried out periodically.
- Maintenance subject to both internal and external inspection.
- Structured process for non-conformance with (computerised maintenance management systems) CMMS database for tracking.
- Named, competent person responsible for ensuring maintenance is carried out according to work order.
- ICP and TA make checks during visits and interrogating the CMMS, which is reviewed both onshore and offshore.
- Onshore TAs are required to make several visits per year.
- All KPIs documented and monitored weekly.
- Technical Clerk inputs all work order data in to CMMS to ensure consistency.
- Cycle ICP surveyors to limit familiarisation.
- Clear links to ICP monitoring for monitoring of closeout.
- All anomalies are subject to a formal RA.
- Internal and external auditing is performed as well as cross company auditing.
- ICP undertakes audits of SCE work.
- QA audits are performed.
- Asset manager uses dashboard method to measure quality outputs.
- Integrity meetings are held weekly and integrity reviews are held monthly.
- Quarterly integrity reviews are held at vice president level.

## 3.9 O / N - REVIEW OF ICP RECOMMENDATIONS/VERIFICATION

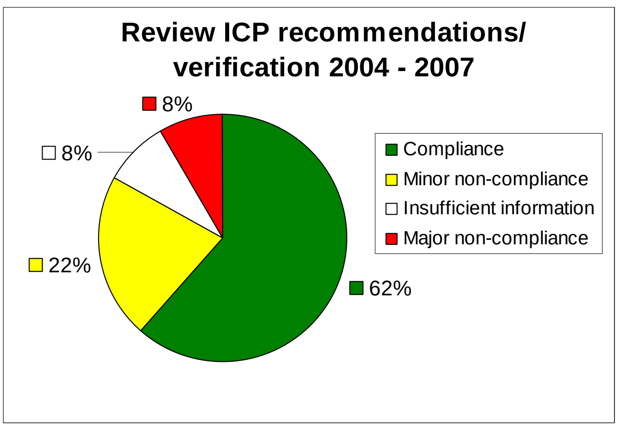


**Figure 17** Review of ICP Recommendations/Verification

There are two separate onshore templates for this topic. There was sometimes disagreement between the O and N onshore traffic lights, with the KP3 committee having to decide on their overall view. There were three reds in 2004-05, two in 2005-06 and two in 2006-07. There were four ambers in 2004-05, three in 2005/06 and 11 in 2006-07. Performance was generally good for this topic. Ambers and reds showed the following problems:

- Outstanding actions not complete;
- ICP actions signed off when WO raised, not on work completion and not by ICP;
- ICP seen as internal inspection rather than a proper sampling of DH system;
- Deferrals of ICP-related work orders;
- No review system for ICP findings;
- Lack of records on SCEs;
- Not meeting performance standards;
- SCE verification is not working;
- DH not open with HSE on ICP recommendations;
- Lack of DH review on verification;
- SCEs found unsuitable during verification;
- ICP checks were deferred;
- SCE performance standards were in abeyance.

Greens showed the following good practices:

- SCEs are covered and linked to MAH scenarios;
- Database for ICP recommendations by SCEs;
- Clear prioritisation scheme for ICP recommendations;
- Frequent reviews of ICP information;
- Functionality, reliability and dependability all considered;
- Failure modes are recorded;
- Ex-equipment prioritised;
- Frequent WSEs;
- Frequent meetings with ICPs;
- ICPs involved in performance standards;
- ICP audits any SCE deferrals and backlogs;
- ICP test systems, PFEER SCEs are examined;
- Clear decision process for ICP recommendations in terms of DH prioritisation.

## 3.10 P - REPORTING ON INTEGRITY STATUS

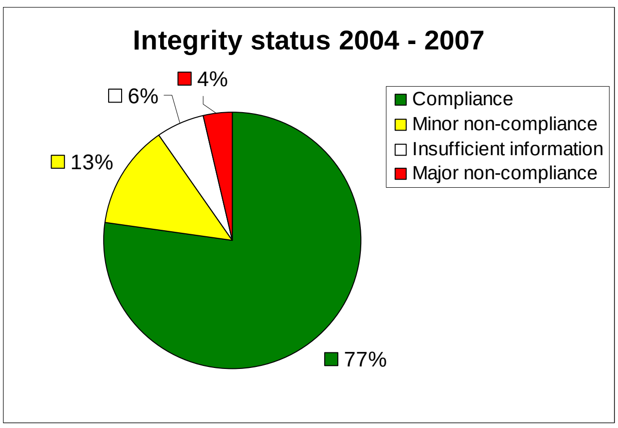


**Figure 18** Reporting on Integrity Status

There is only an onshore template for this topic. This inspection topic was not contentious, as the KP3 committee made only a few changes in traffic light designation. There were two reds in 2004-05 and one in 2006-07. There were seven ambers in 2004-05, one in 2005-06 and three in 2006-07. Performance was generally good for this topic. Ambers and reds showed the following problems:

- MMS is not sophisticated;
- No thinking on reporting mechanisms;
- Loss of maintenance engineers;
- No information flow upwards on need for resources;
- No distinction between operational and platform structural requirements;
- Resource limitations;
- SCE and other types of maintenance are not distinguished;
- Maintenance can be deferred but no audit process for it;
- Safety-critical elements not considered;
- Information not available on MMS.

Greens showed the following good practices:

- Monthly reports to senior managers;
- Use of internet reports;
- KPIs monitored by technical assessors;
- Reports to senior management team;
- Integrity status reviewed regularly and changes made;
- Monthly integrity reports;
- Use risk-based inspection techniques;
- Strategy and integrity reviews every five years.

## 3.11 Q - MAINTENANCE KEY INDICATORS

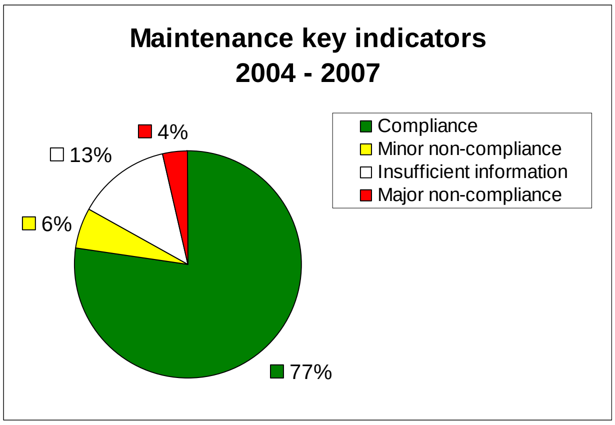


**Figure 19** Maintenance Key Indicators

There is only an onshore template for this topic. This inspection topic had some contention, as the KP3 committee made minor changes in traffic light designation. There were three reds in 2004-05. There were four ambers in 2004-05 and one in 2006-07. Performance was generally good for this topic. Ambers and reds showed the following problems:

- No targets for preventative - corrective ratio;
- No trend analysis;
- No analysis for SCEs;

- Use of collected information unclear;
- No review of plant performance;
- Data on PM-CM and out of service not well populated;
- Some business controls, not safety;
- No trigger for SCE test failures;
- Neglect of equipment recognised by DH;
- No KI at all.

Greens showed the following good practices:

- Monthly reports;
- Key indicators available on the following topics - corrective maintenance, preventative maintenance ratio, backlogs, deferrals, failure of SCEs, performance standards, resources, uptime and downtime.

