HSE
Health & Safety Executive

Maintenance - Reducing the risks

Prepared by **MaTSU**
for the Health and Safety Executive

OFFSHORE TECHNOLOGY REPORT

2001/007

Maintenance - Reducing the risks

Rachael Spencer and Fiona Davies
MaTSU
Harwell
Didcot
Oxfordshire
OX11 0QJ
United Kingdom

HSE BOOKS

First published 2001

ISBN 0 7176 2075 1

Summary

The Joint Industry/HSE (OSD) seminar and workshops, '*Maintenance: Reducing the Risks*', took place in Aberdeen on 17 and 18 January 2001. This event was organised by the Aberdeen and Grampian Chamber of Commerce in conjunction with HSE's Offshore Division, Step Change, UKOOA, OCA, IADC and MaTSU.

This maintenance-related event aimed to:
- be inclusive in nature and allow all parties to contribute views on factors that come into play and the constraints they operate under
- enable sharing of known facts and dispel misconceptions
- promote examples of good practice, and learn lessons from poorer practice
- move on to working towards solutions

A seminar on Day 1 set the scene and workshops on Day 2 concentrated on working towards solutions. The event attracted a high standard of speakers and 142 delegates, from around 50 different organisations. It sought to attract all levels of people involved in maintenance - from maintenance technicians through to those responsible for the overall budget and operational performance. It was successful in doing so, with delegates including representatives of operating companies, contractors, drilling contractors, HSE offshore inspection teams, university researchers and a small number of consultants. Both onshore and offshore staff were present, including around 50 offshore workers. This high representation from the offshore workforce was encouraging as in many cases it meant that these delegates were attending during their onshore leave or had made special arrangements for their time onshore to be covered by their back-to-backs. The ticket price (£125 inc. VAT to cover both days, with a reduced price of £110 for offshore workforce) was kept low so that cost would not be a barrier to participation. At the same time, the delegate pack included a number of priced and free publications, plus details of how to obtain further publications to build a Maintenance 'toolkit'.

Conference speakers gave:
- a keynote speech on common maintenance-related causes of accidents and the lessons we can learn from them (*Trevor Kletz, Loughborough University*)
- four presentations from the perspective of different stakeholders: HSE (*Bob Bruce*); a Duty Holder (*Ian Tope, UKOOA*); a Contractor (*Bill Edgar, Wood Group*); a workforce view (*Robert Whittaker, Brown & Root*)
- an insight into human factors issues in maintaining integrity (*Bob Miles, HSE*)
- an introduction to HSE's recent publication *"Improving maintenance - a guide to reducing human error"*, (*Steve Mason, Human Factors Reliability Group*)
- presentations on two examples of industry practice: Shell's leak reduction programme (*Ron Boyd, Shell*) and Campaign maintenance (*David Daniels, Marathon*)

Six workshops were run on Day 2, with all delegates being able to attend three workshop sessions. The topics covered were:
- Implementing maintenance strategies
- Safety issues for SMART teams - Team-based working
- Human error interdependency
- Making the Safety Management System interface work
- Improving maintenance by reducing human error
- Task risk assessment

The written feedback received from delegates, plus views expressed at the event, indicate that the event as a whole can be considered a success. However, there are always lessons to learn. The detailed feedback has provided valuable indications of 'what works well' and 'areas which could improve'. This will be taken into account when planning future industry/ HSE events. Key messages include:

- Having a broad range of delegates - including a good level of representation from the offshore workforce - enables views from all sectors and all levels of the industry to be heard.
- Delegates particularly value hearing contributions from all perspectives and learning from the experience of others.
- A combination of seminar and workshops - possibly with an accompanying exhibition - is the most popular format.
- For workshop sessions most respondents would prefer:

⇨ A clear focus, with the aims and objectives aligning with those of the seminar
⇨ A facilitating team (in preference to a single facilitator) so that groups formed within each workshop have access to a facilitator
⇨ Fewer, but longer, sessions that allow topics to be explored in depth
⇨ To feel, at the end of each workshop, that that they have achieved something to take away and discuss / use back in the workplace.

Over 85% of respondents indicated interest in attending future events of this type. While a wide range of other topics have been suggested, there is clear interest in holding further events on the topic of maintenance. This reflects a desire, not only to explore issues in greater depth, but also to start to make progress towards developing possible solutions to address issues.

The event closed with a short session titled *"Committing to action - Where do we go from here?"* in which a number of requests were made for follow-up actions to be considered by the event's Steering Committee (see Section 5 for details). Some of the actions have been placed with clearly identifiable action parties. For the remaining actions there is a need to ensure that they are passed to an appropriate body for determining where the responsibilities are best placed. Therefore, the Steering Committee is forwarding these actions to the Senior Managers' Forum for consideration.

Finally, one indicator of the success of the event is that Day 2 drew to a close later than the scheduled finish time as suggestions for future action continued to be discussed.

This report will also be published in the HSE's Offshore Safety Reports series, as OTO 2001 007.

Table of Contents

Summary iii

Table of Contents v

1 Introduction 1

1.1 BACKGROUND 1
1.2 AIMS OF EVENT 1
1.3 DELEGATES 1
1.4 REPORT STRUCTURE 2

2 Event Programme 3

2.1 SEMINAR PROGRAMME - DAY 1 3
2.2 WORKSHOP PROGRAMME - DAY 2 4

3 Seminar Presentations 5

3.1 WELCOME 5
3.2 KEYNOTE SPEECH: PREPARATION FOR MAINTENANCE AS A CAUSE OF ACCIDENTS 6
3.3 HSE DATA - THE TRENDS, THE PROBLEMS 8
3.4 A DUTYHOLDER VIEW 10
3.5 A CONTRACTOR VIEW 12
3.6 A WORKFORCE VIEW 14
3.7 MAINTAINING INTEGRITY - THE DESIGN, THE PEOPLE, THE SYSTEMS, THE EQUIPMENT 16
3.8 IMPROVING MAINTENANCE - REDUCING HUMAN ERROR 23
3.9 SHELL'S LEAK REDUCTION PROGRAMME 25
3.10 CAMPAIGN MAINTENANCE 27

4 Workshop Sessions 30

4.1 WORKSHOP A – IMPLEMENTING MAINTENANCE STRATEGIES 30
4.2 WORKSHOP B - SAFETY ISSUES FOR SMART TEAMS 35
4.3 WORKSHOP C - HUMAN ERROR INTERDEPENDENCY 37
4.4 WORKSHOP D - MAKING THE SAFETY MANAGEMENT SYSTEM INTERFACE WORK 40
4.5 WORKSHOP E - IMPROVING MAINTENANCE BY REDUCING HUMAN ERROR 43
4.6 WORKSHOP F - TASK RISK ASSESSMENT 44

5 Commitment to Action 47

6 Delegate Feedback 49

6.1 INTRODUCTION 49
6.2 PROMOTION OF EVENTS 49
6.3 VIEWS ON THE FORMAT & OBJECTIVES OF THE EVENT 49
6.4 VIEWS ON THE PRESENTATION SESSIONS 50
6.5 VIEWS ON THE WORKSHOP SESSIONS 51
6.6 GENERAL VIEWS ON THE EVENT 52
6.7 FUTURE EVENTS 52
6.8 FURTHER COMMENTS 52
6.9 LESSONS LEARNT 53

Appendices

APPENDIX 1 DELEGATE LISTING 57
APPENDIX 2 DELEGATE FEEDBACK FORM 63

1 Introduction

1.1 BACKGROUND

The rates of accidents and dangerous occurrences offshore remain stubbornly flat and unacceptably high, despite strong leadership and significant investment by an industry that can claim to take health and safety seriously. 27% of all injuries are maintenance related. About 20 hydrocarbon releases occur per month, 30% of which are due to procedural faults and 10% ascribed specifically to maintenance. This inevitably raises questions, especially when viewed in the light of the decreasing offshore population, of whether enough resources are maintained offshore to perform maintenance safely and to maintain installations in a safe condition.

The above statistics alone support the need for a maintenance-related event. In addition, HSE has recently published cross-industry guidance relating to maintenance (*"Improving maintenance - a guide to reducing human error"*) and there was a desire to introduce this document to the offshore industry. It was also considered that it would be of benefit to gather together the different stakeholders to air their views, share their knowledge of maintenance issues and how they have tackled problems, and work together towards solutions.

To address these needs, a joint Industry/HSE (OSD) seminar and workshops, *Maintenance: Reducing the Risks*, was organised by the Aberdeen and Grampian Chamber of Commerce in conjunction with HSE's Offshore Division, Step Change, UKOOA, OCA, IADC and MaTSU. The aim was to provide a forum where these, and related, issues could be discussed in a constructive manner. The event took place on 17 and 18 January 2001, at the Aberdeen Exhibition and Conference Centre.

1.2 AIMS OF EVENT

The event aimed to:

- Be inclusive in nature, so all parties could contribute their views on factors that come into play, and the constraints that they operate under
- Enable sharing of known facts and dispel misconceptions
- Promote examples of good practice and learn lessons from poorer practice
- Move on to work towards solution

The seminar on Day 1 set the scene and provided the opportunity to air concerns while giving a platform for examples of good practice. The workshops on Day 2 concentrated on working towards solutions. In addition a small exhibition was run to allow visitors the opportunity to purchase relevant publications and learn from the experiences of others in the field.

1.3 DELEGATES

The target audience was broad and included all those involved in maintenance, from the maintenance technicians through to those responsible for the overall budget and operational performance.

In all, 142 delegates, from about 50 different organisations, attended the seminar and workshops (see Appendix 1). The delegates included representatives of operating companies, contractors, drilling contractors, government bodies, universities and consultancies. There was representation from all levels within organisations: those defining themselves as workforce, supervisors and management. Both onshore and offshore staff were present, including around 50 offshore workers.

1.4 REPORT STRUCTURE

The remainder of this report is structured into the following sections:

- Section 2 - Event Programme
- Section 3 - Seminar Presentations
- Section 4 - Workshop Sessions
- Section 5 - Commitment to Action
- Section 6 - Delegate Feedback

Supporting information can be found in the Appendices.

2 Event Programme

2.1 SEMINAR PROGRAMME - DAY 1

0845 Registration and coffee

SESSION 1 - WHY MAINTENANCE?
Chairman - Oliver Kieran, HSE (OSD)

0915 Domestic arrangements

0920 Welcome
Taf Powell, Head, HSE Offshore Division (OSD)

0930 Preparation for maintenance as a cause of accidents
Trevor Kletz

1015 Discussion

1030 Coffee

SESSION 2 - RAISING THE ISSUES
Chairman - Bob Miles, HSE (OSD)

1050 Stakeholder views 1: HSE
HSE data - the trends, the problems
Bob Bruce, HSE (OSD)

1120 Stakeholder views 2: a dutyholder view
Ian Tope, UKOOA

1150 Stakeholder views 3: a contractor view
Bill Edgar, Chairman, Wood Group Engineering Ltd & Chairman of OCA

1220 Stakeholder views 4: a workforce view
Robert Whittaker, Brown & Root

1250 Summary of morning session
Bob Miles, HSE (OSD)

1300 Lunch

SESSION 3A - SHARING INSIGHTS AND PRACTICE
Chairman - Bob Kyle, Assistant Director of Safety, UKOOA

1410 Maintaining integrity - the design, the people, the systems, the equipment
Bob Miles, Human Factors Research Manager, HSE (OSD)

1450 Improving maintenance by reducing human error
Steve Mason, Human Factors Reliability Group

1530 Tea

SESSION 3B - SHARING INSIGHTS AND PRACTICE
Chairman - Oliver Kieran, HSE (OSD)

1550 Some examples of industry practice
Ron Boyd, Shell - Leaks reduction programme
Dave Daniels, Marathon - Campaign maintenance

1635 Summary of afternoon session / looking forward to the workshops
Oliver Kieran and representatives from the day's speakers

1650 Close

2.2 WORKSHOP PROGRAMME - DAY 2

SESSION 4 - WORKING TOWARDS SOLUTIONS
Chairman - Oliver Kieran, HSE (OSD)

0845 Registration and coffee

0900 Domestic arrangements

0905 Introduction to the workshops / allocation to morning workshops

0915 Workshop Session 1 - Choice of Workshops A, B, C and D

1045 Coffee

1115 Workshop Session 2 - Choice of Workshops A, B, E and F

1245 Lunch

1400 Workshop Session 3 - Choice of Workshops C, D, E and F

1530 Tea

1550 Key messages from the workshops
Feedback from facilitators and participants

1630 Committing to action - Where do we go from here?
Panel-led discussion chaired jointly by HSE and industry

1700 Close

3 Seminar Presentations

Details of the conference presentations are given below, in chronological order. Further information - in the form of papers and/or copies of overheads were provided in delegate packs on the day and are also available via the Step Change Web site: [www.oil-gas-safety.org.uk].

3.1 WELCOME

Taf Powell has been Head of the Offshore Division (OSD) of the Hazardous Installations Directorate (HID) of the Health and Safety Executive (HSE) since 12 June 2000. He has worked in the government regulatory field for 16 years, mostly in health and safety operations connected to the offshore industry. He has experience in offshore policy and regulatory projects, and petroleum licensing. Taf came to HSE in 1991 from BP and joined the team developing the new offshore regulatory framework and support system. As Operations Manager, Aberdeen, he led a group of inspection teams responsible for enforcing the new regulations.

Taf believes he joined OSD at an interesting time, with the union of Step Change and government in a health and safety drive. He is particularly interested in setting targets and looking at the outcomes, for example:

- the high number of hydrocarbon releases has led HSE to set a target of 50% reduction in hydrocarbon releases over the next 3 years
- 7 incidents involving loss of station keeping have led to a target of a 25% reduction in collisions with FPSOs
- nearly 900 injuries/deaths per year have led to a target to reduce lifting and handling injuries.

Taf opened the seminar by encouraging delegates to participate by asking niggling questions and offering others the benefit of their experience.

From a recent event on Hydrocarbon releases (*Joint UKOOA/HSE workshop - Offshore Hydrocarbon Releases, Aberdeen, 9 November 2000*) HSE learned that some professionals believe the making up of flanges is an area where some increased attention to training and procedures might well lead to a significant reduction in releases. Human factors seem to play a big part in persistent failures, such as hydrocarbon releases.

Maintenance is important to everyone: to those who own/operate assets; to the workforce; and, to HSE as the regulator. It plays an important part in securing both revenue and a safe working environment. Some offshore legislation refers to maintenance activities, for example:

- the Provision and use of Equipment Regulations places an absolute requirement on a Duty Holder to maintain equipment in a safe state
- The Safety Case (Design and Construction Regulations) require that the 'Integrity' of an installation be maintained.

Maintenance can mean different things to different people at different times. It is not a new issue and it is symptomatic of a dynamic process to ensure the risks from major hazards on offshore installations are kept ALARP (as low as reasonably practicable). It is important that the resources committed to maintenance are sufficient.

Turning to this event, the organisers have sought to bring together people from different parts of the offshore industry - and some from other environments - so that a broad range of views can be expressed and discussed. The keynote speaker, Professor Kletz, is from outside the oil and gas industry and brings a lifetime of relevant experience. The next two days would give a platform to duty holders and workforce members so that the subject of maintenance could be viewed from different perspectives. It was hoped the discussions would be a trigger for continuing development.

As Head of the Offshore Division, Taf acknowledged that he would be expected to have a message related to health and safety performance. The message was that the rates of accidents and dangerous occurrences are stubbornly flat and unacceptably high, despite strong leadership and significant investment by an industry that can claim to take health and safety seriously. Since April 1999, the offshore population has dropped from 25,000 to 19,000. 27% of all injuries are maintenance related. Hydrocarbon releases are worryingly high at 20 per month, 30% of which are due to procedural faults and 10% (or 2 per month) of which are ascribed specifically to maintenance. Drawing the threads together, Taf said that he was bound to wonder whether enough resources are maintained offshore to perform maintenance safely and to maintain installations in a safe condition. Perhaps this event could help provide some answers.

