



Effective supervisory safety leadership behaviours in the offshore oil and gas industry

Prepared by the
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for the Health and Safety Executive

**OFFSHORE TECHNOLOGY REPORT
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Effective supervisory safety leadership behaviours in the offshore oil and gas industry

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EXECUTIVE SUMMARY

The first line supervisor has been identified as having a critical role in the management of safety. It is therefore important to identify which aspects of supervisor behaviour are associated with effective safety management. A study by Mearns, Flin, Fleming and Gordon (1997) appears to be the first published study carried out in the UK offshore oil industry, which investigated the factors associated with effective supervisor safety management. This study identified eight different factors, which separated supervisors that managed safety effectively from those that were less effective. There were a number of weaknesses in this study, such as the low sample size (23) and the qualitative nature of the research. To have confidence in the findings, it was necessary to replicate the study using a different method and to increase the sample size.

The first stage of the current study involved the development of two self-completion questionnaires, one for offshore supervisors and one for their subordinates. The subordinate questionnaire consisted of four sections, demographic information, safety climate scale; self-report safety behaviour and supervisor safety leadership behaviour. The safety leadership scale contained 15 items, designed to measure the eight safety leadership factors identified in the previous study.

The supervisor questionnaire consisted of a demographics section, a safety climate scale, a safety management attitude scale, the Fleishman leadership style scale and a 16-item safety leadership behaviour scale. The 'safety management attitude scale' measured attitudes that corresponded to factors identified in the previous study. The 'safety behaviour leadership scale' mirrored the safety leadership scale in the subordinate questionnaire.

The supervisor questionnaires were sent to 140 first line supervisors on the nine participating installations. The subordinate questionnaires were distributed at safety meetings to the work group members of the participating supervisors. The overall response rate for the study was 33%, which is low, but it is similar to other offshore studies using self-completion questionnaires. In general, both supervisors and subordinates indicated that they had a positive perception of the safety climate on their installation. Subordinates reported very low levels of risk taking behaviour and high levels of proactive safety behaviour. In general, they reported that their supervisors displayed high levels of positive safety leadership behaviour. The majority of supervisors tended to report that they had a 'considerate' style of management but they were more divided about the statements referring to 'initiating structure' style of management. They also indicated that they had positive safety management attitudes and that they displayed high levels of positive safety leadership behaviour.

Analysis revealed that a number of the supervisor behaviours had a significant impact on subordinate safety behaviour. The results indicated that four of the eight factors identified by Mearns et al (1997) had an impact on respondents' safety. The aspects of supervisor behaviour that appeared to impact on subordinate safety included:

- Valuing Subordinates,
- Visiting the worksite frequently,
- Work group participation in decision making
- Effective safety communication.

An overall micro-macro model was constructed to summarise the results. This model indicated that both macro factors (safety climate factors) and micro (supervisor leadership behaviour) had a direct effect on safety performance. The macro factors also had an indirect effect on safety performance by influencing

supervisor behaviour. It is suggested that this model could be useful in the development of safety climate change programs.

The study also confirmed the importance of the first line supervisor in the management of safety. The findings highlight the importance of the interpersonal relationship between supervisors and their subordinates. It was concluded that interpersonal and work group dynamics have a significant impact on safety performance. This aspect of safety management warrants further investigation, especially in the light of the increasing movement towards self managed teams.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
ACKNOWLEDGEMENTS	vii
1. INTRODUCTION	1
1.1 BACKGROUND AND OBJECTIVES	1
1.2 OFFSHORE SUPERVISORS' MANAGEMENT OF SAFETY	1
1.3 OBJECTIVES	2
1.3.1 <i>Specific Aims</i>	3
2. METHOD.....	4
2.1 PILOT STUDY.....	4
2.2 PARTICIPANTS.....	4
2.3 SUPERVISOR QUESTIONNAIRE	5
2.3.1 <i>Measuring supervisors' safety management attitudes and behaviours</i>	5
2.4 SUBORDINATE QUESTIONNAIRE	7
2.5 SUPERIOR EVALUATION SCALE.....	8
2.6 EFFECTIVE SAFETY MANAGEMENT.....	8
2.7 DATA ANALYSIS.....	8
3. RESULTS.....	10
3.1 DESCRIPTIVE STATISTICS	10
3.1.1 <i>Supervisor questionnaire</i>	10
3.1.2 <i>Subordinate questionnaire</i>	13
3.1.3 <i>Superior evaluation scale</i>	15
3.2 DIFFERENCES BETWEEN GROUPS	16
3.2.1 <i>Supervisors versus non supervisors</i>	16
3.3 RELATIONSHIPS BETWEEN FACTORS FROM THE SUBORDINATE QUESTIONNAIRE....	19
3.4 EFFECTIVE AND LESS EFFECTIVE SUPERVISORS	21
3.5 PREDICTORS OF SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR	21
4. DISCUSSION.....	23
4.1 GENERAL.....	23
4.1.1 <i>Supervisor questionnaire</i>	23
4.1.2 <i>Subordinate questionnaire</i>	23
4.2 FACTORS WHICH INFLUENCE WORKER SAFETY.....	24
4.2.1 <i>Accident versus non accident subordinates</i>	24
4.2.2 <i>Predictors of subordinate risk taking behaviour</i>	24
4.2.3 <i>Predictors of subordinate safety behaviour</i>	25
4.3 COMPARISON WITH FINDINGS FROM THE PREVIOUS STUDY	26
4.4 EFFECTIVE SUPERVISOR MANAGEMENT BEHAVIOURS	26
4.5 PREDICTING SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR.....	28
4.6 MICRO - MACRO SAFETY CLIMATE MODEL	28
5. CONCLUSIONS AND RECOMMENDATIONS.....	31
REFERENCES	33

A1. APPENDIX 1 DETAILED RESULTS.....	A1-1
A1.1 DESCRIPTIVE STATISTICS.....	A1-1
<i>A1.1.1 Supervisor questionnaire.....</i>	<i>A1-1</i>
<i>A1.1.2 Subordinate questionnaire.....</i>	<i>A1-11</i>
<i>A1.1.3 Superior evaluation scale.....</i>	<i>A1-17</i>
A1.2 MULTI VARIATE ANALYSIS.....	A1-18
<i>A1.1.1 Differences between groups.....</i>	<i>A1-18</i>
<i>A1.1.2 Relationships between factors from the subordinate questionnaire.....</i>	<i>A1-21</i>
<i>A1.1.3 Supervisors' self report behaviour compared with subordinate evaluation of supervisor behaviour.....</i>	<i>A1-23</i>
A1.3 EFFECTIVE AND LESS EFFECTIVE SUPERVISORS.....	A1-23
A1.4 PREDICTORS OF SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR.....	A1-25