# 4 ENGINEERING TOPICS

The general project objectives are:

- Template elements where poor performance is evident in terms of large numbers of reds /ambers;
- Areas of good performance;
- Common themes – reasons for good and poor performance;
- Change of performance over time in relation to identified areas of poor performance i.e. better, worse, no change;
- Consistency of approach by the teams;
- Information sharing across/between companies;
- Levels of backlog (in relation to obtaining an industry standard definition and the issue of 'acceptable' levels);
- Temporary repairs (in relation to comparison of KP3 results to SN4/2005 Weldless repair of safety critical piping systems, July 2005);
- Data on planned and corrective backlog/ratio issues will be reviewed;
- Two safety-critical elements, namely ESD Valves and HVAC dampers;
- Physical state of plant.

Engineering topics, which will be considered in detail, are:

- D (Maintenance of safety-critical elements (SCE);
- G (Backlogs);
- H (Deferrals);
- I (Corrective maintenance);
- J (Defined life repairs);
- ESD valves;
- Physical state of plant;
- HVAC dampers.

## 4.1 D – MAINTENANCE OF SAFETY CRITICAL ELEMENTS (SCE)

There were significant variations in the standards of SCE maintenance overall. Percentages of ‘maintenance’ traffic lights are given below.

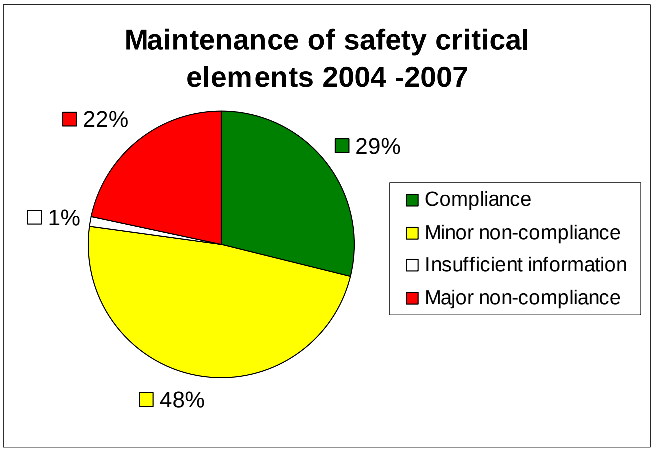


**Figure 20** Maintenance of safety-critical elements

### 4.1.1 Performance Standards

Work orders contained a statement of, or reference to, the relevant SCE Performance Standard in slightly less than 50% of the installations inspected.

Some duty holders were in the process of correcting this situation.

In some cases it was found that assurance routines did not test the totality of performance standards for safety-critical elements.

### 4.1.2 Acceptance Criteria

Work orders contained acceptance criteria in just below 60% of the installations inspected.

In some cases, the failure to meet a PS was recorded on MMS, but the amount of information entered on the system was too low for trend analysis and considered insufficient to help maintenance staff.

On one installation, most work orders appeared to suggest a ‘retry’ to meet the performance standard.

On another platform, the ICP had to interpret whether the PS was met from the preventative maintenance routines.

It was reported that failure to meet a PS on one particular unit might be identified as an anomaly by the ICP or be discovered by an individual on the installation.

### 4.1.3 Contingency Plans

Contingency measures were described in some cases, but there did not seem to be a formal review process.  Routine revision of risk control measures was not apparent.

Procedures on a number of installations required a corrective work order to be raised on failing to achieve a PS.

Performance standards, in some cases, specified the mitigation measures to be put in place if the acceptance criteria were not met. Where this was not the case, risk assessment of the situation was generally carried out, measures put in place, and the situation monitored.

One duty holder recorded PS failures on a register and provided instructions for modified operations until defects were rectified.

It was considered that TAs not had sufficient training to undertake suitable risk assessments on one installation

On a small number of installations, the required action in the event of a SCE test failure was not specified at all.

### 4.1.4 Comparison by Installation Type

The majority of installations inspected were of the fixed type. Traffic lights for floating production and mobile units are given in Table 3 and 4 below.

Red or amber traffic lights were allocated to 57% of the floating production installations inspected (between 2004 & 2007) for the following reasons:

- No reference to performance standards for SCEs;
- Limited verification of correct operation of SCEs.

**Table 3** Maintenance of SCEs – Floating Production

| Maintenance of SCEs | | | |
|---|---|---|---|
| Floating Production | | | |
| KE | 1 | 04 / 05 | |
| BZ | 3 | 05 / 06 | |
| KE | 42 | | |
| KE | 43 | | |
| AV | 51 | | |
| YP | 59 | 06 / 07 | |
| KE | 68 | | |

The majority of the traffic lights for mobile units were amber for one or more of the following reasons:

- Work order did not indicate directly that it related to an SCE;
- No reference to performance standard in WO;
- Standards were somewhat generic in nature.

The performance standards on one mobile unit appeared to be 'goal setting' and lacked detail. Another mobile unit's performance standards were reviewed and found to be generally not measurable or auditable. Both companies received red traffic lights.

**Table 4** Maintenance of SCEs – Mobile

| Maintenance of SCEs | | | |
|---|---|---|---|
| Mobile | | | |
| NR | 27 | 05 / 06 | |
| HR | 32 | | |
| KE | 33 | | |
| EU | 35 | | |
| HC | 40 | | |
| PX | 49 | | |
| LM | 55 | 06 / 07 | |
| JM | 56 | | |
| HS | 60 | | |
| ZK | 61 | | |
| KZ | 73 | | |

### 4.2 G - BACKLOGS

Percentages of 'backlog' traffic lights are given in Figure 21 (for all installation types).

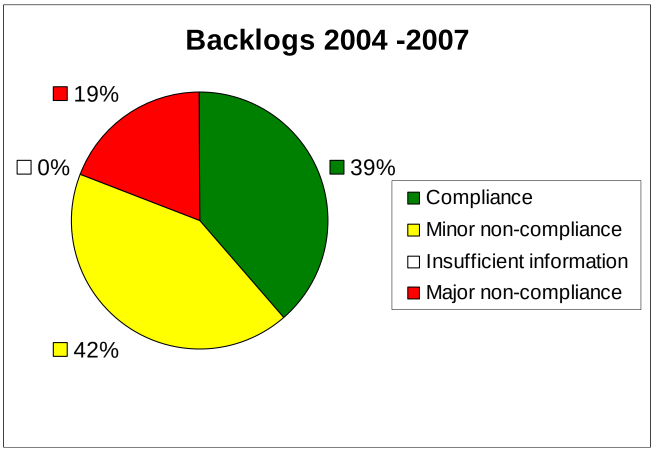


**Figure 21** Backlogs

#### 4.2.1 Definition

The definition of backlog varied throughout the installations inspected. An item overdue for maintenance may immediately fall into backlog. Other duty holders allowed one month past the due date, or categorised equipment to allow some leeway on items that are not safety-critical.

The computerised maintenance management systems in use differ slightly, with some systems allowing a window for implementation rather than a specific date after which a backlog is raised.

For non-routine (corrective) maintenance, generally all outstanding work is considered as backlog.

In one company, an overdue preventative maintenance (PM) routine was classified as a backlog after its due date passed by 15% of the maintenance interval. This was considered inappropriate for long period schedules.

Reporting systems were found to measure performance in different ways, with some systems reporting the number of outstanding work orders rather than actual hours, thus causing distortion of backlog figures.