3.2 KEYNOTE SPEECH: PREPARATION FOR MAINTENANCE AS A CAUSE OF ACCIDENTS

Trevor Kletz graduated in Chemistry at Liverpool University in 1944 and joined Imperial Chemical Industries (ICI) where he spent eight years in research, sixteen in production management and the last fourteen as safety adviser to the Petrochemicals Division. In 1978 he was appointed an Industrial (part time) Professor at Loughborough University. On retiring from ICI in 1982 Trevor joined the University full-time; in 1986 becoming a Visiting Fellow and he is now a Visiting Professor.

Trevor did not have a conventional retirement present, he asked for a filing cabinet and filled it with accident reports. When he sorted the reports into categories, the thickest by far was related to 'preparation for maintenance'. His talk considered some of these accidents and how we can learn lessons from them.

Further details and examples of incidents and lessons learnt can be found in the accompanying paper and figures.

While Trevor's experience is onshore, the incidents are the same as may occur offshore, where they may have even more serious consequences.

Isolation - Trevor found incidents relating to isolation to be the largest cause of maintenance accidents. A serious fire on a crude oil distillation plant killed three people, seriously injured another and caused extensive damage. A fitter was working on the bearings of a pump. The engineer decided that it would have to be dismantled. When the cover was removed hot oil, above its auto-ignition temperature, came out and caught fire. Examination of the wreckage showed that the suction valve had been left open. The process foreman said he had checked it before signing the permit. Either his recollection is incorrect or after he checked it, someone opened the valve. The valve was not locked, or even tagged. Some of the lessons learnt are:

- Do not rely on valves for isolation as they are liable to leak and may be opened in error. Use binds/spades/slip plates.
- Valves used for isolation should always be locked e.g. by padlock and chain.
- The method of isolation should be stated on the permit to work.

Identification - Problems arising from identification were the second most common accident cause. A fitter was given a permit to locate and clear a choke on a caustic soda line. The valves at each end of the line were closed. The mechanic started by breaking the joint (see figure 4 accompanying the paper). Soon afterwards some product, a corrosive and toxic liquid, was moved down the product line into the tank and sprayed out of the broken joint. Fortunately the mechanic had left the job. The process foreman blamed the mechanic for breaking a joint on the "tank header" (so-called as it was accessible from the roof of the tank) but the mechanic looked upon this short section of line as part of the caustic line. His instructions were ambiguous. The process foreman should have labelled each joint that the mechanic was free to break (or least the joints at each end of this section of pipe).

Instructions - A fitter was asked to change a valve on an acid line. The permit stated that gloves and goggles should be worn. He did not wear them and although the line had been drained he was splashed in the eye by a drop of liquid that had remained in the line. Initially, it seems that the injury was entirely due to the failure of the injured man to follow clear written instructions. However, further investigation showed that the process team wrote "Gloves and goggles to be worn" on every permit, even for jobs on low pressure water lines in safe areas. They probably did this so that they could not be blamed for asking for too little protective clothing, but they did not enforce the instruction, which they wrote to protect themselves rather than help others. The maintenance workers realised that the instruction was usually unnecessary, ignored it and continued to do so when it was really necessary. We should ask only for the precautions that are necessary and then enforce them.

Maintenance operations carried out by operators - An operator, a conscientious man of great experience, forgot to vent a filter and started to open the filter door (about 1 m diameter) before blowing off the pressure. The door blew open with great violence, killing the operator and also spraying him, and another man who happened to be passing, with the corrosive sludge that had been left behind in the filter. It is not helpful to say that the accident was due to human error. From time to time everyone makes slips or has lapses of attention (the accident occurred an hour before the operator started his annual vacation and his mind may not have been fully on the job) and so plants should be designed so that errors do not have serious results.

So far accidents due to poor permit-to-work systems or failures to follow the systems have been discussed, as they are by far the most common causes of accidents involving maintenance. However, accidents have also occurred because maintenance workers did not understand how things worked, because workmanship was poor or because specialist skills were lost with the passage of time. As with everything else, the standard of maintenance work should be checked from time to time and supervisors and managers should keep their eyes open when they tour the plant. Also recognise that time-honoured procedures can kill - the key thing is to think and look critically. Outsiders are in a good position to do this.

Many of the slides used by Trevor are taken from the Institute of Chemical Engineers (IChemE) safety training packs. They can be used in e.g. company training packages if required. However, Trevor stressed the benefits of using examples from the delegates' own plant so no-one could say, *'It couldn't happen here!*'. Also, it is preferable to discuss real incidents with staff, telling them what happened and then inviting their views on what should be done to prevent recurrence.

Discussion:
Subsequent questions and comments confirmed:

- That over-specification of PPE and safety precautions still occurs and can lead to the whole system suffering from ridicule
- That fluid isolation is just as necessary as electrical isolation
- The dangers of nitrogen (see paper)
- The dangers of inadvertent action
- The lasting effects of seeing colleagues seriously injured or killed

3.3 HSE DATA - THE TRENDS, THE PROBLEMS

Bob Bruce is a Chartered (European) Engineer who has over 27 years' experience in the UK offshore oil and gas industry. Bob is currently Team Leader of the OSD Data Management section, which deals with the production and analysis of Offshore Accident/Incident statistics based on RIDDOR reports.

Bob spoke about offshore accident/incident data - the trends, and the problem areas. He gave an introduction to reporting requirements and the data collected. The presentation then split into two parts, one looking at Maintenance-related incidents, the other at Hydrocarbon Releases.

Fuller details can be found in the accompanying PowerPoint presentation.

Reporting requirements
The statutory reporting requirements are for all offshore accidents/incidents to be reported under the '*Reporting of Injuries, Diseases and Dangerous Occurrences Regulations, 1995*'(RIDDOR 95). Fatalities, Major Injuries, Over-3-day Injuries, Ill-health and specific Dangerous Occurrences (DOs) must be reported to the HSE Offshore Division (OSD) on the form OIR/9b (F2508A for ill-health). The data is then held in the OSD 'ORION' Database.

There is also voluntary Hydrocarbon Releases reporting as a result of Cullen Recommendation 39. This data is reported on supplementary form OIR/12 and is required only when a hydrocarbon release has been reported on an OIR/9b form under RIDDOR. The OIR/12 is checked against the OIR/9b details and the data held in the OSD Hydrocarbon Releases (HCR) Database.

HSE regularly interrogate the data and analyse trends. Annual accident/incident statistics reports are produced from ORION data (the latest statistics up to 31 March 2000 are in OTO 2000 111 which was included in the delegate packs). Annual Hydrocarbon Releases statistics reports are produced from HCR data (the latest HCR statistics to 31 March 2000 are in OTO 2000 112, also included in the delegate packs). Other reports that are produced include:

- OIAC/Step Change quarterly reports on both Accident/Incident and Hydrocarbon releases data
- Input to HSE/C annual statistics
- Offshore Safety Statistics Bulletin (Internet)
- 'Raw' HCR Data for Industry (diskette)
- External (chargeable) queries
- IRF/NSOAF/NPD etc

Maintenance-related incidents
A series of graphs related to maintenance accidents were presented:

- 1999-2000 Injuries by Operational Category
- Maintenance Injuries: 1997-2000
- Maintenance Population: 1997-2000
- Maintenance Injury Rates: 1997-2000 (per 100,000 workers)
- Maintenance: Type of Incident 1997 - 2000
- Maintenance: Activity Type 1997 - 2000

These allowed the following conclusions to be drawn:

- The number of accidents is decreasing BUT this is because the population trend is steeply downwards.

- The major injury rate trend is upwards.
- The Over-3-day injury rate trend is downward but shallower than the downward trend in numbers.
- Maintenance had the highest numbers of both Major and Over-3-day injuries amongst main disciplines in 1999-2000.
- The main contributing activity types were 'Manual Lifting/Handling' and 'Climbing/Descending'.
- The main types of incident involved were 'Slips, Trips & Falls' plus 'Handling Goods/Materials'.

As a result, OSD has launched two major initiatives in 2000-01, both of which are aimed at reducing the numbers and rates of injuries over the next 3 years. For ***Slips Trips and Falls from Height***, the target reduction is 15%. For ***Manual Lifting/Handling***, the aim is to raise awareness by investigating up to 20% of all incidents. Although these initiatives cover all disciplines, it can be seen that both will address the main problem areas previously identified for Maintenance accidents.

Hydrocarbon Releases

A series of graphs relating to Hydrocarbon releases for the period 1992-2000 were presented:

- Hydrocarbon Releases Reporting: 1992-2000, by Severity
- Hydrocarbon Releases: 1992-2000, by Operating Mode
- Hydrocarbon Releases: 1992-2000, Breakdown by Operating Mode
- Hydrocarbon Releases: 1992-2000, Breakdown by Causation Factor

A total of 331 releases (including 18 major) were a result of ***Re-instatement/Start-up*** causation factors. Of these, 181 (55%) were equipment failures (inc. 10 major) and 150 (45%) were non-equipment failures (8 major). 90% of the non-equipment failures were operational failures, and 53% of these had related procedural faults. The main operational failures included 70 'incorrectly fitted' and 50 'improper operations'. The main procedural failures included 63 'deficient procedures' and 37 'non-compliance with procedures'.

171 releases (including 12 major) were a result of ***Maintenance/Construction*** causation factors. 56 (33%) were equipment failures (inc. 7 major) and 115 (67%) were non-equipment failures (5 major). 109 of 115 non-equipment failures (95%) were operational failures, and 80 of these (73%) had related procedural faults. The main operational failures included 48 'opened while containing hydrocarbons' and 27 'improper operations'. The main procedural failures included 45 'deficient procedures' and 39 'non compliance with procedures'.

127 releases (including 14 major) were a result of ***Shutdown/Blowdown*** causation factors. 86 (68%) were equipment failures (incl. 9 major) and 41 (32%) were non-equipment failures (5 major). 40 of 41 (98%) of the non-equipment failures were operational failures, and 23 of these (58%) had related procedural faults. The main operational failures included 25 'improper operations' and 15 'incorrectly fitted'. The main procedural failures included 27 'deficient procedures' and 11 'non compliance with procedures'.

The main conclusions related to intervention activities are:

- 82% of all offshore releases during intervention activities occurred in the 3 main categories identified
- 51% were equipment failures, 49% non-equipment
- 75% of equipment failures (45% overall) were due to mechanical failure, fatigue or wearout
- 95% of non-equipment failures were due to operational causes with a 52% chance of a related procedural cause
- 16% overall involved improper operations
- 22% overall involved deficient procedures
- 14% overall involved non compliance with procedures

OSD has launched a major initiative in 2000-01 aimed at reducing the numbers of offshore releases by 50% over the next 3 years. The **HSE Process Integrity Initiative** is in 3 parts:

- Investigation of all reported releases in 2000-01, with OSD offshore involvement in serious incidents
- Process integrity inspection of all normally attended production installations over the next 3 years
- A series of seminars/workshops with industry to disseminate findings and discuss the way forward

Although this initiative covers all disciplines, it will address the main problem areas previously identified for intervention activities.

Discussion:

Question: *How do we compare with e.g. Norway?*
Response: *We are better in some areas and worse in others. They look at similar information as us and we do work with them, however we can not report comparatively as we do not record man hours. We are working towards this, e.g. through Step Change. We have very similar concerns to them.*

Question: *How are slips, trips and falls monitored? Is fatigue a factor, e.g. with more slips, trips and falls happening at the end of tours?*
Response: *Current reporting is not very accurate about what time incidents occur. We are concerned that tiredness and fatigue are issues. You should make sure it is noted on reporting forms so it can be identified. Liverpool University are doing some work in this area.*

Question: *They are challenging targets. Were they pulled out of the air, or are they the result of a full assessment of what is possible?*
Response: *The figures were not 'plucked out of the air'. They were discussed with industry at a workshop on 11th January 2001, ('Revitalising Health and Safety'). Remember that these are not HSE's accidents, they are industry's accidents. HSE is raising awareness. The regulator may set targets but it is for industry to achieve them.*

3.4 A DUTYHOLDER VIEW

Ian Tope is a safety engineer of long standing (20+ years) and currently heads up the Hazard Management Consultancy Group in Shell Expro. He is past Secretary and Chairman of the UKOOA Hazard Management Sub-Committee and leads the team that developed the UKOOA Risk Decision Making Framework. He is currently active in the area of hydrocarbon leak reduction and hence is presenting the duty holders' view on the role of maintenance in managing risks.

Fuller details can be found in the accompanying PowerPoint presentation.

There is a challenging target of 50% reduction in Hydrocarbon Releases over the next 3 years. In looking at this, UKOOA have developed a Bowtie diagram (see PowerPoint figure) with:

- the centre being the hazardous event (loss of gas containment)
- the left side of the bow being the fault tree: the sequence of faults and causes that lead to the hazardous event, e.g. mal-operation, overpressure
- the right side of the bow being the event tree: the sequence of events and failures that contribute to the escalation of a hazardous event, e.g. detector failure, deluge failure, explosion.

UKOOA have done a lot on the right hand side of the Bowtie to reduce risks of the hydrocarbon release escalating into a major event. They have also made efforts on the left hand side, e.g. through the permit to work (PTW) system and by drawing on experiences in the nuclear submarine industry. ISO 13702: 'Control and mitigation of fires and explosions on offshore production installations', reinforces the need to balance efforts on both sides.

The offshore industry reports more data than any onshore industry and there is a substantial database of OIR9b data. We can look at the percentage of failure mode versus various causes (e.g. design fault, corrosion/erosion, mechanical defect, material defect, incorrectly fitted). This shows:

- Design faults account for ~25% of releases, e.g. unsupported piping where there is fatigue failure waiting to happen.
- There is a need for inherent safety in design so that leak sources and maintenance requirements can be eliminated.
- It is important to simplify design. Design practices are such that we are still making mistakes related to very well understood problems.
- Maintenance inspection has a role in managing risk.
- Operating practices - example of valve exposed to excessive pressure.
- Integrity management is very much cross discipline, remember the drillers and well services personnel.

There are three key strands to the way ahead in **improved integrity management**:

- new technology (a lot has happened in the last 25 years and there is more to come)
- improved operational practices - involving frontline workers
- better collaboration and formal/informal networks (it is not rocket science, the solutions are out there)

The risk of maintenance needs to be balanced against the risk of getting inspection data. Personnel are exposed to hazards when monitoring.

What has been/is being done in relation to **Operating Practices**?

- Corrosion management - joint industry project (JIP)
- Isolation practices - OIAC
- Fatigue - JIP
- Small bore - IP/UKOOA guidance
- Flange make up - tba from November workshop, preparing guidance
- PTW - OIAC
- Temporary equipment - recent UKOOA guidance

There is a lot of information available already, but a lack of awareness among duty holders of what is available.

Also in relation to Operating Practices, the following selected elements of Safety Management Systems (SMSs) are receiving attention:

- awareness
- change control
- maintenance strategies
- operating envelopes
- communications
- reporting and measurement
- audit and review

In relation to **Information exchange**:

- Many duty holders already have leak reduction teams in place.
- A task force is being formed in UKOOA to support sub groups and committees.
- Networks are emerging.
- Duty holders are actively supporting leak reduction.

In conclusion:
- The number of leaks is not reducing.
- Leaks are multi-causal - everyone has a role to play - designers, operators, etc.
- Duty holders fully support efforts to reduce the number of leaks.
- Effective maintenance is part of the portfolio.

Discussion:
Comment: *Good inspection after construction should allow e.g. inappropriate piping to be spotted. It is important for all relevant parties to inspect, e.g. those who will operate and designers.*
Response: *There are tools being developed to check fatigue issues during design. It was agreed that post-construction there must be inspection by operators and designers.*

Comment: *There is an issue regarding getting operational fault identification back into design, it can take 5-6 years.*
Response: *This is partly what some Joint Industry Projects (JIPs) want to address, for example a JIP related to flanges is seeking to issue guidance within a year.*

Comment: *The gap between designers and operation does need to be bridged. The design office can have a misperception of life offshore, for example one design office had pictures of FPSOs in very calm weather on their walls. These were taken down and replaced by severe weather pictures.*

3.5 A CONTRACTOR VIEW

Bill Edgar joined the John Wood Group in Aberdeen on 1 September 1995, as a Group Director responsible for Engineering. In this capacity he is the Chairman & Chief Executive of Wood Group Engineering, a major North Sea contracting company, Chairman of JP Kenny Group of Consulting Engineers and is the Chairman/Director of twelve other companies within John Wood Group plc. Bill was elected Chairman of the Offshore Contractors Association in May 2000 for a period of 2 years.