APPENDIX 2 SUPERVISOR LETTER

APPENDIX 3 SUPERVISOR QUESTIONNAIRE

APPENDIX 4 SUBORDINATE QUESTIONNAIRE

APPENDIX 5 SUPERIOR EVALUATION FORM

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1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

This project was designed to investigate the role of the offshore supervisor in safety and accident prevention. The study was sponsored by BP Exploration, Phillips Petroleum, AMEC Process and Energy and the Offshore Safety Division of the UK Health and Safety Executive. This is the second study to investigate offshore supervisors' management of safety. The previous study, by Mearns, Flin, Fleming and Gordon, (1997) used a semi-structured interview technique, to identify the behaviours and attitudes of supervisors that manage safety effectively. They identified a number of factors that distinguished effective from less effective supervisors. The purpose of this study was to investigate if the previous findings could be replicated using a different experimental method. In addition, it was felt that it would be of interest to investigate how supervisor safety behaviours interacted with other organisational factors such as 'perceived management commitment to safety'.

In recent years, there has been an increasing recognition in high reliability industries of the importance of the cultural and behavioural aspects of safety management. An increasing number of studies have been carried out investigating safety culture in safety critical industries, for example Cox and Cox (1991) and Lee, MacDonald and Coote (1993). In addition to this, a number of books have recently been published discussing the factors which underpin safety culture, for example Reason (1997) and Turner and Pidgeon (1997). In parallel with these scientific investigations, individual companies and industry groups have embarked upon a number of safety culture improvement initiatives, for example the STEP change initiative in the offshore oil industry.

While many studies (Mearns et al, 1997; Cox & Cox 1991) have concluded that organisational factors such as perceived management commitment to safety are important, few to date have demonstrated effective intervention strategies. There is therefore a need to explore the supervisors' role in safety management and in safety climate improvement programs. It is likely that the actions and behaviours of individual offshore supervisors will continue to have a significant impact on subordinate safety behaviour. In addition to this, the supervisor is likely to be the focal point of the majority of safety improvement initiatives. This will be the case because the supervisor acts as the interface between management and the workforce and therefore is likely to be prime medium for communication (Fleming, Flin, Mearns & Gordon, 1997).

1.2 OFFSHORE SUPERVISORS' MANAGEMENT OF SAFETY

The first academic study to have addressed the role of the first line supervisor in safety management on offshore oil installations was carried out by Mearns et al, (1997) as a part of a larger human and organisational factors study. The Mearns et al study consisted of three main sections, these were: a safety climate survey; an examination of the supervisors' role in safety management and an investigation of the human factors' causes of accidents. The aims and objectives of the supervisor study were: i) To examine the offshore supervisors' role in safety and risk management. ii) To measure and identify offshore supervisors' attitudes to risk and their safety management skills. iii) To identify the supervisory skills that are required for effective safety management.

Supervisors' management of safety was measured by conducting a one hour semi structured interviews with 40 offshore supervisors. The interview was based on the Critical Incident Technique, developed by Flanagan (1958). The purpose of the interview was to identify the important factors in supervisor safety management. Half of the subordinates of these supervisors were given a short safety questionnaire. Of the 202 sampled 112 (55% response rate) subordinates returned the questionnaire. The OIMs on the participating installations evaluated their supervisors' performance on a twelve-item scale. The interviews with the supervisors were transcribed and categories were created and the data coded. The supervisors' management of safety was classified as effective or less effective on the basis of their subordinates self reported risk taking behaviour (measured in the subordinate safety questionnaire) and the score they received on the OIM supervisor evaluation scale.

The supervisors' scores on the OIM scale and the mean score for their subordinates self reported risk-taking behaviour were cluster analysed. This revealed that supervisors could be separated into three groups:

- Group 1: High OIM rating and low subordinate risk taking behaviour.
- Group 2: High OIM rating and high subordinate risk taking behaviour.
- Group 3: Low OIM rating and high subordinate risk taking behaviour.

In the light of this finding Group 1 (16 supervisors) was taken to be the effective supervisors and Group 3 (7 supervisors) the less effective supervisors. The two groups were compared for any differences in their management of safety to identify the behaviours, inter-personal skills and attitudes required for effective safety management.

The comparison of the two groups revealed that: effective supervisors appeared to:

- I. Value their subordinates more;
- II. Visit the work site frequently;
- III. Visit work site out of genuine interest and to see if their subordinates required any assistance;
- IV. Encourage participation in decision making.

The less effective supervisors appeared to:

- I. Abdicate responsibility for their subordinates' safety when they were not directly involved in the operation;
- II. Focus more on productivity and deadlines;
- III. Feel under pressure to get the job done and that it was sometimes difficult to be safe and get the job done.

Unfortunately while these finding are interesting they are based on only 23 interviews and must be treated with caution. It is therefore important to carry out a further research to confirm these findings on larger sample.

1.3 OBJECTIVES

The overall aim of this project is to investigate the validity of the findings from the supervisors' section of the previous Mearns et al (1997) offshore supervisor study, using a different method and on a larger sample size.

1.3.1 Specific Aims

- I. Develop a questionnaire to be given to subordinates to measure supervisors' safety management. This questionnaire will be based on the factors the Mearns et al (1997) study concluded were important for effective safety management.
- II. Develop a supervisor safety questionnaire to measure their performance on the factors that were identified as important in the Mearns et al (1997) study.
- III. Classify supervisors as effective and less effective in their management of safety. Classification will be based on their work groups' self report safety behaviour, the supervisors' superior (e.g. OIM) evaluation of their safety management.
- IV. Suggest possible interventions to improve supervisors' management of safety.

2. METHOD

The method for this study was based on procedure used by Mearns et al (1997) in their investigation of offshore supervisors' management of safety. They used a semi-structured interview technique to investigate what attitudes and behaviours supervisors should display in order to manage safety effectively. While their findings are interesting, they are based on a low sample size and qualitative analysis. It was therefore important to examine the validity of their findings by replicating their study on a larger sample and using a more quantitative method.

