Supply chain issues for offshore accidents in the Southern North Sea

RESEARCH REPORT 352

Supply chain issues for offshore accidents in the Southern North Sea

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The Health and Safety Commission set out a number of targets and strategies in Revitalising Health and Safety that were aimed at improving UK health and safety performance over the period 2000 - 2010. One such strategy included a better understanding of health and safety responsibilities through the contractor client interface and the supply chain. The supply chain is particularly important in the offshore industry where approximately 80% of work carried out offshore is by contract staff. This pilot study is concerned with identifying the issues that may be affecting the apparent plateau of incidents on offshore installations in the Southern North Sea (SNS), in particular the affect of the workforce supply chain. The research is based on comparison of factors identified through analysis of underlying causes of ninety six incidents recorded by one duty holder, with previous research on workforce perceptions of significant factors influencing the existing health and safety performance of duty holders in the SNS. The factors that emerge from this comparison include adequacy of maintenance regimes, training and competency and recording of accident/incidents. The incident analysis also highlighted issues related to procedures. These factors are discussed in relation to the targets and actions plans outlined by the Offshore Safety Division and the Offshore Industry in response to Revitalising Health and Safety.

HSE BOOKS

Acknowledgements

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1. EXECUTIVE SUMMARY

Background

During the late nineties the UK government reviewed the need to revitalise and provide new impetus to Health and Safety at work. The government's aim was to reinvigorate health and safety, to identify new approaches to improving workplace health and safety performance, particularly in smaller enterprises, to ensure that health and safety regulation remains compatible with trends in the development of industry and to ensure coherence between health and safety legislation and other government programmes. This resulted in the Department for the Environment, Transport and the Regions and the Health and Safety Commission developing a Strategy Statement on "Revitalising Health and Safety".

A key area identified in the Strategy is the requirement to have a better understanding of Health and Safety responsibilities throughout the contractor/ client interface and supply chain. The supply chain is particularly important in the offshore industry where approximately 80% of the work carried out offshore is by contract staff and incident data suggests that the rate of contractor incidents is greater than would be expected from numbers involved. Associated with this is fact that the incident performance of the offshore sector has been mixed over recent years.

The overall aim of this pilot study is to inform strategic thinking on the factors that may be affecting the apparent plateau of accidents in the offshore operations in the Southern North Sea (SNS), in particular the affect of the workforce supply chain.

Method

The methodology was carried out in four stages, these included:

1. Reviewing and characterising the HSE revitalising documents and the industry response.

2. Identifying workforce perceptions of the significant factors influencing the existing health and safety performance in the SNS (based on previous focus group research).

3. Analysing incident data provided by one of the major operators to identify potential trends in the underlying causes (described as active and latent failures).

4. Comparing the three data sources to identify common issues and potential differences.

Results and discussion

A number of factors emerged from the commonly occurring categories of underlying causes that may be related to factors identified by the focus groups and to aspects of the revitalising strategy. These include

Maintenance regimes

The incident analysis identified a large proportion of equipment/hardware failures with under lying causes relevant to maintenance regimes. The implication of these is the need for intervention through improved maintenance regimes. Associated with this was the relatively high number of occurrences of Design Deficiencies latent failures. All these points reflect the concerns of the focus groups in relation to cost cutting and maintenance regimes. The groups appeared to identify two areas of concern under this theme. One was poor design leading to

difficulties further down the life cycle of equipment when maintenance has to be carried out. The other was the reduction in funding leading to reduced planned maintenance and thus increasing the potential failure of equipment. The importance of design in safety is well recognised and OSD Plan of works 2003/04 included a topic programme on incorporating health and safety in design (TP3) (HSE, 2003). Statistics for 2003/04 (HSE, 2005c) highlight maintenance/construction continue to be the commonest work process environment for major injuries that year. The work force perception may be that reduction in funding is increasing the number of unplanned (breakdown) maintenance activities and thereby increasing operational risk. Equally significant is the number of Latent failures identified in relation to Maintenance Management.

Training and Competency

Training, Competence and Awareness, particularly gaps or omissions in an individuals training was highlighted as a frequently occurring latent failure in the incident analysis. This reinforces the issues surrounding training and competency identified by the focus groups. Underlying concerns of the focus groups included the loss of expertise from the industry due to demographic changes and a perceived lack of training investment by the industry. Data from Shell (2003) indicates that contractors are experiencing a higher rate of incidents. The data utilised in this research includes employees and contractors and therefore can only provide generalisations on this issue. However it is significant to note that a high proportion (80%) of the work carried out offshore is performed by contractors. Training competence and awareness is identified as a latent failure and therefore may not be immediately translated into the need for action. This is exemplified by the focus groups identifying particular issues that could be addressed through training. It may be relevant to note that training and competence do not appear to be directly addressed by the revitalising strategies, although may be there by implication for instance in the specific actions outlined by industry, although the strategies needed to address these actions are not identified.

Procedures

Although not directly identified as a theme by the focus groups, procedural issues appear to be significant in the incident analysis, in particular the active failure of not following procedures. This could be an indication of a lack of competence and therefore represent a training need. However there may be further explanations which could be related to human factors - organisational or behavioural. Behavioural safety has been given some emphasis within the Stepchange initiative and is part of the key programme KP2 Risk Management in the workplace – securing compliance (HSE, 2002).

A further aspect of procedures that emerges from the incident data analysis is the relatively high frequency of latent failures relating to inadequate procedures and instructions. This is a little more difficult to explain in relation to the focus group themes –it could be an extension of poor maintenance regimes and illustrate lack of management of preventative maintenance systems, for example. However it may to some extent be a reflection of the theme hazard identification and risk assessment through 'permit to work' which was given priority level 3 (least important) by the focus groups. This issue may to some extent be addressed by specific risk assessments that are done and the actions that people take, especially when circumstances change.

Alternatively this result may highlight an issue not recognised by the focus groups.

Accidents/incidents

The focus groups identified a number of concerns in relation to accidents and incidents including lack of consistency in methods of recording and the potential for personal

interpretation. Although the revitalising strategy includes targets to reduce occurrence of accidents, this aspect of consistent recording and analysing incidents is important as it helps to ensure that appropriate organisational/industry learning takes place.

It is noted that the research has a number of limitations based on use of existing data and small sample size used for the incident analysis.