An accompanying PowerPoint presentation is available.

In the last 12 years, contracting companies have:
- Taken more responsibility for the contracting industry.
- Focused on the relative importance of safety, environmental, economics and production constraints.
- Put the emphasis on risk assessment of end task as opposed to productivity assessment.
- Increased management and supervision time spent on HS&E matters.
- Increased investment in personnel training and competency.

While the numbers of people working in the offshore industry have reduced.

To fulfil the needs of the industry, the role of contractors has changed dramatically in the past 12 years. The late 1980s were characterised by:
- Contracting companies being suppliers of labour
- Short term contracts
- Little opportunity to develop management skills or systems

In contrast, today there exists:
- Wide-ranging management responsibilities
- Long term contracts
- A high level of development of personnel and systems infrastructure

Partnerships have been formed, often between rivals. There is an holistic approach, with interfacing acknowledging that companies can be in competition yet also need to work together. In such situations there need to be common maintenance strategies. There is also acknowledgement of cultural differences and language problems, with the Dutch and others becoming increasingly involved in North Sea activity.

Contractors today are delivering to clients in terms of provision of non-core business services and performance-based contracts with risk sharing. In terms of maintenance this means the provision of:

- Management and management systems
- Fully competent labour
- Maintenance systems
- Knowledge-based maintenance procedures

This has resulted in manpower reduction, with outcomes of:

- Team-based working
- Smaller more effective teams
- Reducing the number of activities
- Skilled resource being at a premium
- The emphasis being on risk evaluation of all activities

There is a need to quantify risk. Over time we have moved from productivity assessment of end task to full risk assessment. How do we reduce risk further? The answer must lie in focussed management of resources, i.e. Time, People and Money. Maintenance elements are:

Analysis, Strategy & System Development

- Performance analysis
- PMR (Planned Maintenance Routines) Development
- Quantify risk - Risk assessment takes time. The necessary time must be allowed.
- Develop systems

Management of Execution

- Planning
- Budget control
- Developing people
- Data capture
- Task assessment and risk analysis

Maintenance Execution

- Team-based working - Need to address team skills and team working.
- Working the plan - The plan must be stuck to but it must also be fit for purpose.
- Task assessment

Some of the issues are:
Planning has a key role in reducing risk. The plan is the main communication tool - everyone through the whole organisation must understand the plan. All activities should be entered into the plan.
Developing people. We are reliant on the performance of our employees. What tools should they be given? How should their individual skills be maintained and developed? Core skills need to be defined and assessed. There are other benefits of competency. If a lot is spent on training and development then ideally you want employees to remain with the company. But even if they move to another company their training is still benefiting the industry. It is essential to develop people and the NVQ system has done much to help. It is essential that competency assurance schemes allow time for employees to maintain their skills.

Behavioural change. There are still culture problems with different safety cultures on different installations.

Infrequently performed tasks. What about the skills that are not needed as frequently because they are related to intermittent tasks? It is important to maintain competence on infrequently performed tasks.

Communication. It is important that the 'right messages' are sent out and understood. Is there sufficient communication between managers and those offshore?

Computerised systems. There is increased reliance on computerised systems. People must be properly trained in their use.

The future requires:

- Recognition of the effect of manpower reduction
- Greater emphasis on task based risk assessment
- Enhanced management systems
- Continuing training investment
- Dynamic maintenance strategies to mitigate risks caused by changing process conditions, move from manned to de-manned installations, and high density equipment configuration on FPSOs

Discussion:
Comment: *There is a concern that design contractors do not achieve the correct balance between costs on design, construction and maintenance. The Rail industry has design, construction and maintenance all tied into a single contract to overcome this.*
Response: *The offshore industry are trying to address this, for example there is a whole life costing project that has been taken on by LOGIC. There are also efforts to balance whole life costs and CAPEX.*

Question: *Is enough being done to attract younger/skilled workers into the offshore industry?*
Response: *This is seen as a sunset industry. Systems are being put in place to help. For example, if operators have a surplus of graduates applying for posts, the details may be passed on to contracting companies via OPITO. Attention is also being given to people who have been in other industries for, say, 5-6 years. Their training costs need to be covered. Having said that, there is a worldwide shortage of technicians.*

3.6 A WORKFORCE VIEW

Robert Whittaker has worked in the North Sea for 20 years, the past 8 years as an offshore Electrical Charge Hand Technician for Brown & Root.

Bob put forward a view on maintenance from a workforce perspective.

See PowerPoint presentation and Notes for further details.

Bob opened with a picture of an explosion caused by an escape of hydrocarbons as a result of the failure of O-rings, gaskets and seals. The picture was of the Challenger space shuttle 72 seconds after take off. This example is useful and topical because:

- It is about hydrocarbons and that is pertinent.
- It is interesting because of what was known prior to the shuttle's launch.

NASA knew the shuttle's history and were prepared to believe it: 10 previous flights, 987 orbits of the Earth, 69 days in space. They were over confident. It was known that the O-rings sealing the booster rockets were prone to erosion and it was also known that cold weather increased the possibility of a bad seal as the rubber O-rings were less flexible. NASA were warned by Mr Roger Boisjoly (an engineer who had worked on the O-ring problem) that past history should not in this case be taken to imply that it was safe to launch.

Mr Boisjoly was awarded the prize from the American Association for the Advancement of Science for his 'honesty and integrity'.

If we look at 'Integrity' in the offshore industry:
- Do we have it?
- Have you got it?
- If so, what is it made up of?

The dictionary has two definitions:
- Original perfect state
- Honesty

An original perfect state is difficult to achieve, but we should at least be honest:
- We have all seen, or likely have worked on, older kit and sometimes 'robbed Peter to pay Paul'. In engineering that is usually considered pretty clever, but when outsiders hear of it you get headlines like: 'London Transport robs museum to keep Tube working.'
- In some areas cost cutting can easily go too far, and it can be as hard to change the mindset of natural 'Scrooges' as it was to put savings in place.
- Maintenance needs to be worthwhile. But different attitudes prevail: *'If it's not broke don't fix it*'. *'Run to destruction'. 'An instruction for work has been in place for 18 months. If we have lived with it for that long, then do we really need the maintenance?'*
- We need to keep up with technology, and make ourselves competitive. This means that we should not over-maintain. But if the strategy is to <u>not</u> maintain a piece of equipment because the law does not specifically require us to, why don't we say that?
- The rate of hydrocarbon releases is failing to decline. It might be failing at the same rate as Britain's standing in the engineering field. It might be failing more locally because of a more general sense among contractor staff that we are not now, or ever, stakeholders in what we are doing. This is in contrast to what is said in recent HSE and other Government publications.

One fundamental process or tool widely in use to manage or gauge the amount of maintenance required on large industrial type plant is: Reliability Centred Maintenance (RCM). It would be too time consuming to cover this fully here. However, history of equipment plays a part as does component life span and its criticality. For new equipment, previously acquired data for similar equipment is used. (Whole books are filled with this data.)

There is a lot of distrust of the RCM process.
- Whose standards do we use, Peter's or Paul's?
- Are they uniform?
- What qualifications are required of the propagators?
- Who carries the can and how many cans have there been to date?

A level playing field by way of uniformity of standards needs to be in place for tendering purposes. Otherwise, he who promises most is likely to have to cut most to maintain his promises if not his profit.

Money is a healthy thing, it is therefore a safety thing (especially where maintenance is concerned). In conclusion:

- We have reservations about the effects and the application of unregulated standards regarding systems such as Reliability Centred Maintenance.
- Too many people seem to have a blind faith in these systems.
- There are no rights to halt these processes.
- No authority scrutinises them

Discussion:
Comment: *We shouldn't have blind faith in a system. Remember a system is only a shell, it needs competent staff to operate it.*
Comment: *Integrity of the plant and of the people is important. Cost-cutting can only happen once to give a big effect. There are clearly issues surrounding going beyond the design life and in optimising maintenance.*

3.7 MAINTAINING INTEGRITY - THE DESIGN, THE PEOPLE, THE SYSTEMS, THE EQUIPMENT

Bob Miles is an occupational psychologist working with the HSE's Offshore Division as a human factors advisor and research project manager. Particular interests include workforce involvement, shiftwork, occupational stress and knowledge management. Bob's previous jobs include chartered engineer, winch operator and aircraft mechanic.

See PowerPoint presentation for accompanying illustrations.

Bob started his presentation by considering ***what people may do when they have made a mistake***:

- Will it show? *If so, bury it.*
- Can you hide it? *If so, conceal it before anyone finds out.*
- Can you blame someone else or special circumstances? *If so, get in first with your version of events.*
- Could an admission damage your career prospects? *If so, sit tight and hope the problem goes away.*

Using the ***analogy of a boat steering a course*** without hitting either bank, business is about steering a line between bankruptcy and catastrophe: balancing production and protection. You may not have had an accident but you could still be heading for the bank. Accident reporting tells you where you are. As you head towards safety issues being a concern there should be increased investment in protection. As you head towards production issues being a concern it may be appropriate to have better defences converted to increased production.

Another way of looking at accidents, the '***Dynamic holes in defences*** **(**from Reason 1997)' was introduced. This concept says that we have many defences in place to stop incidents occurring, but these defences are dynamic and have 'holes' at certain points. Circumstances may mean that the 'holes' align and thus the defences can be penetrated. This is often referred to as the Swiss Cheese model. The defences and maintaining their integrity is where you need to focus, not on the lost time injuries and their rates. Keeping the defences in place - managing safety - might require extra protection, improved systems, increased competence etc.

Low accident plants are characterised by:

- High levels of communication
- Good organisational learning
- A strong focus on safety
- Senior management commitment - including small distances between management and employees, i.e. management visibility
- A participative style of leadership
- Skills training emphasising safety aspects
- Good working conditions
- High job satisfaction
- Promotion / selection based on safety

But it is important to be realistic. Companies have to remain profitable.

USEFUL PUBLICATIONS

Bob introduced a number of sources of useful information that is already available in published form.

Note that HSE Books can be contacted on Tel: 01787 881165. Information on Step Change publications can be found on their web site (http://www.oil-gas-safety.org.uk).

"Reducing Error and Influencing Behaviour", **HSG 48, HSE Books.**
This guide looks at:

- What are people being asked to do and where (the task and its characteristics)?
- Who is doing it (the individual and their competence)?
- Where are they working (the organisation and its attributes)?

Job Factors are:

- illogical design of equipment and instruments - e.g. lever marked 'up' but a chalked arrow points down
- constant disturbances and interruptions - e.g. accident reports show accidents are happening when someone is taken off a job to carry out another task. They can not remember where they had got to when they return to the original job.
- missing or unclear instructions
- poorly maintained equipment
- high workload from reduced manning - less people means more work if the process or other factors remain unchanged
- noisy and unpleasant working conditions

Individual Factors are:

- low skill and competence levels
- tired staff
- bored or disheartened staff
- individual medical problems

In reducing manning levels the intention is to retain the most capable staff but the opposite tends to happen. HSE will take a hard look at accidents occurring in, e.g. the 13th or 14th hour of a shift of the 3rd or 4th week of a tour. 24 hour automatic operation of plant with only one person providing 24 hour cover has been found not to be as reliable as predicted.

Organisation and Management Factors are:

- poor work planning leading to high work pressure
- lack of safety systems and barriers
- inadequate responses to previous incidents - people are not creative or novel in their thinking
- management based on one-way communications
- deficient co-ordination and responsibilities
- poor management of health and safety, and poor health and safety culture - trust is very important

There are issues surrounding contractors being brought in to do jobs then leaving the installation. Is their work affected by the fact that they would not face the consequences of any shortcuts or errors that they make?

***"Improving Maintenance; a guide to reducing human error",* ISBN 0 7176 1818 8, HSE Books.**

- Details were not provided as this publication would be discussed in a later presentation and form the basis of one of the workshops.

***"Improving compliance with safety procedures; reducing industrial violations",* ISBN 7176 0970, HSE Books.**

- This publication provides guidance on developing procedures and analysing why they are not complied with. This is a good starting point for revising procedures.
- 'Violations' is an emotive term. They occur for many reasons. Most stem from a genuine desire to perform work satisfactorily, given the constraints and expectations that exist. In a period of change you may want to empower people. Working to rule can have safety implications and in these cases violations may be for safety reasons. A good test is to analyse whether or not the procedures really help.
- Some staff may be 'pushing the envelope'. The result may be a bright idea or it could be an accident waiting to happen. You are a hero if it works but an idiot for ignoring procedures if it fails. The person who gets the blame is always the lowest in the pecking order. Questions that should be answered are: Has it been tried before?; What happened?; Why is this procedure so long?; “Who would have thought it would do that?”
- There is an interesting contrast between London Underground (where 'working to rule is an industrial threat as you will not get to work on time) and Germany (where the trains always run on time because they work to the rules).
- A risk assessment should include all the people who know about the risk. Different constituencies have different things to contribute. Senior management have the bigger picture, while those at the 'sharp end' know, e.g., that a certain piece of equipment may fall on them. There is a need to bring the different perspectives together.

***"Five steps to risk assessment",* free publication from HSE Books.**

It covers:

- Looking for the hazards
- Deciding who might be harmed and how
- Evaluating the risks and deciding whether the existing precautions are adequate or whether more should be done
- Recording findings
- Reviewing the assessment and revising if necessary.

***"Task Risk Assessment Guide"*, Step Change.**

- As well as being a legal requirement, Task Risk Assessment (TRA) is fundamental to reducing the likelihood of having accidents at work. There is a strong desire within the oil and gas industry to improve standards through adopting a common approach to TRA. This desire was demonstrated when the 300 participants at the Step Change Workforce Workshops held in November 1998 identified TRA as a key area to be addressed to promote safety improvement in the industry.

- To address these issues, a working group was set up in 1999 to produce this Task Risk Assessment guide. The guide emphasises the key steps of hazard identification and risk assessment, and also the need to improve communication. Importantly it also provides, more clearly than in the past, opportunities to stop and reassess the task. It illustrates a method, sets standards and expectations, and provides examples of good practice.

It is very important that all personnel are empowered to stop the job if they are concerned about safety. This is one of the best defences. The threat of being NRB'd (not required back) or other action being taken against an individual acts against this. Bob mentioned an example of a Duty Holder stopping production three times due to workforce concerns. When questioned, they responded '*That's the way we run our company.*'

***"Changing Minds - a practical guide for behavioural change in the oil and gas industry",* Step Change.**

- Can be downloaded in PDF from the Step Change web site.
- This guide has been produced by the Behavioural Issues Task Group of the Step Change Initiative. It focuses on safety and behavioural issues primarily relevant to the UK oil and gas industry, and includes a number of appendices detailing research and results, along with a useful reference and resource list.
- The guide illustrates that the organisational factors required to manage safety effectively are similar to those required for effective team-based working that can improve productivity and profitability.

Changes are a big cause of problems. Many incidents happen when conditions at the work-site change, are not as foreseen, or when there is a deviation. When such conditions arise, the individual or work team needs to be empowered to stop the job and re-assess the situation. Only when the re-assessment indicates that the risks can be made ALARP should the task be restarted.

Shift handovers can also lead to problems, e.g.:

- finishing a job started by someone else - workers are very worried about this
- when there is a large difference in knowledge of a hazard
- following time away
- when there are changes or new procedures
- when inexperienced personnel are involved - we no longer have apprenticeships
- when there are unusual operations

These problems can be tackled by:

- writing things down
- having face-to-face conversations
- scheduling in time to do it properly - handovers outside paid work hours will not happen
- avoiding abbreviations (e.g. use tag numbers)
- using the phone as well - phoning ahead to discuss the work before arrival
- double checking - do not interpret silence as understanding!