The current study involved the development of two self-completion questionnaires, a subordinate safety climate and a supervisor safety management questionnaire. A third questionnaire, superior evaluation form developed by Mearns et al (1997) was also used. These three questionnaires were used to facilitate the evaluation of each supervisor by themselves, their subordinates and their superior (a 360-degree evaluation). It was felt that the use of both superior and subordinate evaluations would produce a more accurate measure of supervisors' safety management performance.

The supervisor questionnaires were individually addressed mailed out to all the first line supervisors on the participating platforms. The subordinate questionnaires were distributed to all non-supervisory staff on the participating installations. The OIM's on the installations completed superior evaluation forms for the supervisors involved in the study.

2.1 PILOT STUDY

The questionnaires were pilot tested by carrying out 10 face to face interviews onshore with subjects from installations that did not participate in the main study. The interviews involved getting the interviewee to respond to the pilot questionnaire. Any difficulties the interviewee had responding to were noted. The interviewee was then asked to comment on the questionnaire and to suggest any issues, which they felt should be included. The questionnaires were adjusted in the light of these comments and then presented to the project steering group that was made up of safety managers from the sponsoring organisations and a HSE representative, for comment.

2.2 PARTICIPANTS

Participants in this study can be classified into three different categories based on the questionnaire that they received. The three categories included; subordinates, first line supervisors and managers. Each respondent group received a different questionnaire. In total 1080 questionnaires were distributed to nine North Sea offshore oil and gas installations. The 1080 questionnaires included; 800 subordinate questionnaires, 140 supervisor questionnaires and 140 superior evaluation questionnaires. The supervisory questionnaires were individually addressed and sent to the supervisory staff that had been identified by the sponsoring companies. Supervisors were defined as "anybody who had people reporting to them and that their subordinates did not themselves supervise others". An individually addressed letter was sent to each supervisor explaining the aims and objectives of the study and that individual responses would be confidential to the research team.

The management group consisted of two OIMs from each of the participating BP and Phillips installations, in addition to four onshore AMEC managers. Each manager was sent a one page questionnaire (supervisory evaluation scale) for each of their supervisors, that had been sent a supervisor questionnaire. In the case of AMEC the supervisors' discipline manager completed the evaluation scale because it was felt that these individuals would have a broader knowledge of their performance.

The subordinate questionnaire was distributed to all the non-supervisory staff on the participating installations or in the case of access provided by AMEC questionnaires were distributed to AMEC staff via discipline safety meetings.

2.3 SUPERVISOR QUESTIONNAIRE

This questionnaire was constructed to measure offshore supervisors' perception of the safety climate on the installation and their management style. In addition, two scales were developed to measure the safety leadership behaviours and attitudes, which were identified as important in the previous offshore supervisor study undertaken by Mearns et al, (1997). The questionnaire was split into four sections (see appendix 3).

Section one of the questionnaire covered demographic information, which included; supervisor experience, job category and training. Each supervisor was given a personal number, which was printed on the top of the first page, so that their responses could be linked to their subordinate's questionnaires. A letter accompanying the questionnaire explained the function of the number and the purpose of the study (see appendix 2).

Section two contained the safety climate scale that was used in the previous study (Mearns et al, 1997). This scale was developed by taking the items from the factors, which had reliability values above 0.70. One statement from the safety climate scale (I can get the job done quicker by ignoring some rules) was changed after all the individuals that participated in the pilot study complained that it was ambiguous. This statement was changed to 'some jobs would be impossible to perform if all the rules were followed to the letter'. Ten supervisor safety management statements were included in this section of the questionnaire (see section 2.3.1).

Section three contained the Fleishman's Leadership Opinion scale (Fleishman, 1953). Participants indicated how often supervisors should perform the activities described by the 40 statements on a five point scale. This scale is designed to measure consideration and initiating structure. The Fleishman scale was used in the previous study. While it did not distinguish between effective and less effective supervisors, the two concepts that it measures did appear similar to the issues that separated effective from less effective supervisors.

Section four contained the fifteen supervisor safety behaviour statements (see section 2.3.1).

2.3.1 Measuring supervisors' safety management attitudes and behaviours

The Mearns et al (1997) study identified 17 concepts that could be used to describe the factors that were important in supervisor safety management. These concepts covered interpersonal relationships (valuing subordinates), behaviours (visiting the worksite), perceptions (pressure for production) and attitudes (Importance of safety). A series of Chi square tests revealed significant differences between

effective and less effective supervisors on eight of the 17 concepts. These included:

- Valuing subordinates
- Awareness of subordinates feelings
- Frequency of visiting worksite
- Motivation for visiting the worksite
- Work group participation
- Abdication of responsibility for subordinates safety
- Pressure to get the job done: focus on production
- Safety communication

The supervisor safety management, attitude and behaviour scales were developed by generating attitude and behaviour statements for each of the above eight concepts that separated effective from less effective supervisors. These scales were altered on the basis of the face to face interviews and after detailed discussions from the steering group. In addition to the attitude statements developed for the eight concepts, two additional statements were developed to measure the supervisors' safety consciousness. These statements were developed because pilot study participants and the steering group felt it was important to measure supervisors' attitude to safety. The following two statements were developed to measure supervisors' safety consciousness: 'I am as safety conscious at home as I am offshore' and 'I feel that I am more safety conscious than other supervisors on this installation'. These two statements were included along with the other safety management attitude statements in the safety climate scale.

The final version contained 10 attitude statements and 15 behaviour statements. These statements were used to construct the supervisor safety management scale and the supervisor safety behaviour scale (see table 1 for details). The two scales were in two different sections of the questionnaire. The attitude statements were contained within the safety climate scale where the participants responded on a five-point scale from 'fully disagree' to 'fully agree'. The behaviour statement went to form section four entitled 'Leadership behaviour'. The participants indicated how often they carried out a specific activity on a five-point scale from never to always. An additional statement was included in the leadership behaviour scale to measure supervisors' perception of the amount of risk taking behaviour performed by their subordinates. This statement was: '*I feel my subordinates take short cuts, which involve little or no risk*'. It was felt that it would be interesting to compare supervisors' responses to this statement to their subordinates' responses to the same statement.