### 4.2.2 Current Position

From the information provided, backlog levels ranged from approximately 150 hours to a worst case of 26,000 hours. The maximum figure quoted covers non-routine maintenance only; total backlog (including planned maintenance) will therefore be higher still.

The split between safety-critical and other work was not always evident. Figures provided indicated that backlogs levels in safety-critical maintenance (planned and corrective) ranged from zero to 2,600 hours.

One platform reported a total backlog of 60,000 hours of which 15,000 hours related to safety-critical maintenance (planned and corrective). This data covered seven installations (the main platform plus Normally Unmanned Installations).

The majority of installations prioritised maintenance on safety-critical equipment however, in some cases, lower priority safety-critical corrective maintenance (e.g. fabric maintenance, emergency light fittings etc.) was not being liquidated effectively.

Examination of documentation provided offshore revealed that the true backlog was not being recorded in some cases (outstanding work on EX equipment was not always included in the backlog list).

It was also found that some maintenance was deferred with questionable justification. It appears therefore, that backlogs may be hidden as deferred work in some cases.

Reactive (corrective) work appeared to be managed at the expense of preventative maintenance.

### 4.2.3 Common Causes

Lack of bed space was identified as a significant cause of backlogs on a large number of installations. The situation could also be exacerbated by project and construction work resulting in competing demands for very limited bed space.

Another major issue was the lack of access to equipment due to the pressure to continue production. Backlogs, including safety-critical work (e.g. ESDV tests) and remedial work resulting from corrosion damage reports, required shutdown to complete. Management of work and prioritisation of tasks during scheduled shutdown was also identified as a problem area. On some installations, shutdown had been delayed resulting in increased backlogs.

A number of installations reported difficulties in recruitment and/or retention of experienced technicians (mechanical, electrical, instrumentation). Companies were therefore compelled to employ less experienced technicians. Completion of work orders took longer than planned, due to the need for supervision of new personnel. As a result, rates of backlog liquidation were reduced.

Misalignment of the tour patterns of core crew and maintenance support team was considered to be causing difficulties on some installations. Beneficial shift patterns were in operation for core crew.

Lack of prioritisation or effective management of backlogs in corrective maintenance was reported. Increases in corrective maintenance, due to ageing equipment, were also noted on some installations.

### 4.2.4 Backlog Reduction Measures

Campaign maintenance appeared to be used extensively as a means of reducing backlog. Some duty holders expressed reservations about the effectiveness of this method, as campaign teams tended to lack familiarity with the installation. In addition, problems with bed space and a high handover to core staff of unfinished work orders were experienced.

Discreet work programs in areas such as Ex Inspection were, however, regarded as effective on some installations.

One company plans to move away from campaign teams who pick off ‘easy targets’ and tie up core personnel. Its new strategy is a ‘spread out’ campaign crew that completes work orders and breeds platform competence.

Similar methods included a concerted effort, both onshore and offshore, to reduce backlogs by the provision of flotels, appointment of additional supervision and technicians, and dedicated backlog teams.

A number of duty holders recognised that backlogs could be reduced by improvements in planning and scheduling. Proposals for software tools, pilot schemes, risk-based work selection, workshops and additional training were described.

Root cause analysis of major plant failures was also proposed to prevent ‘fire-fighting’.

A number of installations had recently upgraded their computerised maintenance management systems. This involved the transfer of numerous planned maintenance routines. Rationalisation and removal of duplicate procedures resulted in significant reductions in backlog work orders in some cases.

Vendor maintenance was in use extensively on some installations. On one platform it was stated that 75% of the work scheduled via the maintenance management system was vendor maintenance. Backlogs of vendor maintenance were kept very low. Another platform quoted a backlog of 30 vendor maintenance jobs. More maintenance was to be done on a campaign basis by specialist vendors.

One mobile installation stated that vendors are brought onboard to carry out maintenance, as required. A number of operators stated that additional resources, including campaign maintenance teams, are employed when required. It was not specified whether these extra resources included specialist vendors.

### 4.2.5 Comparison by Installation Type

The majority of installations inspected were of the fixed type. There were significant variations in the levels of backlog on these installations. With some exceptions, backlog numbers on the amber/red installations appeared to be reducing slowly, but levels remained high.

Backlog management on the floating production installations appeared to worsen over time (see Table 5 below) but this may simply be a reflection of the order in which installations were inspected. Red/amber traffic lights were generally assigned where backlog levels remained static due to lack of targeted resources.

On one installation, there was a gross disparity between backlogs monitored onshore and that reported in the MMS (Onshore report indicated 231hrs backlog for planned and corrective SCE maintenance, while MMS showed approximately 3000hrs). Only PFEER related SCEs were considered onshore.

**Table 5** Backlogs – Floating Production

| Backlogs | | | |
|---|---|---|---|
| **Floating Production** | | | |
| KE | 1 | **04 / 05** | Green |
| BZ | 3 | **05 / 06** | Green |
| KE | 42 | | Yellow |
| KE | 43 | | Yellow |
| AV | 51 | | Red |
| YP | 59 | **06 / 07** | Red |
| KE | 68 | | Red |

As shown in Table 6, backlog levels were low on the majority of mobile units inspected. Staff appeared to be well aware of backlog levels, which were discussed regularly. Maintenance management system on one mobile unit displayed all outstanding maintenance activities every time an individual logged on to the system. Backlogs were also reviewed monthly by senior staff and additional resources allocated where required.

Backlog levels on one mobile installation (amber) were generally low, but some inspection items were very overdue (between 90 and 250 days).

The amber traffic light for another mobile installation resulted from a postponement of preventative maintenance routines in order to undertake repair and survey work. Management were aware and appeared to be taking appropriate action.

A third mobile installation (red) reported static backlogs on planned and corrective safety critical maintenance. No defined trigger point for allocation of additional resources or backlog reduction target had been set.

**Table 6** Backlogs – Mobile

| Backlogs | | | |
|---|---|---|---|
| Mobile | | | |
| NR | 27 | 05 / 06 | |
| HR | 32 | | |
| KE | 33 | | |
| EU | 35 | | |
| HC | 40 | | |
| PX | 49 | | |
| LM | 55 | 06 / 07 | |
| JM | 56 | | |
| HS | 60 | | |
| ZK | 61 | | |
| KZ | 73 | | |

### 4.3 H - DEFERRALS

Percentages of 'deferral' traffic lights are given in Figure 22 (for all installation types).

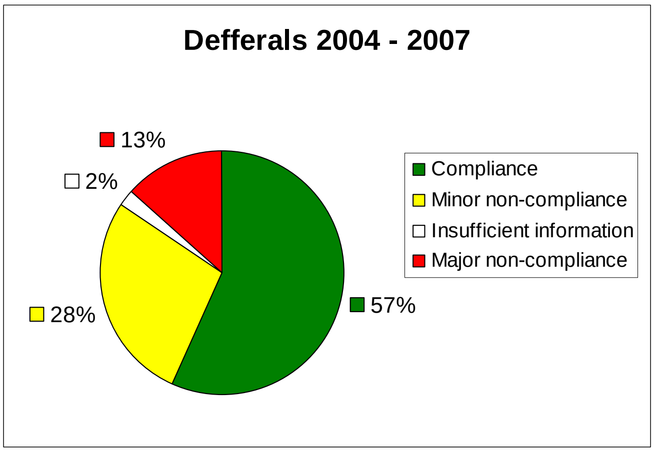


**Figure 22** Deferrals

#### 4.3.1 Current Position

On a number of the installations inspected, new deferral systems had recently been introduced. Deferral procedures for safety-critical elements (SCE) appeared to be well understood. This was not always the case for non-safety-critical items.