2. INTRODUCTION

2.1 Background

Workplace injury and illness continues to be a significant international economic issue. In the United Kingdom there is statistical and anecdotal evidence to suggest that trends of health and safety improvement towards the end of the 20th century have begun to plateau if not decline (Smallman, 2001). During the late nineties the UK government reviewed the need to revitalise and provide new impetus to Health and Safety at work. The government's aim was to reinvigorate health and safety, to identify new approaches to improving workplace health and safety performance, particularly in smaller enterprises, to ensure that health and safety regulation remains compatible with trends in the development of industry and to ensure coherence between health and safety legislation and other government programmes. This resulted in the Department for the Environment, Transport and the Regions and the Health and Safety Commission developing a Strategy Statement on "Revitalising Health and Safety" (DETR, 2000). This document recognises the progress made through the introduction of the Health and Safety at Work etc Act 1974 and sets the health and safety agenda for the next twenty-five years.

The challenge of reducing work related ill-health was further addressed through the 'Securing Health Together' initiative. This was launched by the HSC as a joint government/industry initiative based on a ten year vision of tackling high levels of work related ill-health and reducing personal suffering, family hardships and costs to individuals, employers and society. (HSE, 2001).

A key area identified by these strategies is the requirement to have a better understanding of Health and Safety responsibilities throughout the contractor/ client interface and supply chain. (DETR, 2000) "*It is now widely recognised that, just as organisations stand to benefit from improved productivity when they improve health and safety management systems, so procurers stand to secure better value for money when their contractors do the same - for example contract specifications should make explicit reference to health and safety requirements*" (DETR, 2000 p30).

The need was also identified to engage all stakeholders and get commitment and involvement of everyone concerned. This would include involving all companies within the supply chain not just the client and main contractor. (HMSO, 2000a).

The supply chain is particularly important in the offshore industry where approximately 80% of the work carried out offshore is by contract staff (Shell, 2003) and incident data suggests that the rate of contractor incidents is greater than would be expected from numbers involved (Shell, 2003). Associated with this is fact that the incident performance of the offshore sector has been mixed over recent years, as illustrated in tables 1 and 2.

Table 1 Summary of injuries and dangerous occurrences for the offshore sector April 1999-March 2004 (HSE, 2005)

	1999/00	*2000/01*	*2001/02*	*2002/03*	*2003/04*
Fatalities	2	3	3	0	3
Major	53	53	47	64	48
Over 3-day	193	177	187	120	102
Total injuries	248	233	237	182	153
Dangerous occurrences	647	764	661	635	543

Table 2 Summary of injury rates per 100,000 workers in the offshore sector 1999/00-2003/04 (HSE, 2005)

	1999/00	*2000/01*	*2001/02*	*2002/03*	*2003/04*
Estimated workforce	19,000	23,330	23,206	20,619	18,793
Fatalities and major	289.5	240.0	215.5	287.5	271.4
Over 3-day	1015.8	758.7	805.8	582	542.8

These data reflect the progress in achieving overall UK targets where there is no clear evidence of change in the fatal and major injury rate. The balance of evidence suggests that overall incidence of work-related ill health is likely to have risen since 1999/2000 (HSE, 2003).

Indications of improvement in occupational health management within the offshore sector are also mixed. Since the baseline year of 1999/2000 there has been a steady fall in the rate of accidents that have been reported as resulting in MSD injuries (RIDDOR). It is too early to evaluate any changes in company approaches as a result of this programme. The Step Change Occupational Illness scheme is still developing. Information from the first two years data cannot be easily compared due to different number of duty holders. MSD and mental illness are main reasons for illness reports for both years. 2002/2003 comparison shows a rise in MSD cases from 42% to 59% and a reduction in mental ill health from 50% to 21% of the total reports given. These differences may reflect differences in reporting (TSO, 2004).

These data may raise concerns as to the efficacy of the strategy outlined in revitalising programmes.

2.2 Aims of the project

The overall aim of the research is to inform strategic thinking on the factors that may be affecting the apparent plateau of accidents in the offshore operations in the Southern North Sea (SNS), in particular the affect of the workforce supply chain. More specifically the aim of this pilot study is to:

- Analyse incidents occurring offshore, through the identification of underlying causes and compare with workforce perception of health and safety management; and.

- Benchmark these against the targets and issues outlined in revitalising health and safety strategy.

3. METHODOLOGY

The methodology was carried out in four stages, these included:

5. Reviewing and characterising the HSE revitalising documents and the industry response.

6. Identifying workforce perceptions of the significant factors influencing the existing health and safety performance in the SNS.

7. Analysing incident data provided by one of the major operators to identify potential trends in the underlying causes.

8. Comparing the three data sources to identify common issues and potential differences.

These stages are detailed below:

Stage 1. **Review and characterise the HSE revitalising documents and the industry response**

This stage involved reviewing HSE material published under the banner of revitalising health and safety. This included overarching targets and strategy for the UK and more particularly trends and targets that have been identified for the offshore sector by the Offshore Division of the HSE. The review also included the industry response (duty holders and major contractors) as part of the Step Change Programme and the Cross Industry Safety Leadership Forum. Printed documents and web sources were used for this review.

Stage 2. **Identify workforce perceptions**

The aim of the second stage was to gather workforce perceptions to identify emerging health and safety issues for those working in the SNS. This included the supply chain and the contribution of the contractor work force in achieving health and safety goals and targets. The data was taken from previous work carried out by SNS IMTs (England, 2005). A series of 6 focus groups were run yearly over the three year period 2000/01-2002/03. The focus groups were targeted at three groups - the workforce, Offshore Installations Managers and Senior Managers. The following industry sectors were involved in the workforce groups:

- Main oil company and main contractor employees
- Drilling company and accommodation barge employees
- Wells servicing and support company employees
- Maintenance and subcontract company employees

The process of these Workforce Involvement Focus Groups is illustrated in figure 1. At the end of each phase a report was produced to inform the following series of focus groups. This enabled the development of a robust framework. The results from phases one and two informed the final phase.