***"Multi-Skilling in the Petroleum Industry",* ISBN 0 7176 1582 0, HSE Books.**

- This booklet provides guidance on some of the issues that need to be addressed when flexible or multi-disciplinary working practices - such as multi-skilling - are being introduced or developed.
- It is aimed primarily at employers and at employees and their representatives, both onshore and offshore.

Multi-skilling is a risk-based decision. The jobs grouped together in a multi-skilling 'package' must 'make sense' and not conflict. Staff must receive adequate training in both team skills and the relevant technical skills. Where the grouped jobs are similar or very different bring different types of problems, e.g. increased risk of confusion when jobs are very similar, increased difficulty when they are too different. Also, forms may need to be adapted, to prevent the same individual signing off all parts in their different roles. Bob mentioned problems with a Self-Managed Team onshore, where no-one knew who was responsible for pressing the alarm. The result was that the alarm was not sounded.

Less people can mean: less peer support; less opportunity for a second opinion; a smaller team for manual handling; sole responsibility for isolations; but also less exposure to risk.

Introduction of multi-skilling tasks will affect:
- SMS procedures
- task procedures
- countersigning, PTW (permit to work) and delegated authority
- supervisors become team leaders

***"Guidance for Health and Safety Management Systems Interfacing",* Step Change.**
- Available from Step Change. Details at www.oil-gas-safety.org.uk.
- Bob did not provide details on this publication, as it would form the topic of a later workshop.

***"Sound Solutions",* HSG 138, HSE Books**
- Case studies of noise reduction
- Clear examples with technical and cost information

HUMAN FACTORS IN MAINTENANCE

In looking at human factors in maintenance you should consider:

Competency and training:
- Have arrangements for selecting, placing and assessing personnel with the necessary competencies been discussed and agreed?
- Is there a system to confirm that all personnel involved in the shared activity have the necessary competencies to fulfil the requirements of their job/role?
- Have specific arrangements for induction training, additional health and safety training and emergency response been defined and agreed?

Hazard analysis and controlling risks:
- Have the parties agreed a process for identifying and assessing health and safety hazards that may arise from the shared activity?
- Have arrangements for identifying, assessing and controlling the health and safety risks arising from the work of third parties been defined and agreed?
- Are processes in place to ensure that all work equipment and plant is suitable for its purpose and maintained in an efficient state, working order and in good repair?

Control of change:
- Is there an agreed method of developing, agreeing and keeping under review the programme of shared activity?
- Have responsibilities and arrangements been defined for managing changes that may impact upon health and safety?

Reliability:
Bob said he saw few examples of programmes aimed at improving reliability.

- What is being done to improve up-time?
- What feedback is currently in place to purchasing departments, suppliers and designers?
- Is the industry being tough enough on manufacturers? At present, too much equipment is having the same faults repaired. The motor and aviation industries have addressed these problems.
- Could the industry work with manufacturers to improve reliability?

Where is poor design apparent?
The consequences may be seen as:

- high levels of in-service modification
- high maintenance requirements (hazard)
- accidents repeated from one design to the next
- high levels of operator error - this is often due to badly designed equipment. An example was given of 10 years' of accident data being analysed, revealing that the controls in a crane cab obscured the operator's view of the lay down area. As a result, the cab was redesigned.
- loss of containment

There is a need to move away from automatically buying the same design of equipment if it has caused problems before.

Barriers to safe design are seen to be:

- fast track projects
- the many bespoke designs
- sub-contracting of design
- a mobile designer population
- front-end-cost-driven contracts
- CAPEX-driven procurement of equipment
- little or no operator feedback
- lack of loss costing - there is a need to collect data to show the true costs of unreliability
- lack of designer competency standards

Some key messages are:

- everyone can make errors
- develop fault tolerant systems
- managers' and designers' errors may lie hidden
- identify errors and violations separately
- treat past incidents as valuable warnings
- have procedures that do not require violation to get the job done
- get designers and managers really involved

Where do I start?

- during risk assessments
- when analysing incidents, accidents and near misses
- in design and procurement
- in day to day H&S management

Where do any gains come from?

- More reliable kit
- Better procedures
- More skilled crew
- More 'adaptable' crew
- Faster decisions

- Logistics and planning
- Ownership / motivation
- ***Less people only if it derives from the above. i.e. less people should only arise as an outcome, it should not be the starting point***

Key issues include:
- Staff retention: leavers, joiners, experience, knowledge, skills
- Corporate discretion in alliances?
- Lifecycle?
- Cost / benefit of downtime – oil price?
- Does this achieve your objectives?

Discussion:
Comment: *We seem to be good at producing standards etc, but not so good at getting out and penetrating companies with the information.*

Comment: *It is often questioned 'Why have this procedure?' People need to know why procedures were introduced so they can fully appreciate their need. Otherwise there is a danger of some procedures being withdrawn because the original reason for them being in place has been forgotten. Then an accident occurs later.*
Response: *There need to be mechanical interlocks as well.*

Comment: *How do we ensure we get the right data for root cause analysis?*
Response: *If people are being asked to carry out an extra activity they need to be shown that there is a real purpose to it. Then the collected information needs to be fed back to personnel, showing how they will benefit. People may feel more comfortable primarily collecting other information but mentioning safety issues as well.*

3.8 IMPROVING MAINTENANCE - REDUCING HUMAN ERROR

Steve Mason has a degree in Engineering and obtained his Masters degree in Ergonomics in 1975. He is a Fellow of the UK's Ergonomics Society, and a Registered European Ergonomist. He has over 25 years' experience in applying ergonomics within industry. Steve is currently the Principal Human Factors Consultants with HSEC Ltd. He is a member of the Human Factors in Reliability Group (HFRG).

See PowerPoint presentation and associated paper for further details.

It is likely that a maintenance operator who is motivated, well trained, under no time pressure, given the correct information, and working with equipment which has been designed to be maintenance friendly, will complete all specified maintenance work to a high standard. But how do we know that staff are motivated? Do they really know the procedures and what may happen if the procedures are not followed?

Looking at some human factors background helps point to solutions. James Reason prepared the following definitions:

- Slips and lapses - you fail to achieve what is wanted
- Mistakes - you achieve intended action, but action proved to be wrong
- Violation - you achieve intended action, knowingly in breach of safety rules and procedures

These differing scenarios can be respectively addressed by improving Design, Training and Safety Culture.

In addressing violations it is important to consider direct motives. Did the person violate to make life easier, or to get the work done on time? You can then think about appropriate behaviour modifiers, e.g. addressing poor understanding of consequences, or tackling poor attitudes of supervisor/ manager.

The Human Factors in Reliability Group (HFRG) is a forum of individuals from industry, regulators and academic institutions, all with an interest and expertise in human factors associated with reliability. The group aims to foster collaboration, support research and assist dissemination of information. The Maintenance sub-group of the HFRG recently prepared the publication *'Improving Maintenance - A Guide to Reducing Human Error',* available from HSE Books (ISBN 0 - 7176 - 1818 - 8). This publication is included in the delegate packs.

The guide is intended to be relevant to most industries, with a solution-orientated approach that can be used by non-human factor specialists. It offers practical advice and a methodology to help managers and engineers involved in: the management of maintenance; performance of people; and, quality of maintenance activity.

The report has the following sections:

- Maintenance risks
- Human performance in maintenance
- Assessment method
- Maintenance management issues
- Appendices, including copies of blank work sheets

The 'Maintenance management issues' section is based on the HSE publication HSG 65: *Successful health and safety management* and covers:

Policy & Organisation

- Policy
- Resource allocation
- Roles, responsibility and accountability
- Formal communication
- Management of change
- Organisational learning

Planning and Implementation

- Procedures & permits (contents)
- Procedures (presentation, understanding and usability)
- Work design
- Crew/shift handover and shift design
- Individual capabilities
- Competence (technical and interpersonal skills0
- Teamwork
- Supervisor effectiveness
- Environmental factors
- Plant and equipment design

Measuring Performance, Audit & Review

- Routine checking of maintenance performance
- Review of maintenance performance

The assessment method has three stages:

Stage One: Identify Areas for Assessment

- Physical location of the work
- Type of work (e.g. routine/breakdown or electrical/mechanical etc)
- The main consequences (e.g. plant reliability, safety to the public, safety to employees etc)

Stage Two: Application of Questionnaire and/or Incident Analysis

It is suggested that both processes are used, however each has its strengths and weaknesses, so in some situations it may only be prudent to apply one process.

Stage Three: Analysis of Results

- Identify priority areas for improvement - select 3 to 5 of the 18 human factors issues which can impact on safety and maintenance performance
- Guidelines and recommendations section of the guide - provides useful information and suggestions on each of the 18 issues in a way that those that are relevant can be selected, then a number of practical suggestions relating to making improvements in each area can be identified.

In summary, human error is a key factor in offshore maintenance. The HFRG approach is solution-led and has been specifically designed for non-human factor specialists. The HFRG authors would welcome feedback from users.

Discussion:
Comment: *The classification of errors appears very useful as it points directly to solutions. You could also have a fourth category related to mismatch, e.g. no-one could physically turn the valve.*

Comment: *We are not just looking for temporary behaviour modifiers, we need a permanent change in attitude. As an analogy, a driver who is exceeding the speed limit slows down when they see a police car but speeds up again when the police car has gone. We need to want to continue driving within the speed limit.*
Response: *When behavioural modification programmes are used, the required changes often fail to continue when people are no longer being closely monitored.*

Comment: *If instructions are wrong then violations can prevent accidents.*
Response: *Managers are told not to immediately reprimand staff but to stop and listen to their reasons for violating procedures. There may have been a valid reason for their violation. If so, this indicates that the procedures need to be revised.*

As a final comment, '*Make a commitment to make a difference'* - do not put the HFRG guidance on the shelf - use it!

3.9 SHELL'S LEAK REDUCTION PROGRAMME

Ron Boyd joined Shell Expro in 1982 from ICI, initially as an Instrument Maintenance Technician and the Instrument & Electrical Maintenance Engineer on two Brent platforms. After a period of 14 years working offshore, he transferred onshore as an Operations Engineer providing input into new projects. Recently he has joined the Hydrocarbon Leak Reduction Team, tasked with reducing the number of offshore hydrocarbon releases.

See PowerPoint presentation for accompanying graphs.

Shell Expro is committed to reducing the number of hydrocarbon leaks by at least 50% over the next 3 years. To meet this commitment, they have established a dedicated project team to identify problem areas and instigate improvements. Ron is the Operations/Maintenance representative in the team.

The team has used OIR 9/12 returns data for the period 1992 - 2000 to identify ***when leaks are happening and what is leaking***. Leaks occur at all stages of operation including, Reinstatement, Start-up, Well operations, Blowdown, Maintenance, Shutdown, Drilling operations, Testing, Removal and Normal operations. They result from incorrect specification, improper maintenance, improper inspection, incorrect fitting, etc. 50% of leaks are caused by hardware and 50% by software. Pipework (piping steel, flanges and joints) is the most common source of leaks, followed by instrumentation.

The team also looked at ***'Hole distribution percentage versus cause'***, where 'hole sizes' were <10mm, <50mm, >50mm and 'causes' were mechanical defect, improper operation, left open/opened, deficient procedure, corrosion/erosion, or design fault. This showed that while, for example, there may be a lot of erosion events, these were only at the smaller hole sizes, so the overall leakage was not too great. The leaks for the largest hole size are of most interest in respect of determining the greatest leakage and these are found primarily in the areas where the operator is most likely to have made a mistake (improper operation, left open/opened, deficient procedure).

A number of events were analysed to determine the ***underlying root causes***:
- Pinhole leak on meter prover pipework (caused by Corrosion)
- Level bridle leak (caused by Corrosion)
- Gas lift line flange leak (caused by Flanges)
- Closed drains system (caused by Human factors)
- Fuel gas valve leak (caused by Instrumentation)
- Oil rundown system pipework (caused by Erosion/corrosion)

In order of decreasing frequency, the underlying causes were found to be:
- Maintenance management
- Design
- Procedure
- Training
- Hardware
- Communication
- Organisation

The process of shutdown through to start-up was also analysed and found to contribute to 38% of all leaks:
- shut down (6%)
- isolation
- maintenance activity (6%)
- re-instatement (14%)
- start-up (12%)

As part of the Leak Reduction Programme, the appropriate combination of maintenance and inspection strategies that are to be applied to an asset or system is determined through the undertaking of strategy reviews. This may be by using Reliability Centred Maintenance (RCM) and/or Risk-based Inspection (RBI) and/or Instrumented Protective Function (IPF) techniques, or it may be based upon generic strategies that have been proven elsewhere.

Initiatives that the Leak Reduction Programme has planned for 2001 include:
- Increase awareness - for the offshore workforce to contribute to solving maintenance problems they have to be aware that they may have problems
- Chemical injection systems
- Small bore connection surveys - feedback is needed from offshore. All installations were issued with a questionnaire. UKOOA small-bore guidance was issued in November 2000.
- Competency training - specialist training is needed on the use of flanges and joints. Those who benefit most are personnel who have been offshore for many years. They learn the reasons why they do what they do.
- Awareness videos
- Engineering checklists
- Competency refreshers
- UKOOA guidelines
- Self assessment CD-roms
- Vendors

In conclusion, leaks are multi-causal and improvements will be made by:

- Competency training
- Increasing awareness
- Review of procedures
- Maintenance strategy reviews
- Inspection strategy reviews
- Root cause analysis

What is needed are practical ideas. Shell is happy to listen to the suggestions of others. For example, they 'stole' the idea of leak search teams from BP. These teams survey areas where they do not normally work.

Discussion:
Question: *Are there any special tools for monitoring leaks?*
Response: *We are looking at new ultrasonic tools but so far it is observation from staff and standard systems that are picking up leaks.*

3.10 CAMPAIGN MAINTENANCE

David Daniels has worked offshore for the past 18 years for Marathon Oil on their Brae Alpha and Brae Bravo platforms. He is presently assigned to the Aberdeen office setting up, amongst other things, a Platform Reliability, Integrity and System Modification (PRISM) Campaign Maintenance Team.

PowerPoint Presentation is available.

The objective is to campaign the planned maintenance and construction workscopes throughout the Brae field using a dedicated squad for planned durations on each platform. The size and make-up of the squad will be determined by activity. A core squad operates and is manned-up as required by the schedule.

Past maintenance structure
In the old structure there were three platforms, each with their own dedicated maintenance squad and with supervision, planning and services to support the squad. There was also a field construction squad spread across the three platforms, with its own supervision utilising platform services to support it.

Reasons for change
The reasons for changing the maintenance regime were:

- A more efficient and organised system of work (campaign maintenance)
- Core platform crews being able to concentrate solely on the safe and efficient operation of the platforms without the distraction of a heavy planned maintenance workload
- Increased efficiency of planned maintenance
- A maturing asset determines a requirement to reduce OPEX
- Campaign maintenance is part of an overall project to reduce OPEX
- Introduction of multi skilling/ tasking within the platform core team

New maintenance structure
The new structure is smaller multi skilled/tasked platform core teams operating the platform and carrying out frontline maintenance and breakdowns, plus a Field Campaign Team of maintenance and construction technicians supported by their own service crew. The campaign team move around the field working to a planned scope of work for a pre-determined period of time on each platform. Pre-planning is essential to the success of this system.

The Field Campaign Team includes an offshore planner who: ensures the maintenance fits with other platform activities; organises permits; orders materials, etc. There is an abseiling squad as well as scaffolders and drillers. The team even has its own catering crew.

The team work scope includes planned maintenance of the following aspects on a > 1 year frequency:
- Fire and gas
- HVAC
- Lighting
- Switchboards
- Transformers
- Battery maintenance
- Telecom bulk
- Construction work orders
- Vessel inspections
- Pressure safety valves
- Platform integrity management and Corrosion and Risk management programmes
- Technical modification requests of a manageable size

It was considered that platforms would prefer to carry out the 6 monthly checks themselves.