From the figures provided, deferral levels ranged from zero to a worst case of 196 work orders. Other installations reported 153 preventative and corrective maintenance items and 139 items respectively.

The majority of installations reported less than 40 items of deferred work.

It was difficult to determine a trend in the level of deferrals. Records from some companies indicated that levels were reducing or were consistently low. Company policy of strong challenges from the onshore technical authority discouraged requests for deferrals on some installations.

Deferrals were increasing on other installations due to, for example:

- Delays in planned shutdown;
- Competing demands (such as project work) during the shutdown period;
- Adverse weather conditions (preventing or reducing time on installation).

The split between deferral of safety-critical and other work was not evident in a number of cases. One platform reported 39 safety-critical items on their deferred list (total number of deferrals unknown).

Some installations differentiated between deferrals of planned and corrective maintenance, others did not allow deferral of reactive work.

Planned shutdowns were generally the focus for planning and executing deferred maintenance activities.

### 4.3.2 Authorisation

Where green traffic lights have been allocated, deferral of safety-critical work was generally authorised by onshore technical authorities, with the involvement of the Independent Competent Person, where required. This was not, however, always explicit in the deferrals procedure. Cases were noted where deferrals were not sent to the ICP, who should have been involved (e.g. ESDVs and PSVs).

On a number of installations, the authorisation procedure was dependent upon the category of the item in question. Offshore authorisation was permitted for lower category deferments or non-safety-critical items. One duty holder described a Risk Assessment Matrix (RAM) screening and prioritising tool used to assist in this process.

Inspectors expressed concern over decisions to defer tests possibly being taken at the wrong level on some installations.

### 4.3.3 Additional Issues

Some installations recorded uncompleted maintenance (during shutdown or campaign maintenance) as deferred work items, instead of backlog. This process led to artificially low backlogs, which do not reflect a ‘true’ backlog status. Deferrals were issued to bring the work into line with the next scheduled shutdown or visit to platform.

Concern was expressed over perceived pressure to defer safety-critical equipment maintenance during shutdown due to the large man-hour demand from project work.

HSE felt that submission of deferral requests on the maintenance due date indicated a pressure to prevent non-compliances rather than assessing each request (and particular piece of equipment) on its merits.

One particular procedure allowed for a refused deferral to be placed in ‘overdue work’, and many deferral requests remained unauthorised despite being past their SAP due by date.

Although generally required by the deferral procedures, evidence of risk assessment and identification of additional measures was limited in some cases. In addition, identified measures were not always implemented following deferrals (e.g. increases in inspection frequency).

The competence of staff carrying out risk assessments was unclear. Some TAs were not trained in risk assessment. On other installations, no formal discipline advice was available for input to RAs.

The deferral procedure adopted by one duty holder failed to assess the cumulative risks arising from multiple safety-critical equipment failures. Operational risk assessments were looked at in isolation.

It was found on one installation that, where there was no history of past performance, it was assumed that the SCE in question had passed the last three assurance routines. Therefore the perceived risk factor defaulted to a lower value. In addition, subsequent to approval, the time period for the deferral could be altered.

### 4.3.4 Recording of Deferrals

Methods of recording deferrals differed over the installations inspected. Deferred items were still viewed as backlog in some cases, and were recorded as such within electronic maintenance management systems.

Other duty holders removed deferred items from their list of backlogs. In this case, deferrals were generally tracked through some form of register and may be monitored, by senior management, as a Key Performance Indicator.

Deferrals may be rescheduled within the maintenance management system, hence the target date moves and no longer shows up as a backlog item. HSE considers that management oversight is important to track this move.

On some installations, work orders on the electronic maintenance management system contained details of comments, reasons and considerations when granting a deferral. Other duty holders used paper-based systems to record deferral details.

An example was provided where, on completion of deferred equipment tests during shutdown, the electronic system had not been updated correctly onshore.

Rather than simply monitoring the number of deferrals over a time period, HSE inspectors suggested that a measure of the number of accepted and rejected deferrals during this period may be more meaningful.

### 4.3.5 Trigger Point

Many of the installations reported no formal action level for number of deferrals. In some cases, this was due to consistently low levels of deferred maintenance.

The trigger point for action on deferrals at one installation was stated as 50% of the way through the backlog period.

Another stated that serial deferral of equipment (more than twice) triggers an onshore risk assessment that involves the onshore team.

At the time of inspection, there were 39 safety-critical items on the 'deferred list' at one platform. Their Asset Management Team was scheduled to discuss this and to determine appropriate action.

### 4.3.6 Comparison by Installation Type

The majority of installations inspected were of the fixed type. Deferral procedures (and allocated traffic lights) differed fairly significantly throughout these installations. It was therefore difficult to determine a trend.

Deferral procedures (and allocated traffic lights) on floating production units appeared to be improving during 05/06 (see Table 7 below).

Two floating production installations were allocated red traffic lights. Early inspection (04/05) of the first installation indicated that decisions to defer tests were being poorly recorded (and possibly taken at the wrong level). Company procedure on the second (inspected 06/07) required that RA is carried out on deferred SCE. This procedure was relatively new and most deferred SCEs did not have any risk assessment. In addition, HSE inspectors questioned the usefulness of the limited number of risk assessments in existence.

**Table 7** Deferrals – Floating Production

| **Deferrals** | | | |
|---|---|---|---|
| **Floating Production** | | | |
| KE | 1 | **04 / 05** | |
| BZ | 3 | **05 / 06** | |
| KE | 42 | | |
| KE | 43 | | |
| AV | 51 | | |
| YP | 59 | **06 / 07** | |
| KE | 68 | | |

Mobile units in general had very low deferral rates. As a result of this, some operators did not have a formal system in place to record the process involved in the deferral of maintenance. Where maintenance of a safety-critical element was deferred (drilling programme at a critical point, for example), the majority of duty holders carried out risk assessment and introduced additional safety measures, where required.

One mobile installation was marked amber because, although generally their informal deferral system appeared to work, there was potential for abuse of this system, particularly by the increasing number of new, inexperienced staff.

Another mobile installation, inspected in 06/07, had recently introduced a deferrals procedure. This unit was marked amber as complete systems were not in place.

**Table 8** Deferrals – Mobile

| Deferrals | | | |
|---|---|---|---|
| **Mobile** | | | |
| NR | 27 | **05 / 06** | |
| HR | 32 | | |
| KE | 33 | | |
| EU | 35 | | |
| HC | 40 | | |
| PX | 49 | | |
| LM | 55 | **06 / 07** | |
| JM | 56 | | |
| HS | 60 | | |
| ZK | 61 | | |
| KZ | 73 | | |

## 4.4 I – CORRECTIVE MAINTENANCE

Percentages of 'corrective maintenance' traffic lights are given in Figure 23 (for all installation types).