Stage 3. **Analyse incident data supplied by an operator**

The aim of this stage was to identify underlying causes of incidents. The analysis was based on incident data supplied by a major operator. Ninety six incidents covering the period Jan 2003-Jan 2005 were provided. These included hydrocarbon releases, environmental spills, near misses and accidents. Due to the relatively low total number of incidents on the data-base, those involving both contractors and employees of the organisation were included. The data was extracted from a structured incident root cause data base. This is enabled incidents to be analysed by:

- Case category – this is described as a 'broad' incident type
- Active failures
- Latent failures

The data was analysed as a whole set and then further analysed by case category.
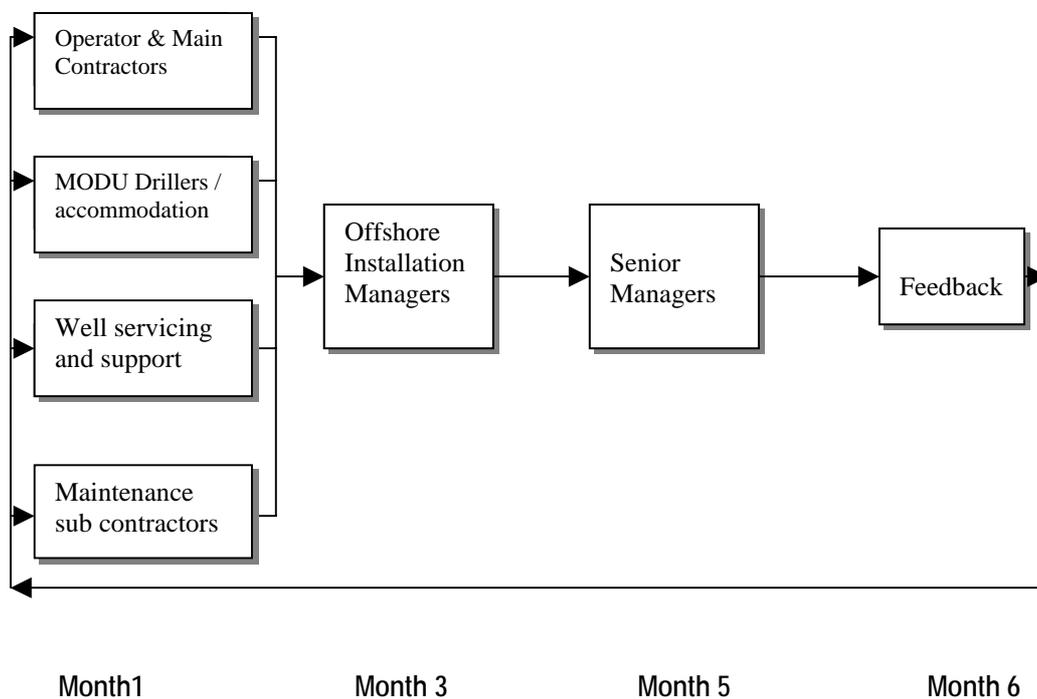
Figure 1 Process map for the workforce Involvement Focus Groups
(Source England, 2005 p47)

Stage 4   Compare the three data sources

The data was collated and analysed. The two main sources of data were compared to establish whether issues and themes identified by workforce perceptions are reflected in the causes of incidents and ultimately therefore if the strategy and targets identified in the revitalising programme are appropriate and or are being achieved. The results are presented in the following section.

4.   RESULTS

The results of stages 1 to 3 are presented in the following sections.

4.1   Targets outlined in Revitalising Health and Safety

4.1.1   Overall targets

The general targets set out in Revitalising Health and Safety (HMSO, 2000), are based on all stakeholders working together and include:

- The reduction in the number of working days lost per 100,000 workers from work related injury and ill health by 30% by 2010
- The reduction in the incident rate of fatal and major injury accidents by 10% by 2010
- The reduction in the incident rate of cases of work related ill health by 20% by 2010
- The achievement of half of the improvement under each target by 2004

The baseline for these targets was April 1999 to March 2000. The final year for meeting the targets is April 2009 to March 2010.

To support these targets a number of priority areas were identified, these include:

- Falls from heights
- Musculoskeletal disorders
- Slips and trips
- Work related stress
- Workplace transport

Each of the priority areas has reduction targets for 2004 and 2010. Their selection was based on the high figures in the incidence rate of injuries or ill-health, the large numbers affected and the presence of 'levers' available to bring about changes and success (HSE, 2005a).

Specific occupational health targets under the ten-year strategy (2000-2010) outlined in Securing Health Together includes:

- Reduction of ill-health causes to members of the public by 20%
- 30% reduction in number of days lost due to work-related ill-health
- Those off work due to ill-health or disability to be made aware of opportunities to prepare for and find work as appropriate
- Those not in employment due to ill-health or disability to be made aware of opportunities to prepare for and find work as appropriate

4.1.2   OSD Response

Each government/ industry sector was expected to respond to the challenges laid down in these strategy documents and the Offshore Safety Division of the Health and Safety Executive responded with the Plan of Work 2000-2001 identifying the following broad targets (HMSO, 2000c).

- To achieve a continuous year on year improvement trend in safety that has delivered at least a 50% reduction in the fatal and major injury rate by 2010.

- To reduce the number of working days lost per 100,000 workers from work-related injury and ill health by 30% by 2010.

The baseline for these targets was April 1999 to March 2000. The final year for meeting the targets is April 2009 to March 2010.

In addition to the above broad revitalising targets The Offshore Safety Division also set the following area specific targets to be achieved by 2004 (HMSO, 2000).

- 10% reduction in rate of injuries / ill health from manual handling
- 15% reduction in reported incidents of slips trips and falls from height
- 15% reduction in accidents and dangerous occurrences involving lifting and mechanical handling.

The baseline for these targets was April 1999 to March 2000. The final year for meeting the targets is April 2003 to March 2004.

Fatal and major injury rate baseline.

The baseline figure for the national fatal and major injury rate is 260 per 100,000. The target for 2010 is 230 per 100,000. These figures include a correction for under reporting that is based on returns from Labour Force Surveys.

The baseline figure proposed for the offshore industry's fatal and major injury rate is the three year rolling average at March 2000, i.e. the average rate for the period April 1997 to March 2000 = 306.7. A 50% improvement on this is a target of 153 per 100,000. In terms of injury rates per million man-hours, the baseline and target are approximately equivalent to 0.67 and 0.33 per million man-hours respectively. The figure for 2010 will be the HSE figures for the period April 2007 to March 2010. These figures do not include any correction for under reporting.