Table 1
Supervisor safety management behaviour and attitude statements categorised under the concepts that separate effective from less effective supervisors

Supervisor behaviour statements	Safety management attitude statements
<i>Valuing subordinates</i>	
I make it clear to each of my subordinates that I value their contribution to the team I show concern for team members' welfare	My subordinates are not particularly better than other workers on this installation I often have to speak to my subordinates about their performance not meeting the required standard
<i>Awareness of subordinates</i>	
I find it difficult to know how my subordinates are thinking and feeling	It is important to be aware of how my subordinates are thinking and feeling
<i>Frequency of visiting worksite</i>	
I visit the worksite three or more times a shift	It is better not to visit the worksite often, as it makes people feel that they are being spied upon
<i>Motivation for visiting the worksite</i>	
I visit worksites to check that my subordinates are working	I visit the work site frequently to encourage safe working
<i>Work group participation</i>	
I carry out safety inspections with my subordinates I involve my subordinates in decision making I involve work group members in risk assessments	It important for a supervisor to dictate what safety precautions must be taken when their work group are carrying out a job.
<i>Abdication of responsibility for subordinates safety</i>	
I accept responsibility for my subordinates' safety I ensure that my subordinates understand the PTWs that they work under	Supervisors are often unfairly blamed if their subordinates are involved in an accident
<i>Pressure to get the job done: focus on production</i>	
I have to put pressure on my subordinates to get the job done on time I talk more about safety than productivity	I protect my subordinates from feeling under pressure to meet deadlines
<i>Safety communication</i>	
I attend pre-job safety meetings and tool box talks I have difficulty motivating subordinates to work safety I encourage safe working by setting a good example	

2.4 SUBORDINATE QUESTIONNAIRE

The subordinate questionnaire was developed to measure respondents' evaluation of their supervisor's performance on the safety management behaviours identified in the previous Mearns et al study and the safety climate on the installation. While the supervisors' actions, attitudes and their relationship with subordinates effect work group safety behaviour the context or climate within which they operate is also likely to have an impact. It was important to measure the safety climate on the installation so that relationship between it and supervisors' safety management could be investigated. In addition, it would be useful to relate the supervisors' responses to the safety climate survey to those of their subordinates.

A subordinate questionnaire similar to the supervisor questionnaire was developed for non-supervisors on the installations (see appendix 4). Section one of this

questionnaire covered demographic information, which included; supervisor's name, offshore experience, job category and included questions on previous involvement in accidents and dangerous occurrences. The questionnaire also contained the safety climate scale used in the supervisor questionnaire. The 10 specific supervisor attitude statements were not included because it was felt that subordinates could not validly respond to statements about their supervisors' attitudes. Section three of the questionnaire contained a safety behaviour scale and a supervisor safety leadership behaviour scale. The safety behaviour scale contained eight statements which respondents had to indicate how often they performed each activity on a five point scale from 'never to very often'. Five of the items were taken from Mearns et al (1997) and the remaining three were taken from Flin, Fleming and Gordon (Unpublished report). The supervisor safety leadership behaviour scale contained 15 items and respondents had to indicate how frequently their supervisor performed each behaviour on a five point scale from 'never to always'. The 15 statements mirrored the statements from the supervisor questionnaire as described above in section 2.3.1.

2.5 SUPERIOR EVALUATION SCALE

The performance of each of the supervisors surveyed was evaluated by their superior using the OIM evaluation scale developed by Mearns et al (1997) (see Appendix 5). This evaluation scale contained twelve performance criteria to rate the supervisor on a six point scale from unsatisfactory to an outstanding performer. The OIMs on the participating installations were given an evaluation scale for each of the supervisors on their installation, who had been sent a questionnaire. In the case of AMEC the supervisors' discipline manager completed the evaluation scale because it was felt that these individuals would provide a more accurate evaluation of their performance. In addition, AMEC supervisors were on installations operated by organisations that were not participating in this study and therefore it was not possible to be confident that the OIMs would complete the evaluation scales.

2.6 EFFECTIVE SAFETY MANAGEMENT

The attitudes, behaviours and perceptions related to effective supervision were identified by comparing supervisors with the best scores on the safety performance indicators, with those who performed less well. The supervisor safety performance indicators that were used in the previous project were also be used in this study. Supervisors were classified as either effective or less effective on the basis of their subordinates' self report safety behaviour and their score on the superior evaluation scale. Supervisors who manage safety most effectively were defined as those who receive a high score on the superior evaluation scale and whose subordinates report a low level of risk taking behaviour.

2.7 DATA ANALYSIS

The responses from the returned questionnaires were entered into a SPSS Windows (Statistical Package for Social Sciences) database. The data were analysed on computer using SPSS. This software package provides a range of data management and statistical techniques (Norusis 1992). Statistical methods used included factor analysis (principal components analysis), analysis of variance, chi-square, correlation and multiple regression.

Factor analysis is a statistical method by which abstract concepts, such as safety attitudes, can be investigated. It assumes that a set of variables combine to form an underlying dimension (or factor), which is determined by analysis of the

correlation between the subjects' responses on these variables. The degree to which each variable contributes to a given factor is indicated by the 'factor loading'. It is similar to a correlation coefficient where the closer the 'loading' is to 1, the stronger it's association to that group. Varimax rotation was used to adjust the composition and loading of items to yielded factors from within a given scale that are independent (orthogonal) of each other. The number of factors to be extracted was obtained by inspecting the scree plot. The scree plot is a plot of the total variance associated with each factor. A distinct break between the steep slope of large factors and the gradual trailing off of the rest of the factors indicates the number of factors to be yielded from the scale. Missing values were excluded listwise, where only cases with valid values for all variables were used. Cronbach's Alpha was used to test the reliability of the dimensions, where a high correlation between items refers to a reliable dimension.

A series of ANOVAs were performed to identify any differences between groups (e.g. occupation). Bivariate correlations and regression analysis were performed to identify any relationships between subordinates' self-report safety behaviour and their evaluation of the supervisors' management of safety. Differences between effective and less effective supervisors were identified by performing a series of t-tests.

3. RESULTS

A summary of the results are present below and detailed descriptive statistics and analysis can be found in Appendix 1.

3.1 DESCRIPTIVE STATISTICS

The combined number of questionnaires returned was 309 which is an overall response rate from both the supervisors (n=92) and the subordinates (n=217) questionnaires of 33%. This response rate is conservative because more questionnaires were sent than were distributed to offshore employees. While the response rate is low it is similar to previous offshore studies, for example the Mearns et al (1997) study also had a response rate of 33%.