The Field Campaign Team transition has been:
- June - September 2000. Scope of work defined
- September 2000. Offshore construction began reporting to the Field Campaign Team Superintendent. Offshore Planners on board.
- September - November 2000. Yearly Planned work for 2001 compiled into Plan alongside Platform Plans
- November - December 2000. Personnel transfer into the Field Campaign Team from all three platforms
- January 2001 - Field Campaign Team commence first Campaign on Brae Alpha.

The preparation of an appropriate schedule and plan for the year 2001 is critical to the Field Campaign teams' success. The PMR man-hours for each platform were assessed and this along with platform activity determined the size of the team, route and length of time to be spent on each platform during the year 2001. This equated to 23 weeks on the Alpha platform, 17 weeks on Bravo and 12 weeks on East. All known construction activities were added to the overall plan and the hours plotted against the Campaign Team manning. Activities have been planned such that the Field Campaign Team will remain together for each platform tour. It is essential to their success that they are not fragmented throughout the field.

Addressing the problems
A number of problems - and ways to overcome them - have been identified:
- ***Repetitive work:*** Positions will be rotated with platform core team posts after about a year of operation
- ***Reduced morale:*** Ensure equality of conditions with Platform Core Teams, e.g. own rooms, 'back-to-backs'
- ***PMR deferment:*** During the first year some PFEER and Category A PMRs will fall into backlog on two of the three platforms. Each of these PMRs has been risk assessed by a Technician, checked by platform supervision and approved by the SH&E group. A few instruments needed to be maintained on schedule. These were handed back to the Platform Core Team.

- ***Transfer of manpower to the Field Campaign Team:*** Platform priorities took over. Platform supervisors were reluctant to release personnel to the team, leading to delays in setting up the team.
- ***Integration of Construction and Maintenance personnel:*** New methods of working. All personnel will be Task Supervisors, there will be no Chargehands or Foreman.

Discussion:
Question: *How do you envisage that campaign maintenance will reduce risk? It could increase risk.*
Response: *All involved will be Brae personnel. There will be no reduction in manpower, all positions will be back-filled on the platforms. Historically work on PMR has suffered as staff are pulled onto other jobs. With the campaign team they will be able to concentrate on PMR work and equipment will be brought back into service more quickly and more efficiently.*

Comment: *The best safety cases are where there is a good plan, it is well communicated and well carried out. All three aspects are needed for success.*

Question: *How keen are personnel to join planned maintenance teams?*
Response: *One or two people were reluctant initially. There are people who like planned maintenance (they are not meeting anything unexpected) and others who prefer breakdown maintenance (where anything might need to be done).*

Question: *How do you appraise the competency of people in teams?*
Response: *Competence assessments are in place for all disciplines in each company. We rely on that.*

Question: *From a health and safety viewpoint, what if you fall behind and start pressing men to work harder and/or longer hours*?
Response: *If the team fell behind schedule it would be up-manned.*

Question: *What led to the radical change of implementing campaign maintenance?*
Response: *Planned maintenance was always getting backlogged. This approach should allow a platform team to concentrate on breakdowns and the campaign team to concentrate on planned maintenance.*

Question: *How will you deal with major overhauls, e.g. that relate to fired hours (gas turbines)? These can't be dealt with on a quarterly or yearly basis.*
Response: *We looked at having a rotating equipment specialist, but have agreed that the platform specialist will carry out this work. The campaign team will backfill the position.*

Question: *How are you monitoring individual risk for the maintenance team, e.g. extra transport by helicopters?*
Response: *The helicopter risk will be lower as there will be less flying between platforms. We will utilise a container for tools and equipment. The week before a campaign ends, a forward team will be sent on to the next platform to organise the start-up (rigging, scaffolding etc). When we leave a platform, we will leave a small team behind to wind things up.*

4 Workshop Sessions

Six workshop sessions were organised for the second day of the event:

Workshop Topics	Facilitator
A: Implementing maintenance strategies	Bob Miles, HSE (OSD)
B: Safety issues for SMART teams - Team-based working	Jan Corpe, Biffie Management Services
C: Human error interdependency	Michael Wright, Greenstreet Berman
D: Making the Safety Management System interface work	Gordon Thom, Halliburton
E: Improving maintenance by reducing human error	Steve Mason, HSEC Ltd / HFRG
F: Task risk assessment	Dave Carroll, BP Amoco Yvonne McGregor, Aker Oil & Gas

Each workshop session ran twice, with delegates attending three workshops of their choice out of six.

4.1 WORKSHOP A – IMPLEMENTING MAINTENANCE STRATEGIES

Workshop A was facilitated by Bob Miles, HSE, with the assistance of Melanie Clark, Amey Vectra, and Del Davison, Rigblast. The original objectives of Workshop A were to:

- introduce delegates to the different ways of organising maintenance teams
- discuss the pros and cons of campaign maintenance versus on-installation teams
- discuss the analyses that should be in place before implementing a change in an organisation's maintenance strategy
- consider possible performance indicators for the change process
- consider the role of technical developments in delivering reduced maintenance
- discuss strategies for mitigating the disadvantages of each approach and maximising the benefits
- and finally, to come up with suggestions for the next step

Time limitations precluded the workshops being able to examine all of the relevant issues in depth. Each of the two workshops concentrated on a sub-set of the issues. The discussions are summarised below.

See complete set of *'Organising maintenance safely'* PowerPoint slides for possible pros and cons of the following trends: Multi-skilling/multi-tasking; Self managed teams (SMTs); Contractorisation (or the reverse); Beach vs. installation; Traditional working (i.e. Supervisor/technician); Peripatetic working; Campaign maintenance.

WORKSHOP A - SESSION 1

In terms of safe organisation of maintenance, little relevant theory exists. A good starting point is to look at what people have done when they met problems - what look at what works and what does not.

Trends
'Changes in codes and standards' and 'Competence' were suggested as additions to the original list of trends to be examined in the workshop, giving a listing of:

- Multi-skilling/multi-tasking
- Self managed teams (SMTs)
- Contractorisation (or the reverse)
- Beach vs. installation
- Traditional working (i.e. Supervisor/technician)
- Peripatetic working
- Campaign maintenance
- Changes in codes and standards
- Competence

Multi-skilling / multi-tasking
Bob suggested that the pros and cons might be:

- Flexibility in staffing **(+)**
- Less staff **(+)**
- Enables one man 'isolations' **(+)**
- Whole job 'interest' **(+)**
- Issues of maintaining competence **(-)**
- Outlay in initial training **(-)**
- Task conflicts **(-)**
- Status and development **(-)**
- Loss of peers / support (?) **(-)**

The key points from related discussions were:

Isolations
New OIAC guidance on isolations was produced in 2000. Isolations are the cause of many accidents. The statistics show that electricians are better at isolation than pipefitters etc. Electricians have formal assessment of their training as they progress and this is now happening in other trades. There is a need for a formal approach to training. One delegate highlighted 'Safety through knowledge' in his company - process workers carry out the isolations but pass on relevant information to the maintenance workers.

Maintaining competence
There are concerns about 'bolt-on' or secondary skills. How can you ensure that competency is maintained on tasks which an individual may perform only once every 6 months?

Job 'packages' for recruitment etc.

- There are questions relating to what should be included in job adverts

⇨ How do you advertise multi-skilled jobs to get the right applicant?
⇨ How can applicants determine that they would be suitable candidates when the multi-skill mixes vary between jobs and employers?

- Use of NVQs as opposed to 'in-house' qualifications / recognition

⇨ Can you rely on the standard of attainment if using the NVQ system or is it more a 'value judgement' on the part of the assessor?
⇨ Does use of 'in-house' qualifications help retain staff and thus resource expenditure or does it lead to staff feeling 'trapped' and that they can't move on?

Self-managed teams
Bob suggested that the pros and cons might be:

- Empowerment **(+)**
- Ownership **(+)**
- Faster decision-making **(+)**
- Motivation (? Can have inverse effect) **(+)**
- Bigger jobs (pay?) **(+/-)**
- Innovation and best practice **(+/-)**
- Authority balance **(?)**
- Control of procedures **(-?)**
- Lack of promotion **(-)**

A delegate gave an example of empowerment. His team has a company Barclaycard. The restrictions imposed on its use are: £1000 limit per single transaction; £5000 limit per month; not for use on kit requiring authorisation. This is an interesting concept and, in the case presented, was well received by the workforce. There is no suggestion of violations or misuse in the longer term. This appears to be a fast and efficient means of obtaining spares. There is cost benefit as the workforce are more focused on what items they are purchasing. The question was raised that although the system was started using volunteers, this was not necessarily the best way. It may be more appropriate to use selected staff.

JSAs (job safety assessments) are widely used and considered effective. They usually involve use of a checklist card with key questions, that takes 10-15 minutes to work through. There has been mixed experience with B-mod (behavioural modification programmes) and some concern over the individualistic nature of some programmes.

Beach vs. installation

Bob suggested that the pros and cons might be:

Beach

- Risk exposure **(+)**
- Major hazard **(+)**
- EER **(+)**
- Technical information **(+)**
- Resource influence (i.e. nearer head office so more chance of obtaining funds) **(+)**

Installation

- Availability 24x7 **(+)**
- Local knowledge (kit and people) **(+)**
- Communication **(+)**
- PTW / status **(+)**
- Trust **(+)**

Contractorisation
Delegates involved in the workshop did not perceive any conflict between operator and contractor staff offshore. In the past operator staff received better training than contractor staff but now provision is similar.

Traditional (Supervisor/Technician)
The supervisor role may be removed but his responsibilities remain and must be taken on by team members - e.g. there must always be an individual who is responsible for safety.

Campaign maintenance (CM)
There is a variety of experience. Marathon is obviously adopting campaign maintenance and others will take a close interest in the outcomes. Some other companies are considering its adoption, particularly for NUIs. Other companies have a mix of campaign and traditional maintenance regimes. BP is an example of a company where the maintenance regime varies between installations. Delegates believed that there are issues around competition. Also, there is a shortage of skilled staff across the board - in suppliers, operators, and contracting organisations.

There are concerns that campaign maintenance will lead to a reduction in permanent positions. At the same time the work will increase and either the CM teams could end up on installations permanently, or they leave and the remaining permanent staff are left to 'pick up the pieces'.

There are a number of practical issues to resolve:
- Core crew tools may not be available to the CM team. If they find they need extra kit would they be allowed to borrow equipment based on the installation or would they have to be ship it in?
- In an emergency, is the CM team's allegiance to the installation OIM or to their own senior manager? Might they have to learn several sets of emergency procedures?
- Is there sufficient bed space for the CM team?
- How do you keep the plant running while CM is ongoing? (Did CM look more attractive when the oil price was $10 a barrel?)
- Delays in CM on one installation will have a knock-on effect on other installations waiting for the team to visit.

There was a general feeling that the answer is to move to campaign maintenance where it is appropriate. For example, one delegate said that his company had used CM for many years for painting tasks but there was more resistance when they moved to CM for electrical tasks.

WORKSHOP A - SESSION 2

How can maintenance be made more appealing to senior management?
- Present a full / explicit explanation of the need, including cost benefits.
- It should be initiated from the outset (i.e. at the concept design stage) and worked through the entire lifecycle of an installation. Maintenance costs should be budgeted for from the start and not left for OPEX.
- Use of incentivised contracts - i.e. manufacturers /suppliers get more money if the equipment remains operational rather than being paid to fix breakdowns.

Reliability Centred Maintenance (RCM)
RCM is a design tool that is based on the premise:
- What is the function of the equipment?
- How can it fail to fulfil this function?

A query was raised as to whether HSE has a standard or code of practice for RCM. There is known to be one in the USA.

How can equipment be improved?
There is general acceptance that, despite industry knowledge and experience of sub-standard equipment in circulation, it is extremely difficult to get manufacturers to make modifications and change unless the company pays.

The main points raised were:
- How can this problem be best addressed?
- Designers? / manufacturers? never consider maintenance – can this solved?
- Buying power alone is not sufficient to initiate change. Perhaps consideration needs to be given to development of an industry-wide confidential web site to circulate information on problem equipment and thus bring more pressure to bear on the manufacturers.
- Problems stem from a 'make do and mend' culture

Techniques currently being used include:
- Collecting equipment histories (including, if it breaks down is it worth fixing?)
- Root cause analysis (performed both onshore and offshore)
- Loss reporting

IT programmes
Specific mention was made of:
- SAP
- MAXIMO - maintenance and procurement programme
- IFS
- JD Edwards
- EN-GUARD

Delegates requested:
- Examination of the possibility of benchmarking for such software tools
- HSE involvement in how SAP (in particular) is being used within the industry

Bob Miles summarised the findings from his workshop sessions.

- Firstly, he issued a 'health warning'. Duty holders appear to want guidance on maintenance strategies to come from HSE, but in a goal setting regime it is for industry itself to provide guidance. There is a need for performance standards and a clearer code of practice regarding changes in maintenance regimes.

- Regarding campaign maintenance, there were three distinct schools of thought:

⇨ To some this is not an issue
⇨ To others it is a very important topic
⇨ There are others who have been working a limited form of campaign maintenance for specific tasks for which they think it is suited. While this complementary use works well they have no plans to extend it.

- There is a noticeable trend among Duty Holders to take jobs from contractors and bring them back in to permanent employment.

- Reliability Centred Maintenance has to be applied at the design stage if it is to work. How is it to be evaluated for safety and performance? How should it be controlled? Is it cost cutting?

- There is widespread use of SAP and other IT programmes to manage maintenance, parts and competence. There must be <u>appropriate</u> use of IT. There is diversity of opinion as to what works. There are many complaints about the difficulties of getting the system right and problems associated with the software 'driving' the maintenance. There is a need for benchmarking on IT Maintenance Programmes.

- With OREDA and other databases it is important to collect the right data, feed it back and use it. There is a need to improve OREDA by collecting more detailed information so that preventative strategies are captured as well as MTBFs. [OREDA (**O**ffshore **RE**liability **Da**ta) is a project organisation sponsored by 10 oil companies with worldwide operations. Its main purpose is to collect and exchange reliability data among participating companies and to act as a forum for co-ordinating and managing reliability data collection with the Oil & Gas industry.]

- The workshop revealed some key actions that are being taken to improve the situation. Examples of good practice in different companies include:

⇨ Developing and implementing component histories
⇨ Good loss reporting, including recoding reliability related losses and analysing them
⇨ Applying root cause analysis to reliability failures
⇨ The next step is to integrate with the sce analyses being done for safety

- The scheme employed by one company, whereby a team has its own credit card for buying spare parts etc., is of interest. This allows the team to purchase directly and improves efficiency.

- Finally, Bob noted that a question had been raised relating to shift handover: '*How can we ensure that there is a reliable handover of the risk assessment as well as the state of progress on the job?*' This is a very good question and probably deserves a further look.

4.2 WORKSHOP B - SAFETY ISSUES FOR SMART TEAMS

Workshop B focussed on Team-based working and its implications for offshore safety. It was facilitated by Jan Corpe, Biffie Management Services. Advice and guidance for management of safety teams was examined and delegates were asked to complete a questionnaire that would identify how well their organisation have thought through safety and teamwork implementation. This was followed by an interactive session for delegates to discuss: (a) how does good teamwork help improve safety practice and culture; (b) what recommendations they would make to improve the way safety is managed by offshore teams.

See scanned workshop material, including questionnaire, for more detailed information.

What are SMART teams?

- They understand their company's objectives and the role they play in achieving the objectives
- They fully involve the workforce by encouraging them to contribute their skills more fully and to be involved in decision making
- They develop cultures that support creativity and innovation
- They build commitment to excellence and constructive debate

Why is the offshore industry taking up SMART team work?