Additional OSD baseline.

Specific baselines for OSD have been calculated as follows:

- 358 per 100,000 workers for the rate of injuries / ill health from manual handling.
- 416 per 100,000 workers for the incidence of slips, trips and falls from height.
- 674 per 100,000 workers for the incidence of accidents and dangerous occurrences involving lifting and mechanical handling.

Lost working days baseline

Although many companies collect data on the number of workdays lost, there is no industry-wide collection of data and no agreed definitions of what should be counted. This problem is not unique to the offshore industry. The national baseline has been established as 24 million days per year; 18 million due to work-related ill health and 6 million due to work related injuries. This is equivalent to 97,000 days per 100,000 workers.

OSD action plans

More recent OSD targets (HSE, 2005b) have been set and include the following action plans:

- Manned installations to be proactively inspected annually
- 97% of accidents classified as serious enough for mandatory investigation to be investigated
- 95 % of valid complaints to be investigated

- 50% reduction in significant hydrocarbon releases to be achieved through identification of common failure modes, increased awareness of poor performance and identification of root causes/effective remedies
- 25% reduction in events with the potential to give rise to a collision to be achieved through targeted investigation, development of guidance and inspection of operations against the resulting industry guidance
- 100% of submitted safety cases to be assessed prior to scheduled date for commencement or continuation of operations.

4.1.3 Offshore Industry response to Revitalising health and safety

The offshore industry set down its strategy for responding to the Governments' Revitalising Health and Safety in July 2001 via a paper issued by the Cross Industry Safety Leadership Forum (CISLF, 2001). The response focused on the high level targets set by the Government but recognised the fact that pro-active, leading indicators are required to monitor any action plans that may be implemented to achieve those targets.

Development of action plans

Actions plans were developed by focussing on the main causes of injuries and lost workdays in the offshore sector. During 1999/2000 there were 2 fatal accidents and 52 major injuries within the offshore industry reported under Reporting of Incidents Diseases and Dangerous Occurrences Regulations (RIDDOR) (HMSO, 1999b). Analysis of these accidents highlighted that:

The main kinds of accident causing fatal and major injuries were:
- 36% due to slips, trips or falls from height
- 25% due to being struck by moving, flying or falling objects

The main operations resulting in fatal and major injuries were:
- 29% maintenance
- 25% drilling/work-over,
- 25% deck operations.

Based on the above information, the offshore industry action plans focused on reducing injuries due to:
- Slips, trips and falls
- Lifting and mechanical handling
- Dropped objects

Specific actions that were identified by the industry included:

- Reducing accidents during access to the work area. Awareness of hazards appears to be lower during access to work compared to awareness during execution of actual work.
- Correct positioning: reducing number of people being injured when in positions where they have no need to be.
- Increasing the willingness to act when observing unsafe acts or conditions.
- Improving connection between the risk assessments that are done and the actions that people take, especially when circumstances change.

4.2   Workforce Perceptions of the significant factors

The results from the final series of focus groups formed the basis for the data presented here. It was felt by this stage of the consultation that a robust framework had been developed which supported open responses and free flow of discussion between participants.

A large number of issues were raised by the groups. Each of the focus groups was asked to weight the issues raised on a scale one to twelve. The purpose of this approach was to identify those issues that were considered high priority by the focus group and to filter out the "nice to have" or a strongly presented but minority viewpoint. The issues raised were drawn together in themes. Each theme was then prioritised on a scale of one to three.

A total of 35 issues were raised that were grouped into 14 themes.

For the purposes of the data analysis, priority one and priority two themes are presented. Under each of these themes the issues with weighting of one, two, three or four are discussed. This approach thus incorporates the most important generic themes underpinned by the strongest issues. A total of seven themes underpinned by 13 prioritised issues are presented. Table 3 indicates the total prioritised themes and weighting of the issues underpinning them.

Table 3 Workforce themes and issues

Priority	Theme	ISSUE WEIGHTING											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Planning and Communication	*						*		*			
1	Employment	*											
1	Accident / Incident	*			*			*				*	
1	Training and Competency	*	*	*				*					
2	Cost Cutting		*		*			*					
2	Culture and Accountabilities		*	*									
2	Stress		*	*				*					
3	New Starts			*				*					
3	Permit to Work				*	*	*	*					*
3	Safety Reps/Advisors				*	*					*		
3	Dangerous Goods						*						
3	Feedback wanted						*		*				
3	Maintenance and Disposal						*						
3	Safety Initiatives						*						

Priory themes one and two are presented in the following sections with key issues and supporting issues highlighted.

4.2.1 Key issues and support issues

Planning and communication

Key issue
Management is not ensuring realistic forward planning given the reduction in Supply Vessel runs. This is impacting on personnel supporting quayside and vessel activities.

Support issues
Explosives on vessel for long periods and then returned to onshore
Decrease in support vessels increasing transport of cargo by helicopter
Onshore and offshore not reaching agreement over change management issues
Cost reductions have led to more multi role vessels but cargo logistics and offshore activity planning has not kept pace with changes
Still evidence of last minute planning i.e. Friday Afternoon requests
Understanding and competency of planners appears an issue.
Reduction in frequency of supply runs appears not to have been considered

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Employment conditions

Key issue
Safe teams rely on the basis of good attitudes and behaviour's by all, this stems from creating the right environment within the community we live and work. Terms and conditions of employment will always be a factor in team development. It is recognised that basic salaries will always vary between employers but differences in basic benefits hamper creating an aligned community. There is a need to acknowledge that not only that we have a mature industry but also a mature workforce, who have invested their careers in the offshore sectors. The opportunity to create offshore cycles, which recognise this investment for all, exists and not only would assist in community alignment but would also attract new blood to the industry. Concerns do exist that whenever terms and condition are raised management consider this as the workforce whinging and use this to disconnect it from health and safety.

Support issues
Working conditions not good
Different terms and conditions
Working time directive – where are we?
Train local people – do not use expensive experts
Level playing field creates better moral and safety

Accidents/incidents

Key issues

Consistency of Methods of Recording / Investigation of Incidents which removes personal interpretation. To underpin the continued safety cultural improvement seen across the industry, a consistent balanced approach is required to ensuring that incident management processes are supportive. Workforce support is clear for a common system that removes all personal interpretation and strives for integrity.