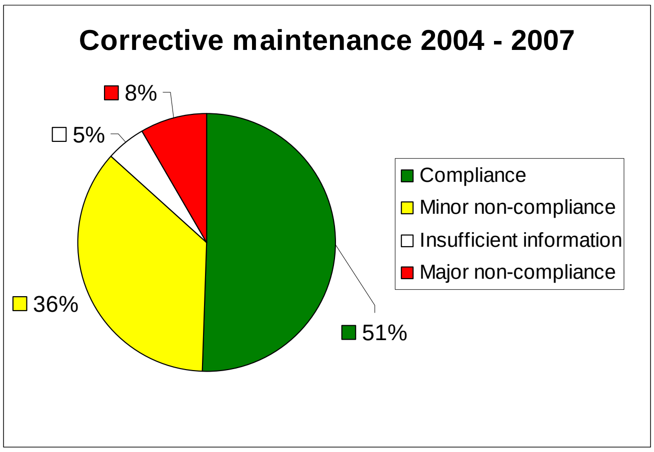


**Figure 23** Corrective Maintenance

### 4.4.1 Significance

Approximately 20% of the installations stated that the onshore support team were automatically consulted to determine significance of anomalies on non-safety-critical equipment or routine corrective work orders.

From a total of 80 installations that provided information, approximately 90% stated that the onshore support team were automatically consulted to determine significance of anomalies on safety-critical elements.

### 4.4.2 Continued Safe Operation

Where onshore support staff were consulted, the majority of installations stated that risk assessment was carried out and additional barriers identified, if required. Risk assessments were recorded and additional barriers noted. In some cases, these were included in the performance standards.

It was unclear how the effect of faulty SCE was evaluated by offshore technicians and supervisors or if additional measures were considered.

A small number of installations stated that no matrix or guidance was available to decide what additional barriers were needed in the event of equipment failure.

### 4.4.3 Technician Levels

Responses from both onshore and offshore were analysed. Where conflicting, the worst case (usually offshore) was taken. Approximately 20% of the 84 installations stated that they had insufficient technicians to cope with corrective maintenance. This issue was, however, sometimes covered under other template elements (see backlog/deferrals).

### 4.4.4 Comparison by Installation Type

The majority of installations inspected were of the fixed type. Corrective maintenance procedures (and allocated traffic lights) differed fairly significantly throughout these installations.

The standards of corrective maintenance on the floating production units appeared to worsen over time (see Table 9 below).

One floating production installation (inspected in 2006/2007) was allocated a red traffic light. HSE inspectors saw evidence that corrective maintenance was not being handled well and was both increasing and effecting operations and safety.

**Table 9** Corrective Maintenance – Floating Production

| Corrective Maintenance | | | |
|---|---|---|---|
| Floating Production | | | |
| KE | 1 | 04 / 05 | |
| BZ | 3 | 05 / 06 | |
| KE | 42 | | |
| KE | 43 | | |
| AV | 51 | | |
| YP | 59 | 06 / 07 | |
| KE | 68 | | |

The majority of mobile installations were considered to have suitable procedures for corrective maintenance – marked green.

Four of the mobile units were marked amber. This was due to the lack of formal systems to evaluate risks to safe operation or to implement additional barriers for failed SCEs.

**Table 10** Corrective Maintenance – Mobile

| Corrective Maintenance | | | |
|---|---|---|---|
| Mobile | | | |
| NR | 27 | 05 / 06 | |
| HR | 32 | | |
| KE | 33 | | |
| EU | 35 | | |
| HC | 40 | | |
| PX | 49 | | |
| LM | 55 | 06 / 07 | |
| JM | 56 | | |
| HS | 60 | | |
| ZK | 61 | | |
| KZ | 73 | | |

## 4.5 J – DEFINED LIFE REPAIRS

Percentages of ‘temporary repair’ traffic lights are given in Figure 24 (for all installation types).

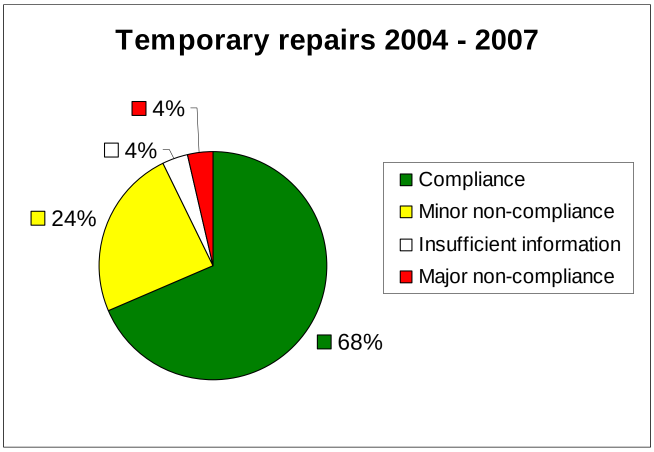


**Figure 24** Temporary Repairs

### 4.5.1 Comparison with Safe Practice (SN 4/2005)

Template elements have been compared with the various aspects in the above guidance document, where possible (see below). In order to make a full comparison, more detail on the repair procedures employed would be required.

*Philosophy*

On 40% of the installations, repair philosophy was stated to comply with guidance.

*Risk Assessment*

A number of installations stated that TA or ICP approval was required for temporary repairs however, it was unclear if this included RA.

*Design of the Repair*

25% of installations referenced consideration of piping or repair design.

*Types of Repair*

Where the types of repair were specified, the majority were wraparound or engineered clamps.

*Installation of Repairs*

The inspection reports contained very little information on installation of repairs.

*Inspection*

Approximately 50% of the procedures stated that work orders had been drawn up for the inspection of the defined life repair.

*Maintenance*

Where defined life repairs were permitted, the majority of installations maintained a register of piping repairs.

*Management System*

The inspection reports contained very little information on safety management systems with respect to non-welded repair of piping systems.

### 4.5.2 Comparison by Installation Type

The majority of installations inspected were of the fixed type. Of these, approximately 60% of the fixed installations received green traffic lights

Generally suitable controls for temporary repairs were in place on the floating production units inspected.

The procedure on one floating production unit was also still in its infancy. The Temporary Repairs Register presented was incomplete.

**Table 11** Defined Life Repairs – Floating Production

| Defined Life Repairs | | | |
|---|---|---|---|
| **Floating Production** | | | |
| KE | 1 | **04 / 05** | |
| BZ | 3 | **05 / 06** | |
| KE | 42 | | |
| KE | 43 | | |
| AV | 51 | | |
| YP | 59 | **06 / 07** | |
| KE | 68 | | |

The number of defined life repairs on mobile units was extremely low. Some duty holders did not allow repairs on hydrocarbon systems, others restricted repairs to low-pressure pipes. Suitable controls were in place and ICP involvement was evident.

The procedure on one mobile installation had recently been introduced. Previously, there was no evidence of consultation with the ICP, but this was now included in procedure.

**Table 12** Defined Life Repairs – Mobile

| Defined Life Repairs | | | |
|---|---|---|---|
| **Mobile** | | | |
| NR | 27 | **05 / 06** | |
| HR | 32 | | |
| KE | 33 | | |
| EU | 35 | | |
| HC | 40 | | |
| PX | 49 | | |
| LM | 55 | **06 / 07** | |
| JM | 56 | | |
| HS | 60 | | |
| ZK | 61 | | |
| KZ | 73 | | |

## 4.6 PHYSICAL STATE OF PLANT

Percentages of 'physical state' traffic lights are given in Figure 25 (for all installation types).