3.1.1 Supervisor questionnaire

The 'supervisor safety management' questionnaire was returned by 92 of the 140 supervisors who participated in the study, which was a response rate of 66%. The questionnaire consisted of four main sections: (see appendix 3 for details).

1. Biographical questions,
2. Safety climate scale, (including ten safety management questions)
3. Fleishman leadership opinion questionnaire (Fleishman, 1957)
4. Supervisor safety management behaviour scale

3.1.1.1 DEMOGRAPHIC INFORMATION

The sample contains a slightly different occupational mixture than would be expected on an average offshore installation, with more construction and less production supervisors. In addition to this a high percentage (91%) of the sample were employed by contracting companies. This is likely to be due the fact that a contracting company was one of the organisations providing access. A larger than expected percentage of supervisors had spent less than a year on their current installation. This is probably related the large percentage of construction supervisors in the sample. It is interesting that the majority (82%) of supervisors report that they work alongside their subordinates.

3.1.1.2 SAFETY CLIMATE (SECTION 2)

The same safety climate scale was used in both the subordinate and supervisor questionnaires. It was therefore possible to combine responses from both the questionnaires to create a single database of 309 responses. The combined data set was used for the factor analysis. The factor analysis revealed a five factor solution. The five factors that were revealed were slightly different from the original Mearns et al (1997) factor structure. The five factors revealed by the analysis were:

- I. Reluctance to speak up about safety
- II. Perceived lack of commitment to safety
- III. Safety on the Installation
- IV. Supervisor commitment

V. Cost versus safety

Together these factors describe 45% of the data variance, with factor I describing 25% of the variance.

The majority of respondents tended to disagree with statements, which suggest that employees do not speak up about safety. For example over 85% of respondents disagreed with the statements: *I sometimes feel under pressure from my workmates to take chances*; *The OIM is too busy to be involved in minor safety issues* and *If you say too much about safety they might fire you*. These results indicate that the majority of supervisors feel that safety is important. They also indicate that in general respondents from the current study felt that safety was equally as important as respondents from the previous studies. However, there are a number of statements which are still not very positive for example 55% of supervisors agreed with the statement: *People are reluctant to report near-misses*, 42% agreed with *People are reluctant to report accidents* and 33% agreed with *Minor accidents cause so much hassle they are quite often ignored*. This may indicate a bureaucratic accident and near miss reporting system, which makes reporting time consuming or it could be an indication of a perception of 'blame culture'.

The second factor contains statements that refer to the confidence the respondents have in their management's commitment to safety. Over 50% of respondents disagreed with the majority of statements that suggest a lack of management commitment to safety. For example 78% disagreed with the statement *The PTW system is just a way of covering people's backs* and 68% disagreed with the statement *People are rushing jobs on this installation*. There are however two statements with which less than 50% of supervisors disagree: *Some rules are only there to cover management's back* (47% disagree) and *Job insecurity means that people on this installation like to keep information to themselves* (49% disagree). It is concerning that more than 50% of supervisors do not disagree with a statements suggesting that management create rules just to cover their back. In general, it appears that the supervisors in the present study agree with the statements less than supervisors in the Mearns et al (1997) safety climate survey yet they appear to agree more than the 25 respondents in the previous supervisor study.

Factor three contains statements that refer to the respondents' perception of the status of safety on their installation. In general, the supervisors report that they feel safety is perceived to be important and that there is a high standard of safety on their installation. For example 89% of supervisors agreed with the statement *'Safety is taken seriously on this installation, it's not just a cosmetic exercise'* and 90% agree with the statement *The standard of safety is very high at my place of work*. One interesting point to note is that fewer supervisors agreed with statements that refer to management behaviour. For example, 65% agreed with *The OIM is always on the look out for safety rule violations* and 71% agreed with *I feel that the management on this installation are concerned about my general welfare*. Having said this, very few supervisors actively disagree with these statements. It is interesting to note that while they are positive about the state of safety they are less positive about management's' role in creating this positive state of safety.

The statements in factor four refer to the respondents' perception of their supervisors. In general the supervisors indicate they have a positive opinion of supervisors. It is interesting that while over 50% of respondents agree with all the statements only 59% agreed with *'My supervisors care about safety more than the average worker'* and 68% agreed with *'My supervisors aren't scared of taking the blame for their errors'*. This interesting because one would assume that supervisors would be more positive about supervision in general. It is also interesting to note that the item *'This installation has a 'no-blame culture'* is contained within this factor as this suggests that level of a no blame culture is determined by supervisors.

Factor five is the final factor and appears refer to the conflict between getting operations completed on time and doing them safely. This concept has been identified by many safety climate researchers and has been referred to as 'protection versus production' by Reason (1997). It is interesting and concerning to note that 68% of supervisors report that *'The rules do not always describe the safest way of working'*. This suggests that supervisors do not have confidence in them and therefore are not likely to ensure that their subordinates adhere to them. It is important to investigate why supervisors do not feel that the rules describe the safest way of working. It is also worrying to note that over 50% agree with the statement *Some jobs would be impossible to perform if all the rules were followed to the letter*.

3.1.1.3 SUPERVISORS' MANAGEMENT OF SAFETY (SECTION 2)

Within the safety climate scale a number of statements were included to investigate if the attitudes that Mearns et al (1997) concluded separated effective supervisors from less effective have an impact on supervisory performance. In general, the majority of respondents reported a safety management style that was similar to the effective supervisors identified in the Mearns et al study. This illustrated by the fact that over 90% of supervisors agreed with the statements: *It is important to be aware of how my subordinates are thinking and feeling* and *I protect my subordinates from feeling under pressure from production deadlines*. In contrast to this, there were three statements where the responses of over 50% of the supervisors suggested that they had different attitudes as those reported by the effective supervisors in the Mearns et al study. For example only 41% disagree with the statements *Supervisors are often unfairly blamed if their subordinates are involved in an accident* and *My subordinates are not particularly better than other workers on this installation* and only 26% agree with the statement *I feel that I am more safety conscious than other supervisors on this installation*.