Everyone is individually accountable and has a responsibility for others who they work and live with. There is a need to ensure that we maximise on the learning from all incidents and investigations, which should be a positive experience for all. When individual mistakes are made, support diminishes when investigations are not balanced with the potential consequences. There is a clear need to ensure we do not drive minor incidents underground, we all want to learn, we are at the sharp end.

Support issues

What is a 'near miss'? Difference of definition across companies
Focus on those barriers, which did prevent escalation as well as those that failed
Interpretation of RIDDOR is not consistent
Over reaction to incidents has a negative impact on supporting the right culture. Impact of senior management approach
Knee-jerk reaction to incident solutions, e.g. ban knives, ban spanners

Training and competency

Key issues

Some companies are treating personnel differently with respect to ongoing training. Evidence is available that Ad-Hoc and Agency personnel are expected to bare the cost of core safety and refresher training themselves. Issues most frequently manifest themselves during shutdowns and loss of core crew personnel. The reduced skill pool available to the industry is not able to meet competency requirements.

Competency continues to be an area of concern. Issues most frequently manifest themselves during shutdowns and loss of core crew personnel. The reduced skill pool available to industry is not able to meet competency requirements. Improvement has been seen in personnel from agencies; however a greater focus is needed.

Concerns exist that issues associated with the Industry ageing workforce are manifesting themselves through an increased risk to the person and their ability to perform as expected.

Support issues

Survival refreshers are not being funded by employing companies. Companies are not bearing costs of refreshers for core safety training held by employees when employed. Companies pushing NVQ's systems but insufficient assessors and verifiers impacting on support and completions
New starts not being made aware of training that is available
Middle management safety coaching skills not keeping pace with expectations of desired behaviours
More emphasis needed on direct safety coaching for management
Contractor Safety Passport Scheme CITB endorsed, interface with Vantage?
Double standards by offshore operators placing work with small onshore based companies and not applying same expectations or not auditing
Expectation placed on sub-contractors to provide equipment that meets offshore standards but not prepared to cover the cost
Shutdown personnel not meeting competency requirements

Cost cutting and maintenance regimes

Key issues
There is a critical need to ensure we achieve value for money and that resources can meet the expectations of maintenance regimes. Evidence exists of poor design leading to poor equipment reliability and maintenance difficulties. Perceptions exist that budget not safety is a driver and that quality is sacrificed to maintain overhead margins. Opportunities to maximise on the knowledge and experience within the core crews are not consistently applied during design and construction. Real value in respect of quality of purchase, maintenance regimes and reliability can be achieved through engagement. Ask the right people and you will get the right answer.

Concerns exist that the reductions in maintenance regimes are leading to more frequent unplanned shutdowns increasing operational risks.

Support issues
Equipment reliability
Breakdown maintenance
Investment in technology
Ergonomics, cannot access equipment to maintain
Ergonomics versus cost, little money spent up front saves big money down line.
Design accidents out, do not change procedures
Involvement of the right people in design
Maintenance people should be involved in the design and construction
Product design should be 'fit' to maximise safety not 'fit' for budget
Good quality means good safety

Culture and Accountabilities

Key issues
A difference of maturity in safety focus is recognisable between the smaller operators compared with those larger and longer established in the UKCS. An industry responsibility exists to ensure core HSE expectations and support is comparative.

Communication over the last few years has increased exponentially to a point where information overload is common place. The need for a focused approach to providing the right information at the right time is essential.

A common clear and concise industry message that ensures no misunderstanding of safety expectations of everyone and the rules by which everyone can rely on to be fair and constantly applied is needed. This needs to take account of team development and have integrity by ensuring the message is endorsed by the workforce through visible engagement.

Support issues
Root causes include money, time and tighter budgets
Influence of personnel not familiar with safety drivers/culture

Key issues

Stress continues to be a real issue; excessive hours are being worked to get the job done by service and support personnel. Insufficient consideration is given to forward notification of requirements during activity planning, therefore impacting on service and support companies' ability to manage working hours and individuals to manage their family and social lives.

Service and Support personnel are continuing to experience stress primarily resulting from pressure to get the job done. The bureaucracy from increased paperwork, reduction in the number of personnel in the execution of work, which in some cases is driven from the lack of bed spaces and poor planning, compound this.

Support issues

Lack of forward planning

Support personnel working hours maybe controlled offshore, but onshore working hours are not

Vantage will not address or control long hours being worked onshore

Potential for service company personnel to go offshore tired

Service/support personnel last to be considered in forward planning

Personnel turned up for red eye but not on flight, reflection of bad planning

Last minute notifications of requirement impacting on individual's quality/social life and transfers stress to family

Increase in number of day trips (red-eye out, last flight back)

Stress being transferred to family through broken promises etc, those that call off service support do not consider this

4.3   Analysis of incidents

The ninety six incidents were analysed by elements of the incident root cause analysis data base. These included
- Case categorisation
    - Active Failures level 1
    - Active Failures level 2 (a more specific description of level1)
        - Latent Failures level 1
        - Latent Failures level 2 (a more specific description of level 1)