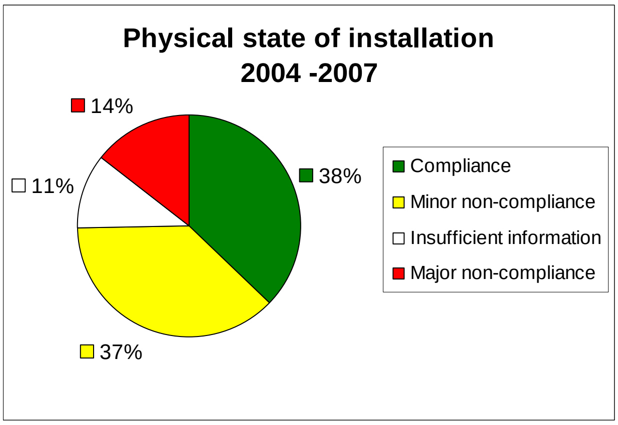


**Figure 25** Physical State of Installation

### 4.6.1 Current Position

During the period of 2004/2007, 37% of installations inspected were considered to be in compliance with regard to the physical state of plant.

50% of the installations received amber or red traffic lights for the following reasons:

**Corrosion**

- Significant corrosion of pipe work, valves, fittings and secondary structures. Cable trays on one installation had almost totally disintegrated due to corrosion.
- A particular problem with corrosion on utility systems was noted during one inspection.
- Chloride stress corrosion cracking of 316L in ‘warm’ lines had been experienced.
- Corroded on-site welds.
- Lack of major attention in maintaining the general fabric and plant integrity.
- No defined strategy for integrity threats such as corrosion under insulation, deadlegs and corroded bolting.

**Passive Fire Protection (PFP)**

- Loss of PFP coating. In some cases the PFP was being removed as it was found to be disintegrating and falling off, presenting a significant hazard to the workforce.

**Other**

- Removal of redundant equipment required (before it becomes unsafe).
- Scaffolding boards obstructing escape routes and deluge nozzles.
- Oil leaks from valve stems.
- Pipe clashes (identified on two installations).

### 4.6.2 Comparison by Installation Type

The majority of installations inspected were of the fixed type. Approximately 50% of these installations were marked red/amber.

Approximately 57% of the floating production installations were marked red/amber (see Table 13). Anomalies reported on these installations include:

- Loss of PFP;
- Corrosion under insulation (CUI);
- Scaffolding resting on pipe work;
- Signs of external corrosion on pipe work and structural steel.

**Table 13** Physical state of plant – Floating Production

| Physical state of plant | | | |
|---|---|---|---|
| Floating Production | | | |
| KE | 1 | 04 / 05 | yellow |
| BZ | 3 | 05 / 06 | yellow |
| KE | 42 | | green |
| KE | 43 | | yellow |
| AV | 51 | | green |
| YP | 59 | 06 / 07 | red |
| KE | 68 | | |

As shown in Table 14, the physical state of plant on mobile units was generally good, however a red traffic light was given due to poor standards of interlocking and local guarding of conductors.

**Table 14** Physical state of plant – Mobile

| Physical state of plant | | | |
|---|---|---|---|
| Mobile | | | |
| NR | 27 | 05 / 06 | green |
| HR | 32 | | green |
| KE | 33 | | green |
| EU | 35 | | green |
| HC | 40 | | red |
| PX | 49 | | |
| LM | 55 | 06 / 07 | green |
| JM | 56 | | green |
| HS | 60 | | |
| ZK | 61 | | green |
| KZ | 73 | | green |

## 4.7 ESD VALVES

ESD valve system tests were carried out on a total of 19 of the installations inspected between 2004 and 2007. Resultant traffic lights are given below.

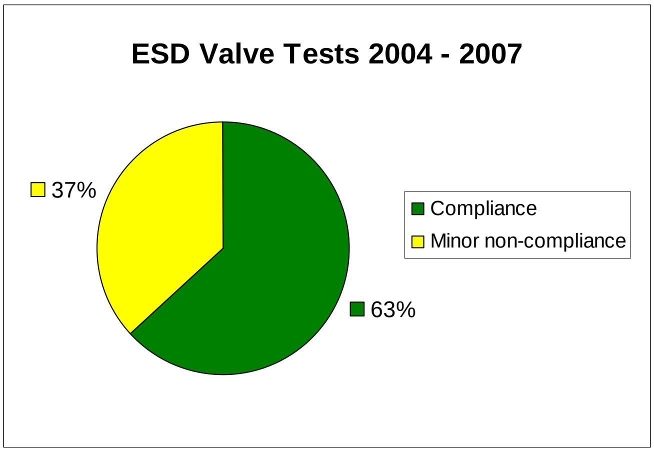


**Figure 26** ESD Valve Tests

The majority of installations inspected were of the fixed type. Of these, 41% were allocated amber traffic lights. The remainder were considered to be in compliance.

**Table 15** ESD Valve Tests

| | Installation Type | | |
|---|---|---|---|
| **Traffic Light** | Fixed | Floating Production | Mobile |
| | 10 | 1 | 1 |
| | 7 | - | - |
| **Total** | **17** | **1** | **1** |

### 4.7.1 Causes

In four cases, amber traffic lights were allocated because ESD valves failed to respond correctly or within the time period specified in the performance standard (PS). Additional failings relating to performance standards are described below:

- Actual valve closure times much faster than figure quoted in PS (not considered a meaningful criterion in relation to valve performance);
- No justification for closure times required by PSs;
- Closure time on PS increased without justification;
- No acceptance criteria quoted on PSs or work orders;
- No evidence of review procedure for PSs.

Further, partial or isolated, system failings were observed by inspectors:

- Work orders for remedial action not raised on failure of valve system test;
- No evidence of mitigation actions or subsequent operational risk assessment following system test failure;
- Nominal SIL rating allocated, but no analysis undertaken to support this;

- 'As found' condition of ESD valves not recorded. This would allow assessment and review of maintenance arrangements, including the test intervals;
- Function tests not always carried out. Despite this, a 'pass' was recorded against the work order. Test report stated that, due to configuration, it was not possible to test the valve ("no plumbing at the valve"). The result should have been 'fail' as the test could not be performed;
- No redundancy or diversity of components;
- ESD valve cycled closed but valve position not measurable directly;
- ESD valves observed with chained handwheels (contrary to UKOOA Guidelines for Instrument Based Protective Systems).

The traffic lights are presented in the bar chart below as percentages per year of inspection.

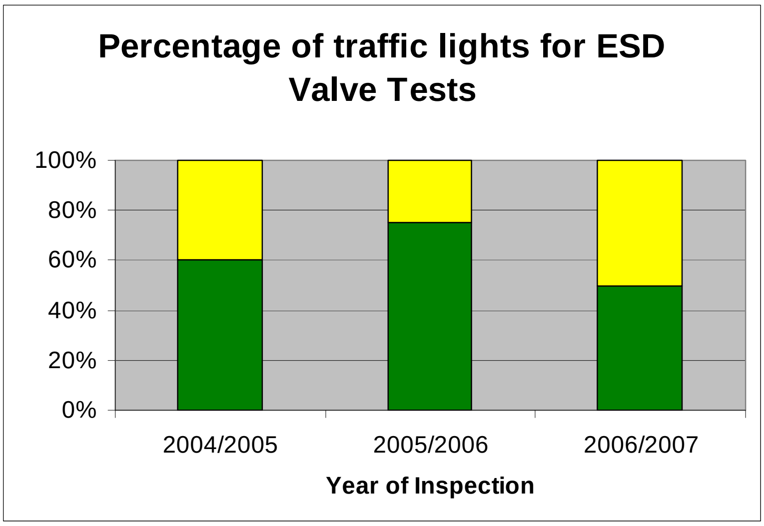


**Figure 27** ESD Valve Tests – Traffic Light Percentages

### 4.8 HVAC

HVAC system tests were carried out on a total of 56 of the installations inspected between 2004 and 2007. Resultant traffic lights are given below.