It offers:

- More efficient, effective and flexible working practices
- Improved productivity though workforce involvement
- Higher achievement of all explicit goals and targets
- Clarity of roles and more effective communication
- Increased workforce awareness and ownership of safety issues through involvement in objective setting
- Improved morale through increased involvement in decision making and team support

HSE advice for offshore SMART teams

- The HSE has funded extensive research into the safety implications of self-managed teamwork
- HSE believes that greater workforce involvement in decision making and objective setting will lead to an improvement in safety culture
- There are key points to address before implementing any type of self-managed teamwork

Key points that impact on safety for offshore SMART teams

- Single point responsibility for safety for any given activity is essential
- A team can not be jointly responsible for the safe operation of a particular activity as this leads to a lack of clarity
- If supervisors are removed and responsibility for their roles delegated to teams it is vital that team members are fully trained in all the health, safety and environmental issues that the supervisor used to carry out
- Team members who have taken on any responsibility for safety must be competent to carry out job risk assessments
- If multi-skilling is to form part of the new team roles it is important to design new jobs to have variety and interest
- It is also important to put in place rigorous training and development plans to ensure that new skills are not lost due to lack of use
- Providing positive incentives to learn new skills works well when implementing multi-skilling
- Shift handovers play a key role in communication flow. It is essential that existing handover procedures are reviewed to ensure that effective communication takes place under the new team work arrangements.
- Learning from experience is essential for continuous improvement. Safety specific team debriefings will help them to learn from mistakes and develop better working practices.
- If a company is looking to achieve improvements to a safety culture it is essential that specific safety targets are developed and agreed by the teams themselves.
- Most important of all is to give people time to adapt and learn their new roles
- The most common mistake made by companies who adopt SMART teamwork is to realise their cost savings from manpower reduction too early
- In the transition phase team members will need additional time and support for training and adapting to their new roles
- A specific safety transition plan should be developed if supervisors are to be removed and team members are to take on safety responsibility

Useful publications - HSE

- OTO 98 160: *"Safety implications of self-managed teams"* *
- OIAC *"Multi-skilling in the petroleum industry"*, available from HSE Books, £9-95
- Advice on workforce involvement in risk assessment PBN 98/21
- OTO 98 160 *"National Inspection project on shift handover"* - includes details of best practice and lessons learnt in shift handovers *
- OTO 2000 049: *"Safety culture maturity model"* *

All items marked * can be downloaded free in PDF from the HSE web site (www.hse.gov.uk)

Useful publications - OPITO

- See SMARTEAMS web site - www.smarteams.co.uk

Jan Corpe summarised the findings from her workshop sessions under three headings.

Safety Issues for SMART teams:

- 13 key points were identified as necessary to deal with safety effectively in SMART teams. More than 50% of delegates agreed that 8 of them have been implemented in their organisations
- The 3 lowest scoring items were: team involvement in setting safety targets; team roles designed to have variety and interest; and, team receives ongoing support and coaching

How does good team work help to improve safety offshore?

- Communication improves because lines are shorter
- Hazards are more readily identified through diversity of views
- Clear identification of roles, responsibilities, strengths and weaknesses
- More acceptance of responsibility
- Building of additional skills base within team
- Team support - many hands make light work
- Ongoing reassessment of standard work procedures
- Peer pressure to improve performance

What would you recommend to improve how safety is dealt with by offshore teams?

- More visible management support and involvement
- Improve feedback and learning across teams
- Teams should be more empowered to turn down safety initiatives that are not appropriate
- Deal with client/contractor teams equally when involved on same installation
- Do away with financial incentives for safety performance (there were some differing views on this point)
- Empower team members to challenge issues without fear of repercussions
- Continuous H, S & E training
- Promote leading indicators
- Determine by root cause analysis the need for a change in approach

Many of the comments about SMART teams apply equally well to existing teams.

4.3 WORKSHOP C - HUMAN ERROR INTERDEPENDENCY

This workshop was run by Michael S Wright of Greenstreet Berman. Michael is a consultant working for HSE and the Human Factors in Reliability Group (HFRG) on the development of a new guide to human error dependency. The document *'Preventing the propagation of error and misplaced reliance on faulty systems: A guide to human error dependency'* is in final draft state and is due to be published by HSE Books later in 2001. There were two overall aims of this workshop: (a) to introduce the concept of Human Error Interdependency (HEI); (b) to run through the assessment methodology described in the guide.

Also, see PowerPoint presentation and scanned workshop material.

'What do you think is meant by 'human error interdependency'?'

- Have you ever made a mistake because you thought someone else had done something when in fact they had not?
- Have you ever got to the end of a series of actions, and then realised that you had missed out the same step on each one?
- Have you ever been a part of a group who have all missed an obvious issue when considering a problem?

If so – you are aware of human error dependency.

What is error interdependency?

It is some form of 'coupling mechanism' that exists between the error and other events, errors, operations and people - such that the occurrence of one influences the likelihood of the error.

How can such errors impact safety and reliability?

One way of achieving high reliability is to have multiple *independent* safety 'defences', so that even if one fails, another should prevent an accident. These 'defences' need to be *independent*, whereby the failure of one will not lead to the failure of another.

Examples of 'independent' and 'diverse' human safety defences

- Appointing supervisors to make independent checks of work completed by fitters
- Having a 'buddy' check your personal safety equipment before attempting a hazardous task
- Having a team of people diagnose a problem rather than relying on one individual
- Having two pilots operate an aeroplane rather than one

What are the different types of dependencies and contributory factors?

Individual dependency: The potential for psychological/physiological factor(s) to cause the operator to make and/or repeat an error. This can be e.g.

- Overconfidence in own ability
- Tunnel vision
- Confirmation bias
- Complacency
- Mind set (80% of male drivers believe they are better than average)

Example: Following maintenance on the cooling system of a pump, the system had to be re-commissioned and the pump restarted. Once running, the pump temperature had to be regularly monitored and logged. The maintenance, re-commissioning and temperature monitoring were all performed by the same person. On one occasion, having restarted the pump, the over-confident operator failed to log its temperature. However, due to a valve being left shut, cooling water was not getting to the pump.

Individual–system dependency: One or more individuals form an attitude that the system is sufficiently reliable that they no longer need to monitor operation of the system or maintain past levels of diligence. e.g. they do not need to double check automatic inspection/test results.

Example: Failure to anaesthetise patient A hospital had a mix of new and old anaesthetic equipment. The new machines had alarms for supply of anaesthetic (alarm activated if incorrect connection / no gas supply). The old machines lacked alarms / gas monitor. The anaesthetist and assistant were used to relying on the alarm and so were not diligent in ensuring supply switched on / connected. They commenced operating on a patient without anaesthetic!

Inter-individual dependency: Two or more people complete a task, such as a team of control room operators, pilots, or supervisors checking the work of team members. Errors are e.g.

- Failing to check another person's work
- People accepting the opinion or judgement of colleagues without question
- Changing one's own opinion to 'fit in' with other people

The Inter-individual factors behind these errors are:

- Mutual trust
- Group think
- Deferential attitudes
- False consensus
- Collective rationalisation / conformity

Example: Clapham Junction railway disaster. The required independent verification of wiring was not completed because of the supervisor's 'good opinion' of the technician's quality.

Detection and recovery of dependent errors

- Is there enough time between committing the error and its consequence to intervene?
- Are there 'obvious' indications of the error, such as an audible alarm?

Dependent errors may go undetected if all persons present are party to the error.

How can these types of errors be identified, assessed and prevented?

- Verify assumptions about reliability of independent checks, team working etc
- Assess the impact of improved competence, trust - group cohesion, new technology etc on behaviour
- Develop a culture of error checking
- Ensure staff appreciate the level of safety required

The HFRG dependency method has four steps:

Step 1: Identify safety critical error dependencies
Step 2: Assess level of dependence and error detection possibility
Step 3: Assess safety significance
Step 4: Identify prevention methods

The guide mentions **four areas of prevention:**

Designing out dependencies - This entails eliminating the possibility of a dependency:

- components may be designed such that it is impossible to repeat an error across two items of equipment
- a task could be entirely automated or avoided by adoption of alternative procedures

Change behaviours (quality strategies) - These strategies aim to reduce the likelihood that the occurrence of one error or process will influence another, such as reducing the propensity of people to rely on one another's judgements.

Error detection - This entails increasing the likelihood that the occurrence of a dependent error will be detected and / or corrected before it has an adverse impact. Detection could involve automatic alarms, such as for alerting operators to loss of automatic warning systems, independent administrative checks on completion of tasks, functional testing and so on.

Managing error prone situations - These strategies apply to those occasions where no practical way of eliminating or reducing the likelihood of an undetected error can be identified, or where further risk reduction is required. The aim is to manage error prone activities in such a way that the potential error is less likely to have an adverse impact. It may include halting operations if the event that automatic systems are not available, improving reliability of automatic systems and so on.

The delegates then applied the HFRG method to one or two examples.

Michael Wright summarised the findings from his workshop sessions.

- People did not come to the workshops with an understanding of HE interdependency
- It is a woolly concept, but giving some examples helped clarification
- Delegates who worked through the assessment method that is to be published by HSE, found it to be useful for looking at tasks in a new way
- One concern raised was that there have been a lot of techniques put forward at this event but how do they relate? Where do you start?
- The question of how we prevent these errors occurring is an audit issue. Are standard error checking procedures being carried out? Are they still in place after time when trust them.
- Campaign Maintenance - with the same team going from installation to installation - conflicts with concepts aimed at reducing interdependency, i.e. preventing error by keeping individual installations separate.
- Similarly the checking role of a Supervisor conflicts with the idea of Self Managed Teams. Does operating without people looking over your shoulder mean that there is insufficient checking?

4.4 WORKSHOP D - MAKING THE SAFETY MANAGEMENT SYSTEM INTERFACE WORK

This workshop reviewed the industry guidance for health and safety management systems interfacing (*"Guidance for health and safety management systems interfacing"*, available from Step Change) and considered the practical difficulties associated with the establishment and implementation of successful arrangements. The workshop was run by Gordon Thom of Halliburton, who was involved in developing the guidance document.

Also, see Powerpoint presentation and scanned workshop material.

The past is characterised by the imposition of contract conditions to work in accordance with the requirements of the Company health and safety management system. There is no recognition of the Contractors' obligations under health and safety legislation or their own policies.

Managing risk at the interface is not just a one-way process and is not confined only to the client/contractor relationship. The imposition of one party's health and safety management system upon the others is no guarantee of effective management of risk at the interface. Where one party's employees, assets or reputation may be at risk from another, then the respective responsibilities and arrangements for the management of these risks must be agreed, documented and communicated.

The guidance has been developed by a Cross-Industry Working Party and is based on the elements of HSG 65 (*"Successful Health and Safety Management"*) but applies equally well to systems developed in the OGP model. Whilst it is limited to H&S Management Systems Interfacing, the process and format could reasonably be utilised for Environmental Management Systems Interfacing. It describes the need for SMS Interfacing, gives guiding principles and proposes a model format

SMS Interfacing is needed to ensure that standards of safety achieved by any one party are not compromised by others whilst undertaking shared activities. The focus is on achieving high standards of health and safety - not solely legal compliance. Establishing interfacing arrangements is a management planning activity.

The difference between Interfacing and integration is a matter of degree. Where complex arrangements are developed to address situations of significant risk, then the degree of interfacing will tend to lead to more integrated solutions. The preferred course of action, where it could be substantiated, would always be to integrate.

Guiding Principles:

- Each party is deemed to be in control of its own SMS and shall be accountable for the management of the risks arising from its own activities.
- Where one party's employees, assets or reputation may be at risk from another, then the respective responsibilities and arrangements for the management of these risks must be agreed, documented and communicated.
- Interfacing arrangements are to be arrived at through consultation and agreement (the imposition of one party's SMS shall not be deemed to provide adequate control).
- Interfacing arrangements shall address all aspects of the shared activities and shall be communicated by those responsible to all affected personnel.
- Interfacing arrangements shall be subject to a process of confirmation of effectiveness and to periodic review and update.
- The final documented interface agreement shall be a **live** document, which serves as a working reference of the controls to be implemented.

The outline process is a series of steps:
- Identify scope
- Assess principal risks
- Document interfacing arrangements
- Implement arrangements
- Review arrangements

The sub-process for defining, agreeing and documenting is:
- Activity/Issue
- Method/Approach
- Standard/Guidance
- Control/Management
- Action
- Actionee
- Actioned

The model format is:
- Set Interfacing Policy and Objectives
- Organise
- Plan and Set Standards
- Measure Performance
- Audit and Review

Extracts from the guidance document were shown, such as the Issues Matrix, the Briefing Record and the Review Checklist

Conclusion:
- Employers' responsibilities for health & safety, as defined by national regulation, contract requirement and stakeholder expectation, have never been more onerous.
- New project developments and existing operational arrangements continue to involve many parties in their delivery.
- The case for effective management of the risks at the interfaces between these parties has never been stronger.
- This guidance attempts to facilitate the achievement of effective risk management, thereby improving health and safety performance.

Experience to date:
- Initially, the guidance has been used as a standard against which existing arrangements have been compared for adequacy.
- Increasingly, the guidance is being referenced as the basis for client/contractor interface in new developments or new ops/maintenance contracts.
- For those who have elected to use the guidance in developing their interface arrangements, the feedback has been good.
- Evidence from the Safety Benchmarking Project indicates that effective SMS Interfacing Arrangements lead to improvement in safety climate and to lower accident/incident rates

But, is the 'imposition of contract conditions to work in accordance with the requirements of the **Company** health and safety management system' and 'no recognition of your obligations under health and safety legislation or your own health & safety management system' the past or more like your present?

Obstacles identified:

- Clients are still imposing their SMS onto Contractors.
- When the need for interfacing is recognised, the process is not being applied as intended.
- Where objectives and targets are agreed, insufficient time and effort is applied to the detail of 'how' they will be achieved, and little or no workforce consultation is involved.
- In instances where interface arrangements are established they are often not adequately communicated to those responsible for implementation.
- Behavioural change is required in order to overcome the obstacles to both the effective implementation of the process and effective implementation of the interface arrangements themselves.

Actions to facilitate progress:

- Increased industry commitment to, and communication of, the SMS Interface Process.
- Greater Regulator scrutiny of SMS Interface arrangements.
- Each employer to critically review their current arrangements or the lack of them, with a view to improvement.
- Employer to insist on use of new guidance for each new shared activity undertaken.

The workshops were split into groups that were asked to consider what should be covered in an interfacing document. Responses included:

- Duty Holder responsibilities under the safety case (Health and Safety at Work)
- Contractors working under operators' procedures, etc (Duty of Care)
- Reporting/Lines of Communication
- Identification of Interfaces (specifically Emergency Response)
- Training and Competency
- Change Management
- Information Management
- Risk Assessment Management

Gordon Thom summarised the findings from his workshop sessions.

- Offshore maintenance is seen to be conducive to SMS Interfacing arrangements.
- In each of the two sessions the audience was asked whether or not they were aware of the Step Change Guidance document. It was very disappointing that only 50% had seen the document in the morning session, and even worse only 25% had seen it in the afternoon session. There is clearly a communication problem.
- Obstacles to efficient interfacing include:

⇨ clients are still imposing their own Safety Management Systems on contractors
⇨ when the need for interfacing is recognised, the process is not being applied as intended
⇨ where objectives and targets are agreed, insufficient time and effort is applied to the detail of 'how' they will be achieved, and little or no workforce consultation is involved

- Actions to facilitate progress include:

⇨ increased individual commitment to, and communication of, the SMS Interface Process
⇨ greater regulator scrutiny of SMS arrangements
⇨ employers to critically review current SMS Interface Process arrangements, or lack of them, with a view to improvement
⇨ employer to insist on use of the guidance.

4.5 WORKSHOP E - IMPROVING MAINTENANCE BY REDUCING HUMAN ERROR

Workshop E was facilitated by Steve Mason of HSEC Ltd. and the Human Factors Reliability Group. It developed the practical solution theme in the related presentation on Day 1. It aimed to provide delegates with a clear understanding of the major issues influencing critical human error in the offshore industries and the underlying root causes that need to be addressed by management action. There was discussion of the suitability of current management methods in addressing these critical issues, enabling the workshop to discuss the suitability of various human factor methodologies in assisting managers and engineers to improve the control of human error in maintenance operations.

Also, see workshop material (in MS Word).

The workshop began by looking at a range of different reasons why maintenance crews have failed to reliably perform tasks in a number of industries. This ranged from physical difficulties in applying sufficient forces to tools, to errors of 'slips/lapses', 'mistakes', and 'violation'. Emphasis was made that such crew failings were largely the result of problems in the organisation of the companies and safety culture rather than the fault of the person at the sharp end on the day of any incident.