4.3.1   Case categorisation

Figure 2 illustrates the analysis by case categorisation. A number of incidents were associated with more than one categorisation, giving a total of 106. Environmental spill and equipment/hardware failure were the most common. There were a relatively large number of uncategorised (data element not completed). The miscellaneous category (4) included one each of manual handling, catering, fire/explosion and diving.
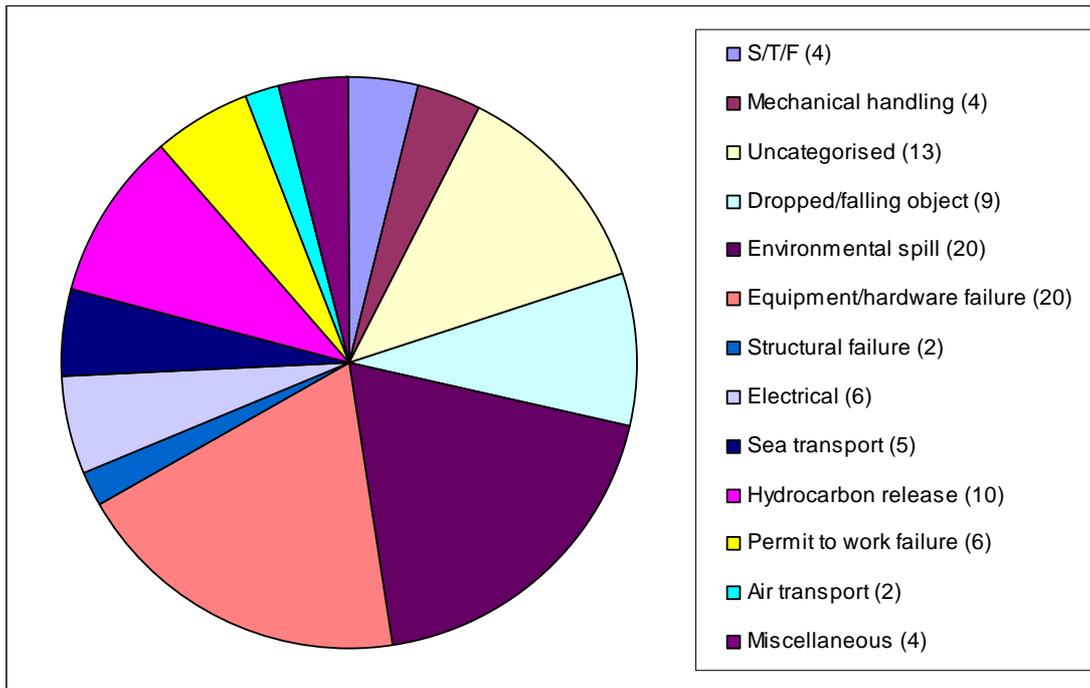
Figure 2 Analysis of incident by case category

4.3.2   Active failures

The 106 case categorisations were analysed by first and second level active failures. In some instances more than one active failure was identified for a particular categorisation giving a total of 133. The results are presented in figure 3 and table 3.
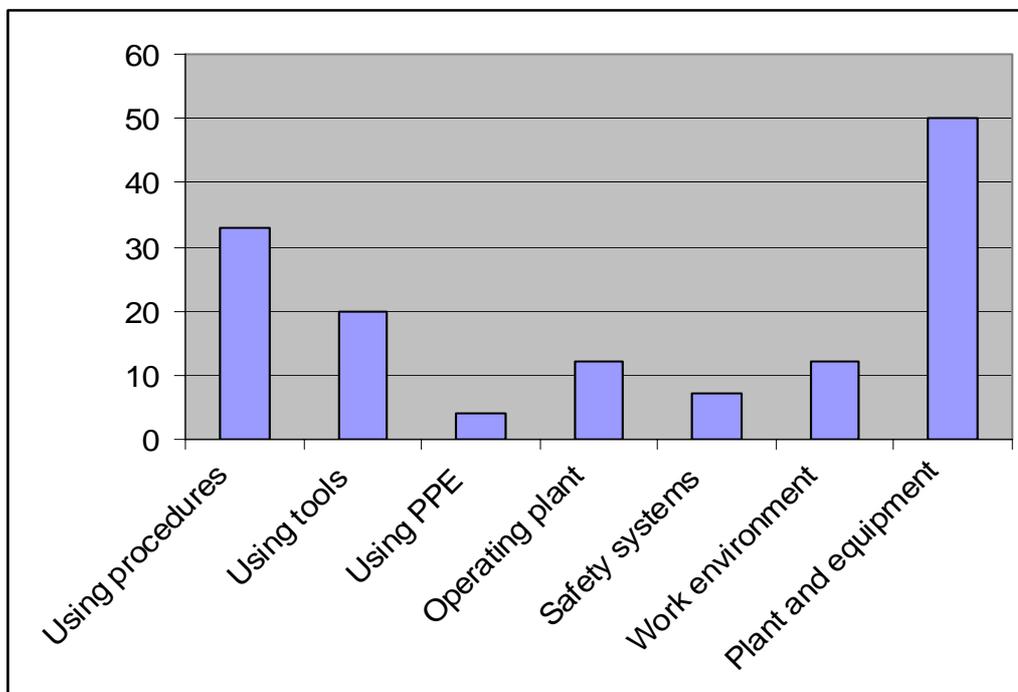

Figure 3 Analysis of incidents by first level active failures

Figure 3 illustrates that Plant and Equipment (50) and Using Procedures (33) are the most frequently identified first level active failures, whilst the number associated with Using PP items is relatively low (4).

Table 4 Number of active failures by first and second level

Active Failure First level	No. of occurrences	Active Failures second level	No. of occurrences
Using procedures	33	Procedure not used	7
		Using an inadequate procedure	6
		Using the wrong procedure	2
		Procedure not followed	18
Using tools	20	Tools, equipment, material not used	2
		Inadequate tool, equipment or material used	6
		Using incorrect tool, equipment or material	7
Using PP items	4	PP items not used	1
		Using incorrect PP items	3
Operating plant	12	Plant inadequately prepared for maintenance/repair	8
		Wrong plant operated	1
		Faulty plant operated	12
		Plant operated incorrectly	1
Safety systems	7	Guards/barriers missing, inadequate or defective	5
		Detection and alarm systems missing, inadequate, defective or inhibited	2
Work environment	12	Includes…	
		Poor layout/design	2
		Slippery or uneven walk surface	1
		Incorrectly place objects	4
		Loose objects	1
		Inadequate lighting	1
		Ionising radiation	2
		Adverse weather conditions	4
Plant and equipment	50	Mechanical failure – corrosion, erosion, wear, fatigue fracture	34
		Structural failure of collapse	2
		Insulation missing, defective or inadequate	2
		Exceeding operating limits	1
		Plant status not as expected	9
		Electrical short circuit or overload	1
		Error or failure in computer programmer	1

Table 4 highlights frequently occurring second level active failures and includes Mechanical failure – corrosion, erosion, wear, fatigue fracture (34) and Procedure not followed (18). Perhaps also worth note is Faulty Plant Operated.

4.3.3   Analysis of latent failures

Associated with active failures the incident investigator is able to identify and categorise underlying causes described as first and second level latent failures. Again, more than one latent failure may be identified for each active failure. The frequency of occurrence of first and second level latent failures is presented in table 5.