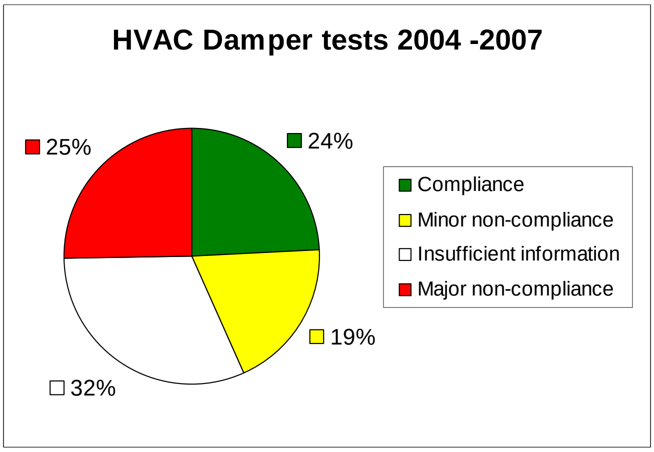


**Figure 28** HVAC Damper tests

The majority of installations inspected were of the fixed type. Traffic light allocations were fairly evenly spread throughout (see Table 16 below).

**Table 16** HVAC Tests

| | | | |
|---|---|---|---|
| | Installation Type | | |
| **Traffic Light** | Fixed | Floating Production | Mobile |
| Red | 16 | 2 | 2 |
| Yellow | 14 | 1 | 1 |
| Green | 16 | 1 | 3 |
| **Total** | **46** | **4** | **6** |

### 4.8.1 Red traffic lights

Red traffic lights were generally allocated where fire dampers failed to close (or only partially closed) during system tests. On one of the mobile installations, only six out of the 44 dampers tested closed successfully.

Related fire damper issues included the following:

**Performance standards / procedures**

- Required fire damper closure time (or required number of dampers to have closed to meet the functionality requirement) not specified in performance standard.
- Lack of knowledge regarding fire damper performance requirements and the reasons behind observed failures.
- Inability to locate fire dampers.
- Failure to follow procedures on fault recording and contingency action.
- Failure of damper during TR pressure test did not generate remedial action or any record of investigation into the cause
- Work orders lacked clarity and sufficient detail on maintenance/inspection/testing requirements.
- Lack of understanding and poor interpretation of function tests results.
- No PM schedule for damper testing on recently installed system (indicative of an unfinished project?).

**Testing, maintenance, inspection**

- Fire dampers did not meet their stated performance standard.
- Exhaust damper closed slowly (~4 secs), duty holder to investigate.
- Dampers failed on first command, but subsequently worked when exercised/re-tested (maintenance/test frequency issue?).
- General problem with HVAC damper reliability (identified through SCE availability report).

- Poor condition of actuator assemblies leading to failure.
- Fire damper PM history indicating high frequency of test failure.
- No facility to test the operation of individual dampers.

**Indication**

- Damper status indicators faulty.
- No lamp test feature available on the fire damper status panel.
- Mechanical position indicators damaged or not supplied.
- No inspection hatches.

Issues relating to other aspects of the HVAC system included the following:

- HVAC system room air changes did not meet the stated performance standard;
- HVAC fans appeared to continue to run (and valves failed to close) resulting in current of air continuing to be drawn in through the main intake dampers after HVAC shutdown;
- Inlet air duct smoke and gas sensors in poor positions for access;
- Failure of detector (did not trip on introduction of test gas).

Duty holder responses on KP3 templates described acceptance criteria (for fire damper availability) in some cases.

### 4.8.2 Amber traffic lights

Amber traffic lights were allocated where isolated failures of fire dampers or fan switches occurred.

Additional issues included:

- Damper status indicators faulty;
- HVAC panel status incorrect on reset/restart;
- Damper position indication not repeated in the Control Room (necessary to leave TR to confirm damper position);
- Inaccessibility of dampers;
- Test frequency of HVAC dampers (dampers on 12 month PM scheme at one installation);
- Logic issues (instrumentation and executive action on gas/smoke detection);
- Pressure testing of the TR not carried out in one case;
- Test scope did not specify all the dampers to be included, making it impossible for the technician to ascertain if the PS was met.

The traffic lights for all types of installation are presented in the bar chart below as percentages per year of inspection.

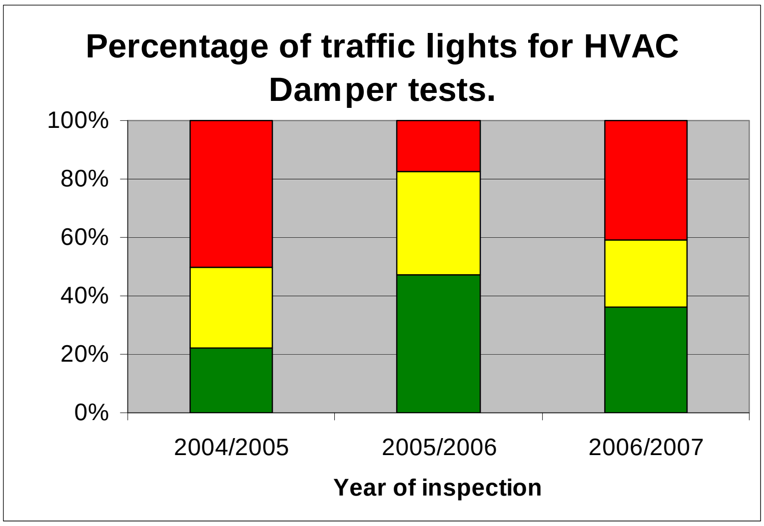


**Figure 29** HVAC Damper Tests – Traffic Light Percentages

# 5 CONCLUSIONS AND RECOMMENDATIONS

## 5.1 CONCLUSIONS

The poorest performing topics (percentage of red traffic lights) were maintenance of SCEs, backlogs, deferrals, and measuring compliance with performance standards. Maintenance of SCEs, backlogs, and deferrals are of most concern (number of reds).

The best performing topics (percentage of green traffic lights) were key indicators for maintenance effectiveness, reporting to senior management on integrity status, defined life repairs and communication onshore/offshore. Maintenance effectiveness indicators, reporting to senior management and defined life repairs are of least concern (number of greens).

Mobile installations appear to be the best performing type of installation in terms of maintenance topics. Floating production installations appear to have a problem with backlogs.

In terms of the percentage of greens, it appears that 2005/06 is the best year, followed by 2006/07, with 2004/05 worst. The situation has not improved. Re-inspected installations showed no significant changes over three years. Most inspections, however, were of platforms which had not previously had a KP3 inspection. In the first year installations considered "not bad" were selected, in the second year mobile installations were introduced, followed by the remainder of installations in the third year. In the third year, the inspectors may have expected improvement and were marking slightly more harshly. Consistency of approach is also an issue. Some amber installations can be 'nearly' green or 'nearly' red. The distinction between ambers and greens is also subjective.