Four syndicates were formed to:

1. Identify tangible indicators of poor (or good) human factors performance
2. Discuss maintenance in their own companies and identify underlying root causes of problems
3. Discuss how the offshore industry currently addresses human error in maintenance
4. Apply the CD-Rom Human Factors Solutions Methodology to a real maintenance incident to identify root problems and selected management actions.

The following structured discussions took place.

The workshops initially considered ***how easy it was for managers and engineers to actually identify human error in maintenance***, either during the tasks themselves or subsequent to the maintenance operations. Although there may be some tangible indicators of error it was generally accepted that these can not be relied upon for management to identify and control error directly. Some of the indicators identified by the syndicates were: evidence of improvisation, process trips, and the non-use of planned consumable spares.

The workshops accepted that ***the most effective strategy was to identify and address those underlying organisational failings which make errors in maintenance operations more likely***. Both workshops generated scores reflecting the relative importance of each of the 18 issues adopted by the HFRG report, which had been made available to all delegates. It was apparent that the management of change, plant and equipment design, and aspects of procedures (both the technical accuracy and their ease of use) were issues that seemed to warrant specific further attention by the offshore industry. There were also notable differences between the scores for the two workshops (the practicalities on the day may have resulted in bias in this data).

The workshops also considered the ***effectiveness of current safety management systems to control the problems of human error in maintenance***. Overall, the workshops identified a range of systems (e.g. risk assessments, no blame culture, procedures, HAZOPS, COSHH, toolbox talks, supervision) and these were thought to be generally effective. However, there was some suggestion that aspects of supervision could be improved and also that more attention should be paid to reviewing the reasons for success (or failure) in major maintenance operations. Also that measures should be introduced to remove the risk of the maintainers being interrupted during critical aspects of the work where this could lead to distractions and errors.

An important part of the workshops was ***whether the methodologies discussed added any value to those working offshore or whether sufficient improvement could be gained by the careful use of 'common sense'***. It was apparent that offshore staff could be subject to significant time pressure and would therefore not generally be able to use any technique that demanded excessive time to administer. The HFRG methodology ideally requires the use of workforce questionnaires and incident reviews and may therefore not be ideal for routine application. The use of the questionnaire only may, however, be appropriate. In its basic form, the HSEC Human Factor Solutions computer technique can be applied in around 10 minutes by an assessor and the report provides a list of potentially problematic human factors issues along with selected recommendations. There was general acceptance among the delegates who used this that this approach was practical and that it could be usefully applied to risk assessments of future maintenance jobs as well as during investigations of actual incidents.

In conclusion, although these methodologies were accepted as having a place in the more critical or complex operations it was considered that simply understanding more about the key human factors issues in maintenance (as provided by both the HFRG report and also the HSE HSG 48 report [*"Reducing Error and Influencing Behaviour"*]) would prove valuable in the day-to-day management of maintenance error in the offshore industries.

4.6 WORKSHOP F - TASK RISK ASSESSMENT

A common theme to many incidents in the offshore industry is inadequate risk assessment. This is often the case, even where robust systems of risk assessment are in place. Workshop F explored the behavioural aspects of risk assessment and what can be done to improve them. It was facilitated by Dave Carroll, BP Amoco and Yvonne McGregor, Aker Oil & Gas, who are both members of the Step Change Task Risk Assessment Team.

The delegates were introduced to the *"Task Risk Assessment Guide"*, published by Step Change in August 2000.

Background
As well as being a legal requirement, Task Risk Assessment (TRA) is fundamental to reducing the likelihood of having accidents at work. The participants involved in the Step Change Workforce Workshops held in November 1998 identified TRA as a key area to address to promote safety improvement in the industry. A working group was set up in 1999 to produce a Task Risk Assessment guide. The guide emphasises the key steps of hazard identification and risk assessment, and also the need to improve communication. It also provides opportunities to stop and re-assess the task - either prior to starting or when a change occurs while doing the task. It illustrates a method, sets standards and expectations, and provides examples of good practice. The guidance was produced after extensive analysis of current practice across industries in the UK.

Workshop tasks
Delegates were divided into four groups, with each group being asked to consider the following questions:
- Regarding task-based risk assessment, what are the issues?
- What are the important issues for you? Prioritise them.

The responses could be grouped under six headings:
- Training and competence
- Showing real commitment
- Communication
- Risk assessment - credibility of process

- Standardisation and simplification
- Involvement of the workforce

Each group was then asked to consider one or two of the above issues and ask themselves:
- What can I do differently at the workplace to influence improvement?

This produced the following collated set of responses:

Training and Competence
- Look at training policies
- Understanding of systems and procedures
- Knowing which tools to use and when
- Able to say *"No, I don't agree."*
- Understand enough about the job and surrounding – 'the big picture'
- The facilitator role is key. They need competence in the process and in team composition
- Contractor training and third parties
- Training standard/competence standard
- Training the Trainers

Showing Real Commitment
- Commitment to the process from managers and workers
- Must be visible management commitment
- Consistency in application of TRA from management, supervision and the workforce
- Feedback loop for improvement
- Auditing of process should be followed up rigorously
- Understand need to STOP and re-assess when conditions change (full management support for this). Consider culture
- There must be sufficient time allowed for the TRA process - build it into the plan
- Appropriate funding
- A set of leading indicators would be helpful
- Combining of processes (PTW/TRA/TOFS/STOP etc)

Communication
- TRAs completed but nobody reads them
- Clarity of TRA content
- Clarity of process
- Consensus of workteam to agree to TRA content
- Feedback to managers on problem areas
- Shift interfaces – ensure that all of the workteam are fully briefed
- Onshore/offshore interface is crucial. Risk assessments are often done onshore. They may not be fully understood offshore, and may not even be read.

Risk Assessment – credibility of process
- Inappropriate use of generic/repeat TRA. There needs to be regular review. Are generic TRAs fit for purpose?
- Too often TRAs are tailored to allow the job to proceed
- The TRA process is over-used, leading to complacency – there is a proliferation of paperwork
- It is important to combat complacency
- Applied too often to simple tasks

Standardisation and Simplification

- Move towards standardisation
- Simple and easily understood
- There needs to be a common process for an increasingly transient workforce

Involvement of Workforce

- Participation of task team members - the right mix of people and competencies, particularly including 'those doing the job'. There must be sufficient task knowledge in the assessment team
- Work site visits are essential
- Under-utilising the knowledge of the workforce
- Involvement should be real, not superficial
- Those carrying out the work must be involved at some stage in the risk assessment process
- Involve the task team in the debrief so they learn the lessons for next time
- Train the workforce to be confident to stand up and say 'No!'

Dave Carroll pointed out that the TRA Guide has gone some way to developing a common process but it could go further. He also stressed that the current Guide is the first version. It should be looked upon as a live document that will be developed further, taking account of comments received and input from events such as this.

5 Commitment to Action

Day 2 of the event closed with a short session aimed at capturing the messages from the event and to look at *"Where do we go from here?"*. The majority of delegates stayed for this final session, which drew to a close later than the scheduled finish time as suggestions for future action continued to be discussed.

Requests were made for a number of follow-up actions to be considered by the event's Steering Committee. It is not within the remit of the Steering Committee - which was set up solely for the purposes of organising this event - to take on the actions. However, the Committee acknowledged the need to ensure that the actions are passed to an appropriate body for determining where the responsibilities are best placed. Therefore, actions 4, 5, 6, 7 and 8 are being forwarded to the Senior Managers' Forum for consideration.

Requests for follow-up action

1	Subject to the agreement of Marathon, and if suitable opportunities arise, feedback on the lessons learnt from Marathon's implementation of campaign maintenance will be provided to the industry. **Action Party: Marathon (David Daniels)**
2	The availability of the 'Managing Error' human error video training package (produced by The Vision Consultancy with support from HSE, Shell and Railtrack) will be advertised in the Step Change monthly flyer. **Action Party: Step Change Support Team**
3	The organising body should consider how best to involve other countries in future events. [Particular mention was made of potential Dutch and Norwegian involvement.] **When planning and advertising future events, organisations such as NOGEPA (Netherlands), OLF (Norway), Dansk Olie og Naturgas (Denmark) and the International Association of Oil and Gas Producers (OGP) will be notified.** **Action Parties: HSE, Step Change Support Team & Aberdeen Chamber of Commerce**
4	The request that the bodies which came together to organise the Maintenance - Reducing the Risks' event should continue to follow up issues has been noted. **The Steering Committee has agreed to take this request forward to the Senior Managers' Forum.**
5	A request to examine the methods to achieve optimum resource for maintenance (including manning) was noted. **The Steering Committee has agreed to take this request forward to the Senior Managers' Forum.**
6	Consider how far to pursue multi-skilled maintenance. Consider what are the safety implications of multi-skilled maintenance. **The Steering Committee has agreed to take this request forward to the Senior Managers' Forum.**

7	Review 'competencies' in the field of maintenance and provide clarification of the meaning of 'competence' and of how it can be measured. **The Steering Committee has agreed to take this request forward to the Senior Managers' Forum.**
8	Seek to examine best practice associated with maintenance of safety critical elements. **The Steering Committee has agreed to refer this to the Senior Managers' Forum and to Step Change to encourage companies to share their best practice.**

6 Delegate Feedback

6.1 INTRODUCTION

At the request of the seminar organisers, MaTSU prepared a feedback form for delegates to complete at the end of the seminar. The form used for this event is included at Appendix 2.

Feedback was received from a total of 36 delegates, from a wide range of the organisations present. Workforce representatives, safety representatives, supervisors and managers put forward their views as well as other attendees such as safety professionals and researchers. Feedback is summarised below under a number of sub-headings.

For full details of the feedback - in unattributable form - see 'Collated Feedback'.

A summary of the lessons learnt from delegate feedback is given in s6.9.

6.2 PROMOTION OF EVENTS

To examine the effectiveness of promotion methods for events such as this, delegates were asked how they had heard about this event and also prompted to provide any further suggestions for advertising events. The majority of respondents had heard about the event from colleagues and quite a number had received the information via email distribution. Very few had received posted information or seen the event advertised e.g. via the Step Change flyer. It was felt that the combination of methods employed for this event was generally sufficient although a few suggestions for additional media were given. This included publicising the event through Industry bodies (if this was not already done); posting information on notice boards on the shop floor; and, an article in OILC Magazine.

It was noted that the event had not been well advertised in the SNS area and there was a request for the event organisers to consider this sector of the industry when planning and advertising future events. It was also suggested that where possible, more advance notice of such events would be beneficial.

6.3 VIEWS ON THE FORMAT & OBJECTIVES OF THE EVENT

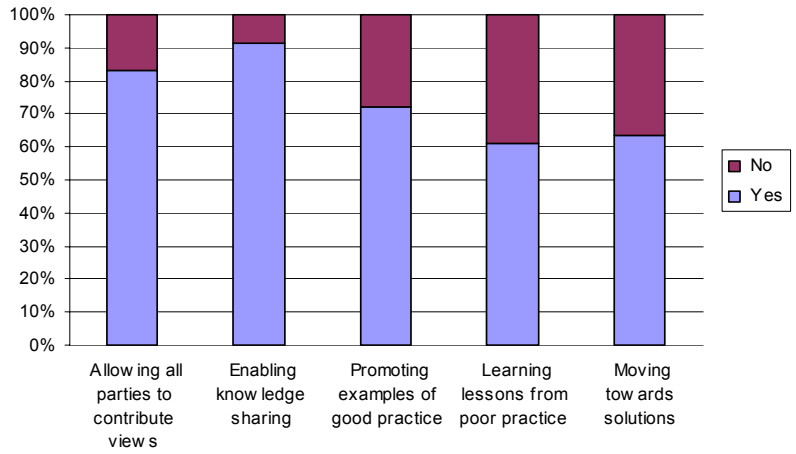
The combination of presentations and workshops was well received and felt by most respondents to be the optimum format for this type of event. The exhibition was also felt to be useful, although secondary to the main conference. All three aspects were felt to provide a balanced variety for delegates.

There were some suggestions that the event could have been shorter and taken place over one day with morning presentations and afternoon workshops. However there were also calls for the workshops to have been longer and allowed more time for discussion. These sessions are felt to be particularly valuable, especially with the diverse nature of participants allowing views to be gained from all sectors and levels of the industry. Some (but not all) the workshops were seen as a presentation plus a 'useless exercise', which seemed to have been included to satisfy the need for audience participation. Industry working forums were suggested as a means of providing better 'solutions'.

The need for careful organisation of workshop sessions was raised by a number of delegates. Comments related to the need to ensure that the number of delegates in a session is not too large, as well as to, for example, the layout of the room. Some delegates expressed a preference for lecture style rooms as this was felt to lead to more open debate, while others preferred syndicate tables that allowed groups to be more focused in discussion. The need to ensure that the acoustics of the session rooms is suitable, was also expressed (this was a particular problem with one of the allocated rooms).

Figure 1 shows the respondent views on how the event achieved its objectives. The majority of delegates believed that the objectives had been met, although promoting examples of good practice, learning lessons from poor practice and moving towards solutions, were not felt to have been as well achieved as allowing all delegates to contribute views and enabling knowledge sharing. In relation to allowing all parties to contribute views, it was particularly noted that there had been no Union input to the event.

Figure 1:



It was felt by some that the title of the event was ambiguous and the conference objectives were unclear. There was also a request for better descriptions of workshops to have been supplied in advance to aid selection of which workshops to attend. For some, the event had not turned out to be what was expected and was therefore a little disappointing.

6.4 VIEWS ON THE PRESENTATION SESSIONS

Of the presentations given on Day 1, the talk by Bob Miles on 'Maintaining Integrity' was most well received. It was felt to have relevant content and to be informative, providing lateral learning opportunities. The speaker was felt to give an enthusiastic and committed delivery, which captured the attention of the delegates.

After this, the keynote speech was of most interest. Trevor Kletz was felt to have given good examples of historic problems. His presentation was well delivered and enthusiastic and based on a lifetime of experience. It formed an excellent overview that made delegates realise that improving safety can be quite simplistic if we go back to basics and do not over-complicate the processes. Interestingly, these positive views were also reinforced by delegates that had found the keynote speech to be a session of least interest. They mainly cited, 'old material' that they had 'heard before'.

The presentations offered something for everyone, as all the other sessions - Stakeholder Views, Improving Human Reliability, Examples of Industry Practice - were listed as sessions of most interest by over 25% of the respondents. Particular value was placed on hearing views from all perspectives and learning from the experiences of others.

6.5 VIEWS ON THE WORKSHOP SESSIONS

Workshop F on Task Based Risk Assessment was most well received. It was felt to be a well-structured and disciplined workshop that was enthusiastically attended, and gave rise to good discussions. The topic of task risk assessment was felt to be particularly pertinent.

Delegates had more diverse opinions on the merits of the other workshops. Representative comments from respondents are listed below:

Workshop A: Implementing maintenance strategies
- *"Only scraped the surface"*
- *"This seemed to be more of a presentation with some audience participation"*
- *"Was really looking forward to this. However lacked structure and was allowed to turn into an unstructured discussion"*

Workshop B: Safety issues for SMART teams - Team-based working
- *"Most operators moving towards this type of organising work"*
- *"As a team we did not fully explore the issues"*
- *"Lack of focus, disorganised. End feeling of a lack of achievements"*

Workshop C: Human error interdependency
- *"Good structure with clear examples"*
- *"A complex subject to get to grips with in the time"*
- *"Was a little slow"*
- *"Too much introduction. Not enough emphasis on solutions"*
- *"Fancy label for inherent issues"*

Workshop D: Making the SMS interface work
- *"Although very important, did not go deep enough into offshore situation"*
- *"Difference in contractor's view against 'company' policies gave food for thought"*
- *"Well structured and presented. Although not immediately relevant to me I found it a joy to participate"*
- *"Clear and helpful - realistic"*

Workshop E: Improving maintenance by reducing human error
- *"Produced useful points for reducing error"*
- *Although very important, did not go deep enough into offshore situation"*
- *"Good but should have been given examples rather than waste time on rather poor actual samples of incidents for the groups to work on. And too little time"*
- *"No new ways of working taken from this"*
- *"Badly organised"*
- *"I did take some good points from this workshop. It also highlighted everyday things that are taken for granted"*
- *"Unclear and difficult to relate to / apply"*

6.6 GENERAL VIEWS ON THE EVENT

On the whole, respondents indicated that this had been a well-organised and worthwhile event that handled a difficult subject well and raised critical issues. It had given a good introduction to current thinking on maintenance and its implications for safety, although it was suggested that maintenance strategies received insufficient attention and there was a lack of solutions. It was felt that there had been a good topic range and the event had raised the profile of maintenance.