Table 5 Number of latent failures by first and second level

Latent failure first level	No. of occurrences	Latent failure second level	No. of occurrences
Communication failing	24	Communications equipment	7
		External factors	0
		Personal factors	11
		Standards and procedures	6
Defences – HS&E Control system failure	16	Equipment	5
		Organisation	0
		Plans, procedures and information	10
		Unfavourable conditions	1
Design deficiencies	26	Design process such as change management, cost control, planning and purchasing	5
		Inadequate: not taken due account of external environment, location or ergonomics	16
		Standards, criteria or philosophy used for the design	5
			0
Error enforcing conditions	30	People related issues such as illness, medication or behaviours	3
		Poor working environment	1
		Supervisory controls	12
		Unfamiliar with working environment or not adequately protected	14
Hardware failures	49	Inspection and maintenance	31
		Tools or equipment not appropriate for the duty	14
		Tools/equipment suitable but problems with use, procedures, controls or conditions	4
Housekeeping	13	Housekeeping poorly executed	7
		Management or supervision of housekeeping	3
		Working environment	3
Incompatible (conflicting) goals	6	Individual factors	6
Training, competence and awareness	38	Gaps or omissions in an individuals training	25
		Content or quality missing	9
		Management of training	4
Procedures, instructions and working practices	40	Omissions or weaknesses in the procedures	21
		Inadequate, not relevant or missing	6
		Not used or not known	8
		Safety culture	5
Maintenance Management (incl inspection and testing)	40	Standards, procedures and equipment	13
		Environmental factors	13
		People related issues	7
		Planning, documentation and control	7
Organisation (Incl HS&E responsibility deficiencies	2	Organisation or responsibilities not clear	2

Table 5 illustrates that frequently occurring latent failures include Hardware Failures (49), particularly inspection and maintenance; Training, Competence and Awareness (38), particularly Gaps or omissions in an individuals training; Procedures, Instructions and Working Practices (40), particularly Omissions or weaknesses in the procedures and Maintenance Management (incl inspection and testing) (40).

4.3.4 Associations between categories

Further analysis was carried out to identify potential associations in the data. This was limited due to the relatively small data set. Analysis was carried out on the most frequently occurring case categories - environmental spills, hardware failure, hydrocarbon release, permit to work and dropped/falling objects. Overall association occurs in a small number of cases. A summary is presented in table 5.

Environmental spills.
Of the 26 active failures identified for environmental spills 50% were categorised as Plant and Equipment and more specifically 38% (10) were categorised as Plant and Equipment mechanical failure – corrosion/erosion, wear, fatigue fracture. A further seven active failures were categorised as Operating Plant. Fifty four latent failures were identified. These were drawn from Design Deficiencies, Error Forcing Conditions, Hardware Failures and Training, Competence, Awareness. However eight latent failures were classified as Maintenance Management (incl inspection and testing) and are associated with Plant and Equipment.

Equipment/Hardware failure
Twenty five active failures and 36 latent failures were identified for Equipment/Hardware Failure. 60% (15) of the active failures were categorised as Plant and Equipment and more specifically 44% (12) were categorised as Plant and Equipment mechanical failure – corrosion/erosion, wear, fatigue fracture and 6 of these were classified as hardware latent failures. Other latent failures were identified including 10 assigned to Procedures, Instruction and Working Practices although not associated with particular active failures.

Hydrocarbon release
Of the 16 active failures identified for hydrocarbon release, 44% (7) were categorised as Plant and Equipment and 31% (5) were categorised as Using Procedures. Forty Eight latent failures were identified including 14 in the category Maintenance Management (incl inspection and testing) and 11 in the category Training, Competence and Awareness, although there was no evidence of associations with specific active failures.

Permit to work.
Of the 16 active failures associated with permit to work 50% were categorised as Using Procedures and 31% (5) as Operating Plant. 41 latent failures were identified including 12 in the category Error enforcing conditions, eight in the category Plant and Equipment, and 6 in the category Hardware failures, although there was no evidence of associations with specific active failures.

Dropped objects.
Of the 10 active failures identified 5 were categorised as Work Environment and 4 as Operating Plant and Equipment. Thirteen latent failures were identified including 5 in the category Maintenance management (incl inspection and testing), although again there was no evidence of associations with specific active failures.

Table 6 Associations between categories

Case categorisation	Active failure	Second level	Latent failures
20 Environmental spills	**26 Total** 13 Plant & equipment ⟶ Operating Plant	10 mechanical failure	**54 Total** 8 Maintenance Management
20 Equipment Hardware failure	**25 Total** 15 Plant & equipment ⟶	12 mechanical failure ⟶	**36 Total** 6 Hardware failure 10 Procedures, instruction
10 Hydrocarbon release	**16 Total** 7 Plant & equipment 5 Using procedures		**48 Total** 14 Maintenance Management 11 Training , competence & awareness
6 Permit to work	**16 Total** 8 Using procedures 5 Operating plant		**41 Total** 12 Error forcing conditions 8 Operating Plant and equipment 6 Hardware failures
9 Dropped object	**10 Total** 5 Work environment 4 Operating Plant and equipment		**13 Total** 5 Maintenance Management

5. DISCUSSION AND CONCLUSIONS

From the analysis of case categorisations and active and latent failures a number of themes emerge (through the relatively high number of occurrences) that may be related to topics identified by the focus groups and to aspects of the revitalising strategy. However there is no distinction between employees and contractors.

5.1 Emerging themes

5.1.1 Maintenance regimes

In addition to the large number case categorisations identified as equipment/hardware failures (20), three under lying causes come out of the analysis that are relevant to maintenance regimes. These are the active failures *Plant and Equipment* particularly *mechanical failure* and *Operating Plant – faulty plant operated* and the latent failure *Hardware Failure – inspection and maintenance*. The association between equipment/hardware failure case categorisation and the underlying causes is also noted (see table 6). The implication of these is the need for intervention through improved maintenance regimes. Associated with this was the relatively high number of occurrences of the latent failure *Design Deficiencies* (in particular *'inadequate; not taken due account of external environment, location or ergonomics'*). All these points reflect the concerns of the focus groups in relation to cost cutting and maintenance regimes. The groups appeared to identify two areas of concern under this theme. One was poor design leading to difficulties further down the life cycle of equipment when maintenance has to be carried out. The other was the reduction in funding leading to reduced planned maintenance and thus increasing the potential failure of equipment. The importance of design in safety is well recognised and OSD Plan of works 2003/04 included a topic programme on incorporating health and safety in design (TP3) (HSE, 2003). Statistics for 2003/04 (HSE, 2005c) highlight maintenance/construction continue to be the commonest work process environment for major injuries that year. The work force perception may be that reduction in funding is increasing the number of unplanned (breakdown) maintenance activities and thereby increasing operational risk. Equally significant is the number of Latent failures identified in relation to *Maintenance Management (incl inspection and testing)*. These issues may further reflect the concerns of the focus groups on cost cutting and maintenance.