There were seven better performing companies with more than 80% green. There were three poor performing companies with less than 40% green. There does not seem to be a correlation between the number of platforms (related to company size) and the percentages of each traffic light type. Observations on companies with fewer platforms will be more subjective as they are based on a smaller sample of traffic lights.

In terms of consistency of approach, inspection teams have different expertise and will be more concerned over some inspection topics or issues than others. Some topics are more contentious than others in terms of changes in traffic light made by the KP3 committee. Reds are easier to identify, as generally there is associated enforcement action. No platform is perfect; some minor non-compliance may not influence the traffic light allocation, so there will be some overlap between green and amber. Red traffic lights demonstrate stronger consistency than ambers/ greens. Differences are moderated by questions set and final analysis by the same team on the KP3 committee.

**Management System Topics**
The poor performing topics were found to be:

- Technical/supervisors' competence (42% amber);
- Maintenance recording (51% amber);
- Maintenance system evaluation (36% amber); and
- Measuring compliance with performance standards (25% amber 11% red).

The better performing topics were:

- Maintenance basics (64% green);
- Communication onshore/offshore (71% green);
- Supervision (68% green);

- Measuring quality of maintenance work (59% green);
- Review of ICP Recommendations/Verification (62% green);
- Reporting to senior management on integrity status (77% green); and
- Key indicators for maintenance effectiveness (77%).

**Engineering Topics**
The very poor performing topics were:

- Maintenance of safety-critical elements (48% amber, 22% red);
- Backlogs (42% amber, 19% red);
- Deferrals (28% amber, 13% red);
- Physical state of plant (37% amber, 14% red); and
- HVAC damper tests (19% amber, 25% red).

The poor performing topics were:

- Corrective maintenance (36% amber); and
- ESD valve tests (37% amber).

The better performing topic was:

- Defined life repairs (68% green).

## 5.2 RECOMMENDATIONS

If future, traffic light based inspection programmes are planned, then the original markings and any changes suggested by any overseeing committee need to be carefully recorded. The reasons for the change also need to be recorded. Topics with both onshore and offshore templates inevitably involve an overall compromise marking. Thus the recommendation is that a single spreadsheet be used to record onshore, offshore and overseeing committee traffic light activity and changes.

# 6 APPENDIX A – KP3 ONSHORE MAINTENANCE MANAGEMENT TEMPLATE

| INSTALLATION | DATE(S) | INSPECTOR(S) |
|---|---|---|
| | | |

| **Persons interviewed** | **Position** |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| Onshore A | **Maintenance basics** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore B | **Communication between onshore support staff and offshore maintenance technicians** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| | |
|---|---|
| Onshore C | **Competence assurance of maintenance technicians and their supervisors** |

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

.

| Onshore D | **Maintenance of safety critical elements (SCE)** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore E | **Supervision** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore F | **Recording of completed maintenance work** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore G | **Backlogs** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore H | **Deferrals** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore I | **Corrective maintenance** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore J | **Defined life repairs** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore K | **Measuring the effectiveness of the maintenance system** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore L | **Measuring compliance with performance standards** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore M | **Measuring the quality of maintenance work** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore N | **Verification** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore O | **Review of ICP recommendations** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore P | **Reporting to senior management on integrity status** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Onshore Q | **Key indicators for maintenance effectiveness** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

# 7 APPENDIX B - KP3 OFFSHORE MAINTENANCE MANAGEMENT TEMPLATE

| INSTALLATION | DATE(S) | INSPECTOR(S) |
|---|---|---|
| | | |

| Persons interviewed | Position |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| Offshore B | Communication between onshore support staff and offshore maintenance technicians | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore C | **Competence assurance of maintenance technicians and their supervisors** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore D | **Maintenance of safety critical elements (SCE)** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore E | **Supervision** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore F | **Recording of completed maintenance work** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore G | **Backlogs** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore H | **Deferrals** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore I | **Corrective maintenance** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore J | **Defined life repairs** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore K | **Measuring the effectiveness of the maintenance system** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Duty Holder Response:

HSE Comments:

HSE Action:

| Offshore | **System test of SCE** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

Test results:

HSE Action:

| Offshore | **Condition of plant** | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

HSE Comments:

HSE Action:

| Offshore | **Examples of Best Practice** | | |
|---|---|---|---|
| | | | |
| | | | NOT TESTED / NO EVIDENCE |
| | | | |

HSE Comments:

# 8 REFERENCES

Key Programme 3: Asset Integrity Programme, HSE Offshore Division, Internet Report, November 2007

Weldless repair of safety critical piping systems, HSE Safety Notice, SN 4/2005, July 2005

# 9 NOMENCLATURE

| | |
|---|---|
| CM | Corrective Maintenance |
| CMMS | Computerised Maintenance Management System |
| CUI | Corrosion-under-insulation |
| DH | Duty Holder |
| ESD | Emergency Shut Down |
| ESDV | Emergency Shut Down Valve |
| EX | Explosion Proof |
| FPO | Floating Production |
| HSE | Health and Safety Executive |
| HSL | Health and Safety Laboratory |
| HVAC | Heating, Ventilation and Air Conditioning |
| ICP | Independent Competent Person |
| IMT | Inspector Management Teams |
| KI | Key Indicator |
| KPI | Key Performance Indicator |
| KP3 | Key Programme 3 |
| MAXIMO | Type of MMS |
| MAH | Major Accident Hazard |
| MMS | Maintenance Management System |
| MODU | Mobile Offshore Drilling Unit |
| NVQ | Non-vocational qualification |
| OIM | Offshore Installation Manager |
| OSD | Offshore Safety Division |
| PFEER | Prevention of Fire and Explosion, and Emergency Response Regulations |
| PFP | Passive Fire Protection |
| PID | Piping and Instrumentation Diagram |
| PM | Preventative Maintenance |
| PS | Performance Standard |
| PSV | Pressure Safety Valve |
| PUWER | Provision and Use of Work Equipment Regulations |
| RA | Risk Assessment |
| RAM | Risk Assessment Management |
| SAP | Type of MMS |
| SCE | Safety-Critical Element |
| TA | Technical Authority |
| TR | Temporary Refuge |
| UKOOA | United Kingdom Offshore Operators Association |
| WO | Work Order |
| WSE | Written Scheme of Examination |

Published by the Health and Safety Executive 10/09

HSE

Health and Safety Executive

# Analysis of inspection reports from Asset Integrity Key Programme 3

Key Programme 3 was a three year inspection project carried out by HSE Offshore Division between 2004 and 2007. Inspections were recorded using standard templates both Onshore (Appendix A) and Offshore (Appendix B). Topics were scored: Red (Non-compliance/Major Failing), Amber (Isolated Failure/Incomplete system), Green (In compliance/OK) or White (Not tested/No evidence). A team of three inspectors, comprising of two specialists (generally from different disciplines) and a regulatory inspector (IMT), would award the traffic lights depending on the duty holder's responses to the questions provided in the Appendices and their own comments and required actions. Some topics would have both an onshore and offshore template. Other topics would have only one template. The OSD KP3 committee would later examine the completed inspection reports and award, for each topic and platform, one overall traffic light. Inspections of system tests of individual safety-critical elements (eg ESD Valves or HVAC dampers) and the condition of the plant were also recorded using traffic lights (see Appendix B).

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

RR748

www.hse.gov.uk