3.1.1.4 FLEISHMAN LEADERSHIP SCALE (SECTION 3)

The Fleishman leadership scale was developed in America in the 1950's to measure the aspects of first line supervisors' leadership style which influence performance. The scale measures two factors 'Consideration' and 'Initiating Structure' which have been linked with supervisory performance on a number of different indicators (Fleishman, 1953). Supervisors that report high levels of 'consideration' tend to have lower levels of staff turn over and absenteeism (Fleishman and Harris, 1962). Employees with supervisors that report high level of initiating structure, tend to be more productive. It was initially felt that scoring high on one scale precluded a high score on the other scale but later research has found that the most effective supervisors scored highly on both factors (Cummins, 1971). This scale was used in the previous study of offshore supervisors by Mearns et al (1997) but no significant differences between effective and less effective supervisors on the two scales were identified. The effective supervisors had a higher mean score for 'consideration' and a lower score on the 'initiating structure' scale.

The majority of respondents reported that they felt supervisors should show high levels of consideration. For example 91% of supervisors indicated that they felt that supervisors should never or seldom *'Change the duties of people in the work group without first talking it over with them'* and 80% indicated that supervisors should often or always *'Back up what people under you do'*. In contrast to this 41% of respondents indicated that they felt that supervisors should never or seldom *'Give in to others in discussions with your work group'*.

Respondents varied in the in the level of 'initiating structure' that they report. For example 35% of respondents reported that they felt that supervisors should never or seldom *'Encourage slow working people in the work group to work harder'*. While

25% report that they felt that supervisors should always or often *'Encourage slow working people in the work group to work harder'*. It is interesting that there is a greater amount of variance in the initiating structure scale than in the consideration scale. This suggests that supervisors are in less agreement about ideally how supervisors should manage the production aspects of their role.

3.1.1.5 EFFECTIVE SUPERVISOR SAFETY MANAGEMENT

The previous study investigating offshore supervisors' management of safety identified a number of different behaviours that separated effective from less effective supervisors. In general, respondents report that their behaviour is similar to that of the effective supervisors in the previous study. For example, 95% of the respondents indicated that they often or always *'accept responsibility for subordinates' safety'* and 89% indicated that they often or always *'show concern for team members' welfare'*. While overall the respondents present a very positive picture of their safety management behaviour a small percentage of supervisors were less positive. For example 33% of supervisors indicated that they occasionally *'find it difficult to know how subordinates are thinking and feeling'* 21% indicated that they *'occasionally have difficulty motivating subordinates to work safely'* and only 73% indicated that never or seldom *'have to put pressure on my subordinates to get the job done on time.'*

3.1.2 Subordinate questionnaire

The offshore safety management questionnaire was returned by 217 of the 800 subordinate questionnaire that were sent offshore, which was a response rate of 27%. This response rate is conservative because more questionnaires were sent than were distributed to offshore employees. The questionnaire consisted of four main sections, these include: (see appendix 4 for details).

1. Section one contained biographical information,
2. Section two safety climate scale,
3. Section three contained the safety behaviour scale
4. Section four contained a supervisor safety management behaviour scale

3.1.2.1 SECTION 1 BIOGRAPHICAL DATA

The biographical composition of the sample is broadly similar to previous offshore samples in terms of accident involvement and length of time offshore. The sample contains a slightly different occupational mixture, with more construction employees than would be expected. In addition to this a high percentage (91%) of the sample are employed by contracting companies. This is likely to be due to the fact that the sample only included non supervisory staff in addition to the fact that a contracting company was one of the organisations providing access. It is interesting that 60% of subordinates indicated that their supervisor was the same discipline as them while 83% of supervisors reported they were the same discipline as their subordinates. This may suggest that the supervisors have a wider perspective of their discipline e.g. construction, while subordinates are more specific e.g. pipe-fitter. It is also possible that supervisors that were the same discipline as subordinates were more likely to complete their questionnaire. The supervisors' and subordinates' samples appear to have different occupational composition, because 37% of subordinates classified themselves as maintenance staff while only 21% of the supervisors came from maintenance.

3.1.2.1 SAFETY CLIMATE

The factor analysis of the safety climate scale, as described above, revealed a five factor structure. The five factors revealed by the analysis were:

- I. Reluctance to speak up about safety
- II. Perceived lack of commitment to safety
- III. Safety on the Installation
- IV. Supervisor commitment
- V. Cost versus safety

Over half of the respondents tended to disagree with the majority of statements that suggest people are reluctant to speak up about safety and that safety is unimportant. For example over 75% of respondents disagreed with the statements: *I sometimes feel under pressure from my workmates to take chances*; *The OIM is too busy to be involved in minor safety issues* and *My supervisor sometimes turns a blind eye when safety rules are broken*. These results indicate that the majority of respondents feel that safety is perceived as being important and are willing to speak up about safety. In general, respondents from the current study felt that safety was equally as important as respondents from the previous studies. However, there are a number of statements that are less positive for example 72% of subordinates agreed with the statement: *People are reluctant to report near-misses*, 60% agreed with *People are reluctant to report accidents* and 53% agreed with *Minor accidents cause so much hassle they are quite often ignored*. This may indicate a bureaucratic accident and near miss reporting system that makes reporting time consuming. From a more negative perspective, it could indicate a perception of 'blame culture'.

The second factor contains statements that refer to the confidence the respondents have in their management's commitment to safety. Over 50% of respondents disagreed with the majority of statements that suggest a lack of management commitment to safety. For example 67% disagreed with the statement *The PTW system is just a way of covering people's backs* and 57% disagreed with the statement *People are rushing jobs on this installation*. There are however two statements with which less than 50% of the respondents disagree: *'Some rules are only there to cover management's back' (37% disagree)* and *'Job insecurity means that people on this installation like to keep information to themselves' (36% disagree)*. It is concerning that more than 50% of respondents do not disagree with statements suggesting that management create rules just to cover their own back. In general, it appears that the respondents in the present study agree with the statements less than respondents in the Mearns et al (1997) safety climate survey and less than the 112 respondents in the previous supervisor study.

Factor three contains statements that refer to the respondents' perception of the status of safety on their installation. In general, respondents report that they perceive safety to be important and that there is a high standard of safety on their installation. For example 87% of respondents agreed with the statement *'Safety is taken seriously on this installation, it's not just a cosmetic exercise'* and 85% agree with the statement *The standard of safety is very high at my place of work*. One interesting point to note is that less respondents agree with statements that refer to management behaviour. For example 71% agreed with *The OIM is always on the look out for safety rule violations* and 54% agreed with *I feel that the management on this installation are concerned about my general welfare*. Having said this very few respondents actively disagree with these statements. Interestingly while they are positive about the state of safety, they are less positive about their management's role in creating this positive state of safety.