5.1.2 Training and competency

Training, Competence and Awareness, particularly *gaps or omissions in an individuals training* has been highlighted as a frequently occurring latent failure in the root cause analysis. This reinforces the issues surrounding training and competency identified by the focus groups. Significantly the groups identified training and competency as priority level one. Underlying concerns of the focus groups included the loss of expertise from the industry due to demographic changes and a perceived lack of training investment by the industry. This could affect the level and type of skills available and impact on the overall technical competence within the offshore sector. The focus groups expressed the view that client companies may not be prepared to invest in the training of temporary workers and this impacts on the companies further down the supply chain. Data from Shell (2003) indicates that contractors are experiencing a higher rate of incidents. The data utilised in this research includes employees and contractors and therefore can only provide generalisations on this issue. However it is significant to note that a high proportion (80%) of the work carried out offshore is performed by contractors. Hope (1999) suggests that the assurance of competence, delineation of responsibility and training are key areas to be addressed in the contractor management process. The support issues highlighted by the focus groups identify particular

topics that could be addressed, for example the competency of mangers in cultural and behavioural issues. Training competence and awareness is identified as a latent failure and therefore may not be immediately translated into the need for action. This is exemplified by the focus groups identifying particular issues that could be addressed through training. It may be relevant to note that training and competence do not appear to be directly addressed by the revitalising strategies, although may be there by implication for instance in the specific actions outlined by industry (see page 8), although the strategies needed to address these actions are not identified.

5.1.3 Procedures

Although not directly identified as a theme by the focus groups, procedural issues appear to be significant in the data analysis. In particular the active failure of *Using Procedures – procedure not followed.* This could be an indication of a lack of competence and therefore represent a training need and be linked to the previous points. However there may be further explanations which could be related to human factors, for example taking a short cut to save time because of production pressures – a reflection of cultural issues - organisational or behavioural. Behavioural safety has been given some emphasis within the Stepchange initiative and is part of the key programme KP2 Risk Management in the workplace – securing compliance (HSE, 2002).

A further aspect of procedures that emerges from the incident data analysis is the relatively high frequency of the first level latent failure *Procedures, Instructions and Working Practices* and in particular the second levels of '*omissions or weaknesses*' and '*inadequate, not relevant or missing*'. This is a little more difficult to explain in relation to the focus group themes –it could be an extension of poor maintenance regimes and illustrate lack of management of preventative maintenance systems, for example. However it may to some extent be a reflection of the theme *hazard identification and risk assessment* through '*permit to wor*k' which was given priority level 3 (least important) by the focus groups (see page 9). **The key issues** identified for permits included greater understanding and ownership by the workforce of risk assessment, control and the process of issuing permits. This can be seen in improved risk identification, the use of improved PTW systems and workforce empowerment. **Support issues** included more risk assessments, greater risk awareness, electronic permits systems, interaction with controller to discuss the job, ownership of safety passed to the workforce and better use of PTW systems (WIN, 2003). This issue may to some extent be addressed by specific action identified in the industry response which included improved connection between the risk assessments that are done and the actions that people take, especially when circumstances change.

Alternatively this result may highlight an issue not recognised by the focus groups.

5.1.4 Accidents/incidents

The focus groups identified a number of concerns in relation to accidents and incidents including lack of consistency in methods of recording and the potential for personal interpretation. Although the data analysis does not provide directly relevant data on this topic, the experience of undertaking this research may reinforce the view of personal interpretation. There are a number of examples. The case categorisation contains a mixture of categories some of which may be described as related to high level tasks/activities e.g. Sea Transport whilst other case categories are outcome related e.g. slips/ trips and falls. The accident investigator has the opportunity to complete more than one case categorisation and in a number of cases this has been done reflecting perhaps in an attempt to reflect both activity and outcome. This may not always be the case. It is also noted that there were over 10% of the case categorisations were unclassified. This may indicate that none of the categories were considered suitable. In addition one of the active failure categories described as Improper

Human Behaviour had no incidents were associated with it. This may be appropriate or may reflect a lack of appreciation of the definition of this particular category. Although the revitalising strategy includes targets to reduce occurrence of accidents, this aspect of consistent recording and analysing incidents is important as it helps to ensure that appropriate organisational/industry learning takes place.

5.2 Limitations of the research

There are a number of significant limitations with this research which include
- using existing data ; and
- small sample size

Using existing data has a number of disadvantages associated with it. As noted in section 4.1.4 this data is based on a number of employees within the organisation completing the incident record. As a result the consistency and reliability of the data is not assured since is it likely to be subject to individual interpretation, dependent on training, competence, experience etc.

The data set is relatively small and therefore can only be used in an indicative manner.

5.3 Conclusions

Although there is a relatively small amount of incident data, the comparison of this with the focus groups appears to reinforce perception on the following themes:

- maintenance regimes;
- training and competency; and
- accidents/ incidents.

In addition to these, procedures were identified as an issue by the incident analysis. This maybe covered indirectly by the focus group themes, particularly the theme 'permit to work', although it is suggested that procedures is an issue that may warrant more detailed consideration.

A difference between contractors and employees cannot be drawn out of research since that data used contained both groups. However all issues are of relevance to contractors particularly that of training and competency.

The issues identified may be partly addressed by revitalising strategies, but this is not always directly the case. It is noted that much of the revitalising approach is driven by targets and priority areas and how these are actually achieved may be left to the organisation. The type of analysis presented in this research, based on root-cause analysis, therefore may provide an insight which could be useful in developing such strategies.

The initial findings of this pilot study suggest that further work in this area may be useful.

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