The event was felt to be a good forum for meeting delegates from other companies and comparing practices and also for bringing together all levels of the workforce - managers through to offshore personnel. A number of respondents commented on how encouraged they were to see HSE being willing to participate and offer their views, some feeling they were more open than client speakers.

Some respondents felt there had been a lack of audience participation, and they were surprised at this due to the relevance of the topic and the fact that it is the offshore workers that have to live on the installations as well as work there.

6.7 FUTURE EVENTS

Over 85% of respondents indicated that they would be interested in attending future events of this nature. The majority of these delegates were specifically interested in future events on the topic of maintenance. Suggestions were for emphasis on:

- Reliability Centred Maintenance (RCM)
- Subsea maintenance
- Safety Case, WSV and Safety Critical Element maintenance requirements
- Maintenance and other topside activities i.e. Operations, Construction, Drilling
- Maintenance in design
- Review of incidents where maintenance has been a factor and how weaknesses in the maintenance system contributed to the incident. (Using HSE-funded research to help people's understanding of incident factors and what they mean.)
- Use of, and maintenance of, multi-skill teams
- Further refinement of maintenance strategies and RCM from the point of view of HSE and Safety Representatives.
- The workforce perspective of maintenance and reducing the risks.

Other suggested topics were:

- Management of change and DCR
- Competence and training for offshore operations
- Process operations safety
- Production related
- Link to delivery/demonstration of performance standards/safety case 'claims'
- Combined Step Change/HSE seminars on 'detailed ' subjects e.g. Risk assessment, Hydrocarbon releases, Slips/trips/falls, Manual handling
- Violations, attitudes, behaviours
- Organisational change management with respect to multi-skilling / multi-tasking team based working

6.8 FURTHER COMMENTS

The following comments were also received:

- Please ensure a full package of view graphs, papers and feedback is passed to participants or put on a web site.
- The eventual value may be judged not just by the minutes but possibly by an 'end of conference plus 3 months' review of actions.

- Please provide names of individuals who ran workshop sessions. These were not detailed on handouts. These people need to be recognised in future. Handouts were not always provided for all sessions.
- HSE documents are not easy to understand. If they need to be worded in a way that covers HSE legally, why not produce a simplified document as well that shop floor people can understand and work to.

6.9 LESSONS LEARNT

The written feedback received from 36 delegates, plus views expressed at the event, indicate that the event as a whole can be considered a success. However, there are always lessons to learn. The detailed feedback has provided valuable indications of 'what works well' and 'areas which could improve'. This will be taken into account when planning future industry / HSE events.

Advertising events

- Email distribution of flyers and 'word of mouth' from colleagues appear to be the most common ways that people hearing about joint industry/HSE events of this nature. The full range of advertising methods should continue to be used. Attention needs to be given to ensuring that companies and individuals based in the Southern North Sea area receive relevant communications from an early stage.
- More advanced notice of events is needed, particularly for offshore workers who may need to arrange cover if they are to be able to attend.

Format of events

- A combination of seminar and workshops - possibly with an accompanying exhibition - is the most popular format.
- The title, aims and objectives of any event should be clear and unambiguous. They should accurately describe the final form of the event.
- For workshop sessions, most delegates would prefer:

⇨ A clear focus, with the aims and objectives of the workshops aligning with those of the seminar
⇨ A set of workshops on related topics that 'fit together' and will drive forward the event as whole
⇨ Workshop topics and objectives that make use of the participants' own experiences
⇨ Introductory presentations and use of 'lecture format' to be minimised
⇨ Full and open discussion within a structured workshop format
⇨ A facilitating team (in preference to a single facilitator) so that groups formed within each workshop have access to a facilitator
⇨ Longer sessions that allow topics to be explored in depth
⇨ A smaller number of workshops to attend
⇨ A sensible limit on the maximum number of delegates in a workshop
⇨ To feel, at the end of each workshop, that they have achieved something to take away and discuss / use back in the workplace

Delegates

- Having a broad range of delegates - including a good level of representation from the offshore workforce - enables views from all sectors and all levels of the industry to be heard.
- Delegates particularly value hearing contributions from all perspectives and learning from the experiences of others.

Fulfilling a need?

- There is considerable interest in holding future events of this nature, which should take account of the constructive feedback received.
- While a wide range of other topics have been suggested, there is clear interest in holding further events on the topic of maintenance. This reflects a desire, not only to explore issues in greater depth, but also to start to make progress towards developing possible solutions to address issues.

Appendices

CONTENTS

Appendix 1 Delegate Listing
Appendix 2 Delegate Feedback Form

Appendix 1
Delegate Listing

APPENDIX 1: DELEGATE LISTING

Delegate	Company
Brian Anderson	BP Amoco
Chris Ball	Global Marine
Ian Barraclough	Halliburton UK Ltd
Frank Bee	Enterprise Oil plc
David Bendrey	AGIP (U.K.) Ltd
Jonathan Bird	Shell Expro
Ron Boyd	Shell U.K Exploration & Production
Ian Brearley	HSE
David Briggs	DSND Subsea Ltd
John Brind	AMEC Offshore Services
Bob Bruce	HSE OSD
Tom Bryce	AMEC Offshore Services
Alastair Buchan	Wood Group Engineering
George Campbell	Kvaerner Oil & Gas Ltd
John Campbell	Rigblast Energy Services Ltd
Donald Carmichael	PGS Production
Graham Carnie	PGS Production Limited
Dave Carroll	BP Amoco
Jim Cassie	Enterprise Oil Plc
Gordon Challinor	Enterprise Oil Plc
Steve Charters	Halliburton UK Ltd
Ian Cheyne	Score (Europe) Ltd
Steve Chilvers	AMEC
Derek Clark	DSND Subsea Ltd
Derek Clark	Texaco North Sea UK Co
Mel Clarke	Amey Vectra
Mike Clarke	Transocean Sedco Forex
Sue Connochie	Enterprise Oil Plc
Jim Cook	Enterprise Oil Plc
Jan Corpe	Biffie Management Services
Fraser Coull	Wood Group Engineering
Michael Cubitt	Shell U.K. Exploration and Production
Dave Curry	Halliburton UK Ltd
Alistair Daly	Arco British Ltd
Richard Daniel	AMEC Offshore Services
Dave Daniels	Marathon Oil
Fiona Davies	MATSU
Del Davison	Rigblast Energy Services Ltd
W Dinham	BG Storage Ltd
Thomas Docherty	AMEC Offshore Services
Lewis Dolman	AMEC Offshore Services

John Dryburgh	Conoco UK Ltd
Rob Duncanson	AMEC
Mark Dunham	Metacor (Duffy & McGovern)
John Duthie	Enterprise Oil Plc
Bill Edgar	Wood Group Engineering
John Edwards	Offshore Design Ltd
Will Evans	Expro North Sea Ltd
Roddy Evans	Shell Expro
Ian Evans	Stena Drilling Ltd
Ian Findlay	Enterprise Oil Plc
Dennis Fordyce	IGL Engineering (UK) Ltd
Michael Forster	Amerada Hess
Alastair Forsyth	PGS Production
William Fox	BP Amoco
Ian Graham	Schlumberger Eval & Prod Svs
David Gray	EQE International
Mike Hackley	Shell U.K.
Gayle Halliday	Aramark Limited
Neil Hardie	IGL Engineering (UK) Ltd
John Hartley	Halliburton Brown & Root
Robert Harwood	Shell U.K. Exploration and Production
Mike Hay	Shell U.K. Exploration and Production
Yvonne Hepburn	BP Amoco
Norrie Hewie	Amerada Hess
Chris Hewson-Smith	DNO Heather Limited
John Holroyd	Shell Expro
Cliff Hoppe	Shell U.K. Exploration and Production
John Horley	Shell U.K. Exploration and Production
Dave Howie	Marathon Oil UK
Stephen Hudson	Conoco
Neil Hutcheon	Schlumberger Eval & Prod Svs
Kevin Jackson	Halliburton UK Ltd
Steve Jewels	BP Amoco
Norman Johnston	BP Amoco
Dennis Keown	Kvaerner Oil & Gas Ltd
Oliver Kieran	HSE OSD
Trevor Kletz	Loughborough University
Bob Kyle	UKOOA
Ray Lawrenson	Amerada Hess
Stuart Lawrie	Phillips Petroleum Co UK Ltd
Keith Lemmon	Expro North Sea Ltd
Alex Lindsay	AMEC Offshore Services
Norman Lloyd	Wood Group Engineering
Trevor Longstaff	Shell U.K. Exploration and Production

Malcolm Lowe	Joint Venture International Ltd
Iain MacDonald	AMEC
Patrick Mallan	Joint Venture International Ltd
Mark Searby	Expro North Sea Ltd
John Martin	Amerada Hess
Steve Mason	HSEC Ltd
Jim Massie	Rigblast Energy Services Ltd
G Massie	Specialist Maintenance Services Ltd
Hugh McClure	Britannia Operator Ltd
Kenneth McClymont	BP
Greg McColgan	Schlumberger Eval & Prod Svs
P McCrory	BP Exploration
Tony McCulloch	Enterprise Oil Plc
Douglas McFarlane	Bluewater Services (UK) Ltd
Yvonne McGregor	Aker Oil and Gas Technology UK plc
John McGuinness	Rigblast Energy Services Ltd
Tom McIntosh	OPITO
Neil McIntyre	Wood Group Engineering
William McLaren	PGS Production Services
Ian McMillan	Mobil North Sea Ltd
Kathryn Mearns	University of Aberdeen
James Meil	British Gas - Meil
Bob Miles	HSE OSD
Dusty Miller	Diamond Offshore Drilling (UK) Ltd
Mike Milliner	Step Change in Safety
Alan Moir	Talisman Energy (UK) Limited
Steve Morrell	Talisman Energy (UK) Limited
John Morrison	Specialist Maintenance Services Ltd
Norman Munro	Aramark Limited
Jim Murison	Britannia Operator Ltd
John Murray	Expro North Sea Ltd
Kris Norrie	BP Amoco
Arno Otten	Wood Group Engineering
Steve Pickthall	BP Amoco
Neil Pickwell	Wood Group Engineering
Arno Pont	Ergonomics Engineering Ltd
Colin Powell	BP Amoco
Taf Powell	HSE OSD
Peter Prior	AMEC Offshore Services
Bob Rae	Eurest Sutcliffe
Dave Rae	Halliburton UK Ltd
Conrad Richmond	Enterprise Oil Plc
Ron Robinson	BP Amoco
John Robinson	Shell U.K. Exploration and Production

Jonathan Roger	Britannia Operator Limited
Steve Black	Salamis
Andy Scott	PGS Production Services
Alan Seaton	Rigblast Energy Services Ltd
Peter Selkirk	Shell Expro
Tony Shelley	AMEC Offshore Services
Ian Sim	Schlumberger Eval & Prod Svs
Edgar Skilnand	PGS Production AS
Ivor Smith	Deutag Limited
Donald Smith	International Association of Oil and Gas Producers
Rachael Spencer	MATSU
Neil Stevenson	Exxon Mobil
David Stewart	Wood Group Engineering
Brian Stokes	Wood Group Engineering
Nick Targontsidis	Phillips Petroleum Co UK Ltd
Bob Taylor	AMEC Offshore Services
Gordon Thom	Halliburton
Ian Thomson	HSE OSD
Alan Thomson	Step Change
Jarle Thorso	PGS Production AS
Ian Tope	UKOOA
Bill Urquhart	Score (Europe) Ltd
Roger Vogel	Global Marine
Dave Warrender	Marathon Oil UK
Andrew Watson	AMEC Offshore Services
John Welsh	Shell UK Ltd
Eric Wesselingh	Rowan Drilling UK Ltd
Richard Weston	Arco British Ltd
Robert Whittaker	Brown & Root
Craig Wiggins	Shell U.K. Exploration and Production
Mark Wilkinson	AMEC Offshore Services
John Wilkinson	HSE
Steve Williams	Step Change
Ken Woolley	QCL International
Martin Worth	Talisman Energy (UK) Limited
Steve Wright	AMEC
Michael Wright	Greenstreet Berman
C.H. Yong	Shell U.K. Exploration and Production

Appendix 2
Delegate Feedback Form

Fax – Back to +44 (0) 1235 436585

To	**Fiona Davies & Rachael Spencer** **MaTSU**
Date	
From	**Name:** **Company:** **Number of pages:**

'MAINTENANCE - REDUCING THE RISKS': A JOINT INDUSTRY/HSE INITIATIVE

Please take a few minutes to complete this fax-back questionnaire and either hand it to Rachael Spencer or Fiona Davies at the event or return by fax.

All responses will be used in reporting and to help in planning future events to best meet your needs.

***** Please return your form by Wednesday 24 January 2001 at the latest *****

About You			
1	Which of the following would you class yourself as?	Workforce Safety representative Supervisor Manager Other	☐ ☐ ☐ ☐ ☐ (please describe)
2	How did you hear about the event?	Postal mailing list Email distribution From colleagues Saw it advertised Other?	☐ ☐ ☐ ☐ (please indicate where) ☐ (please describe)
3	Are there any other means you would like to see used for advertising such events?	Please describe	
The Format and Objectives of the Day			
4	What are your views on the format of the event? Do you prefer…..	Presentations Workshop sessions Exhibitions A mix of the above Other?	☐ ☐ ☐ ☐ (please describe)
5	Do you believe the day achieved its objectives of ….		Yes / No
		Allowing all parties to contribute views	☐ ☐
		Enabling knowledge sharing	☐ ☐
		Promoting examples of good practice	☐ ☐
		Learning lessons from poor practice	☐ ☐
		Moving towards solutions	☐ ☐
6	What are your views on the event as a whole? Please describe		

Individual Sessions and Workshops		
7	Which sessions did you find of <u>most</u> interest and why? Please tick the appropriate boxes and describe alongside. *Conference Sessions* Keynote Speech ☐ Stakeholder Views ☐ Maintaining Integrity (R Miles) ☐ Improving Human Reliability (S Mason) ☐ Examples of Industry Practice ☐ *Workshops* A: Maintenance strategies ☐ B: Team-based working ☐ C: Human error interdependency ☐ D: Making the SMS interface work ☐ E: Improving maintenance by reducing human error ☐ F: Task Risk Assessment ☐	
8	Which sessions did you find of <u>least</u> interest and why? Please tick the appropriate boxes and describe alongside. *Conference Sessions* Keynote Speech ☐ Stakeholder Views ☐ Maintaining Integrity (R Miles) ☐ Improving Human Reliability (S Mason) ☐ Examples of Industry Practice ☐ *Workshops* A: Maintenance strategies ☐ B: Team-based working ☐ C: Human error interdependency ☐ D: Making the SMS interface work ☐ E: Improving maintenance by reducing human error ☐ F: Task Risk Assessment ☐	
9	Would you be interested in attending further events of this type?	No ☐ Yes ☐
	If yes, would you like to see the maintenance topic developed further or do you have a suggestion for a further topic?	Maintenance: ☐ Other suggested topic:
Additional Comments		
10	Please provide any further comments you may have.	

Printed and published by the Health and Safety Executive
C0.50 7/01

MAIL ORDER
HSE priced and free
publications are
available from:
HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL
HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION
HSE InfoLine
Tel: 08701 545500
Fax: 02920 859260
e-mail: hseinformationservices@natbrit.com
or write to:
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

OTO 2001/007

£15.00

ISBN 0-7176-2075-1