The statements in factor four refer to the respondents' perception about their supervisors. In general, they indicated that they have a positive opinion of supervisors. It is interesting that while over 50% of respondents agree with all the statements only 67% agreed with *'My supervisors care about safety more than the average worker'* and 62% agreed with *'My supervisors aren't scared of taking the blame for their errors'*. It is also interesting to note that the item *'This installation has a 'no-blame culture'* is contained within this factor as this suggests that level of a no blame culture is determined by supervisors.

The final factor refers to the conflict between getting operations completed on time and doing them safely. This concept has been identified by many safety climate researchers and has been referred to as 'protection versus production' by Reason (1997). It is interesting and concerning to note that 68% of respondents report that *'The rules do not always describe the safest way of working'*. This suggests that they do not have confidence in the rules and therefore are not likely adhere to them. It is therefore important to investigate why supervisors do not feel that the rules describe the safest way of working. It is also worrying to note that less than half (45%) disagree with the statement *'Some jobs would be impossible to perform if all the rules were followed to the letter'*.

3.1.2.3 SAFETY BEHAVIOUR

In general, respondents reported a low level of risk taking behaviour and a high amount of safety behaviour. It is interesting to note that less than 10% of respondents admit to carrying out the following activities *'I carry out activities which are forbidden'*, *'I bend the rules to achieve a target'* and *'I ignore safety regulations to get the job done'*. In contrast only 63% of respondents indicated that they never or seldom *'take shortcuts which involve little or no risk'*.

In general, respondents indicated that they are proactive about safety. For example over 70% of respondents indicated that they *'encourage fellow workers to work safely'* and *'talk about safety with fellow workers'*. Interestingly only 55% of respondents indicated that they would often perform the following activity *'If I see someone breaking safety procedures I confront them'*.

3.1.2.4 SUBORDINATE PERCEPTIONS OF SUPERVISOR SAFETY MANAGEMENT BEHAVIOUR

Subordinates' responses indicate that their supervisors frequently perform activities that have been linked to effective supervision and infrequently perform activities that have been linked to less effective supervision. For example over 70% of subordinates indicated that their supervisors either often or always carried out the following activities: *'Ensures that I understand the PTWs that I work under'*, *'Accepts responsibility for my safety'*, *'Show concern for team members' welfare'* and *'Encourage safe working by setting a good example'*. In addition less than 10% of respondents (7% Often) reported that their supervisor often or always *'Has difficulty motivating subordinates to work safely'* and *'Puts pressure on me to get the job done on time'*.

3.1.3 Superior evaluation scale

The superior evaluation scale was returned for 129 of the 140 superior evaluation forms that were sent out, which is a response rate of 92%. The majority of superiors surveyed rated supervisors as satisfactory. In general there was very little variance in the superiors' evaluation on the different skills, except for 'technical ability' where 41% of the supervisors evaluated were rated as a very good performer.

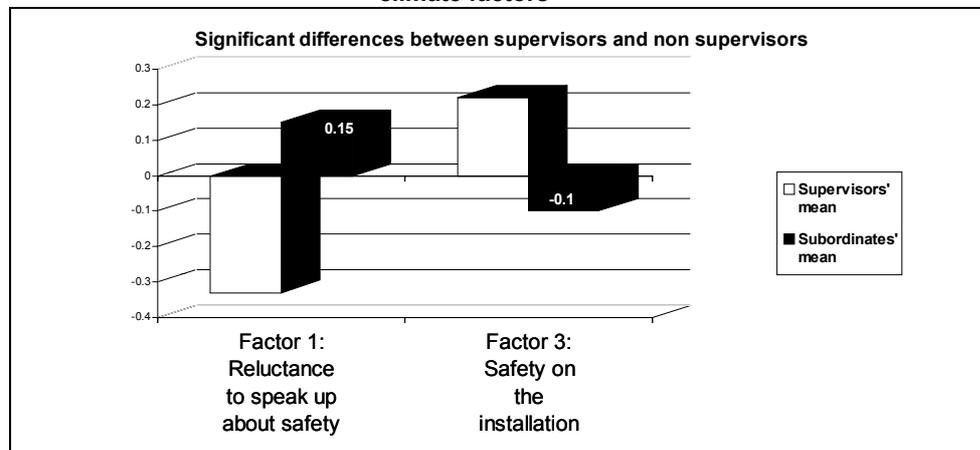
3.2 DIFFERENCES BETWEEN GROUPS

The above section provided an overall description of the data from both the supervisor and subordinate questionnaires. In addition to these descriptive statistics it is important to investigate differences between groups (e.g. accident versus non accident).

3.2.1 Supervisors versus non supervisors

It has been possible to compare the responses of supervisors with non-supervisors on the safety climate scale because the same scale was used in their respective questionnaires. A series of t-tests were performed to investigate if there were differences between supervisors and non-supervisors on the five factors from the safety climate scale. This analysis revealed two significant differences between the two groups on the safety climate scale.

Figure 1
Differences between supervisors and non-supervisors on the five safety climate factors



There was a significant difference between the groups on Factor 1 'Reluctance to speak up about safety' where supervisors indicated that they perceived safety to be more important than non-supervisors. There was also a significant difference between the groups on factor 3 'Safety on the installation' where supervisors indicated that they had a more positive perception of the state of safety on the installation than non-supervisors.

3.2.1.2 DIFFERENCES BETWEEN ACCIDENT AND NON ACCIDENT SUBORDINATES

In section one of the questionnaire subordinates were asked if they had ever been involved in an accident. Of the 217 respondents that completed the questionnaire, 60 (29%) indicated that they had previously been involved in accident. The accident and non accident groups were compared on the following variables: five safety climate factors; the eight safety behaviour statements and the fifteen supervisor safety management behaviour items. These 28 t-test revealed 5 significant differences between the accident and non accident respondents.

Figure 2 presents the results of the statistical tests that revealed a significant difference between the two groups. These results must be treated with a certain amount of caution because the large number of test performed creates the possibility of capitalising on chance. It is therefore possible that one of the findings presented in table 12 is spurious.

Figure 2
Differences between accident and non-accident respondents



It is interesting to note that factor 1 'Reluctance to speak up about safety' was the only safety climate factor where there was a significant difference between accident and non-accident groups. This indicates that non-supervisory staff who believe that people on the installation are reluctant to speak up about safety are more likely to have been involved in an accident. While this finding does not show causation, it is not unreasonable to conclude that employees are more likely to be involved in an accident if they believe that people are reluctant to speak up about safety, which implies a 'blame culture' or that safety is not important.

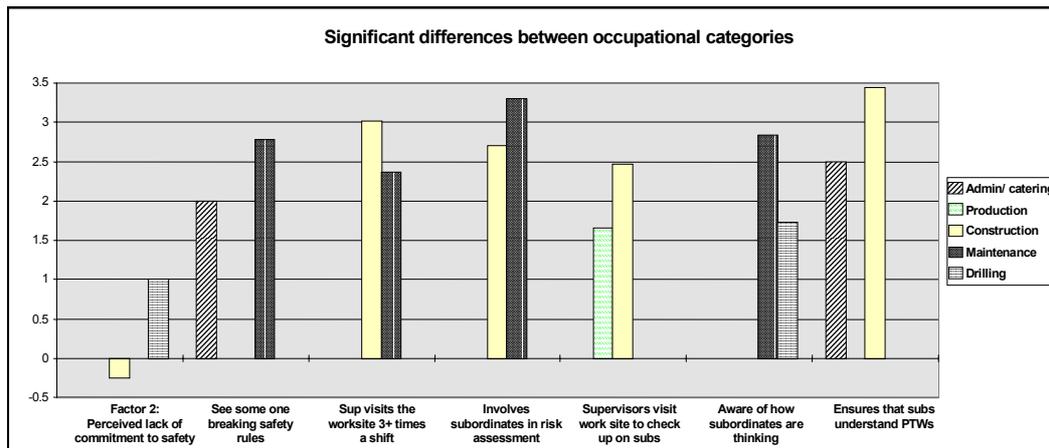
The analysis also revealed a significant difference between the groups on two of the safety behaviour items, one positive 'I talk about safety with fellow workers' and one negative 'I break rules due to management pressure'. This indicates that subordinate safety behaviour is related previous accident involvement, again the direction of causation cannot be shown. Having said that it seems reasonable to conclude that if offshore employees talk about safety with fellow workers and do not break rules due to management pressure they are also less likely to be involved in an accident.

The two supervisor behaviours, which non accident respondents report more frequently are supervisors visiting the work site more than 3 times a shift and supervisors involving them in risk assessments. This indicates that supervisors who manage safety effectively are more likely to visit the worksite frequently and involve their subordinates in decision making. This finding supports two of the primary conclusions from the Mearns et al (1997) study.

3.2.3 DIFFERENCES BETWEEN OCCUPATIONS

The 217 subordinates that completed and returned the 'Offshore Safety Management Questionnaire' were categorised into one of five occupational groups. The five groups were; Administration and catering; Production; Maintenance; Drilling and Construction. The five groups were compared on the five safety climate factors, the eight safety behaviour statements and the 15 supervisor safety management statements. The seven significant differences between the five occupational groups revealed and are presented in figure 3.

Figure 3
Differences between occupational groups

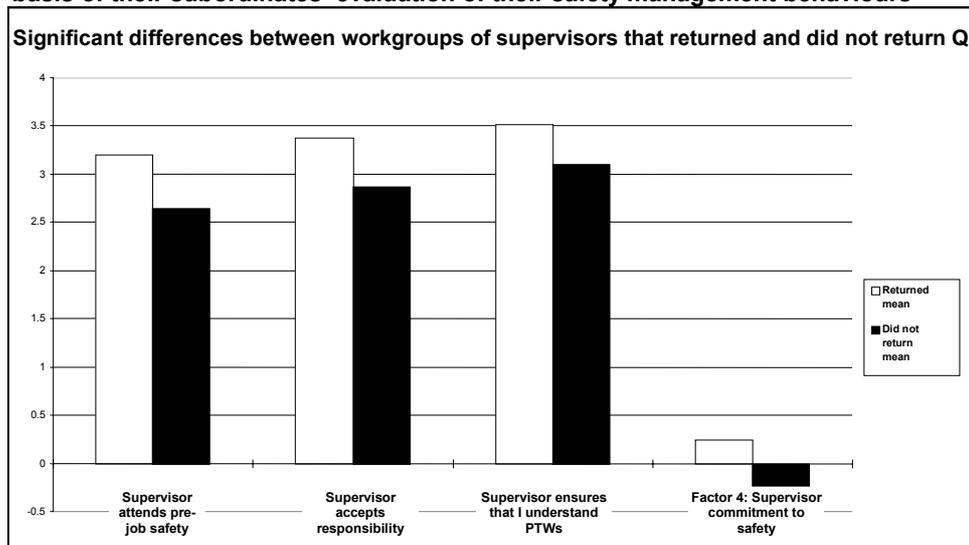


It is concerning that drillers indicated that they had less confidence in management's' commitment to safety as they have one of the more hazardous occupations on an offshore installation. This finding may be linked to the fact that drillers also report that their supervisors are less aware of how they are thinking and feeling. These findings are worthy of further investigation. The other occupational differences appear to be due to variations in the type of work performed by the different groups. For example it is likely that administration and catering staff have less need to use PTW's and therefore have a lower mean score on this item.

3.2.1.5 SUPERVISORS THAT RESPONDED VERSUS THOSE WHO DID NOT

Every effort was made (individually addressed letters, follow up telephone calls and a second letter with a replacement questionnaire), to ensure that supervisors completed and returned their questionnaire. It could be argued that not returning the questionnaire may indicate that safety is not a priority for this supervisor. It was therefore decided to create a variable in the subordinate database to identify respondents whose supervisors did not return a questionnaire. This was done so that it would be possible to compare the responses of subordinates with supervisors that did return the questionnaire with those who had supervisors that did not return the questionnaire. Three categories were created, 1, returned the questionnaire; 2, did not return the questionnaire and 3, supervisor identified by the subordinate was not sent a questionnaire. This revealed that the supervisors of 110 of the respondents had returned the questionnaire and 39 of the respondents had supervisors that did not return the questionnaire. The remaining 50 respondents either did not identify a supervisor or named a supervisor that had not been sent a questionnaire. Four significant differences between the two groups revealed and these are presented in figure 4.

Figure 4
Comparison of supervisors that responded with those that did not, on the basis of their subordinates' evaluation of their safety management behaviours

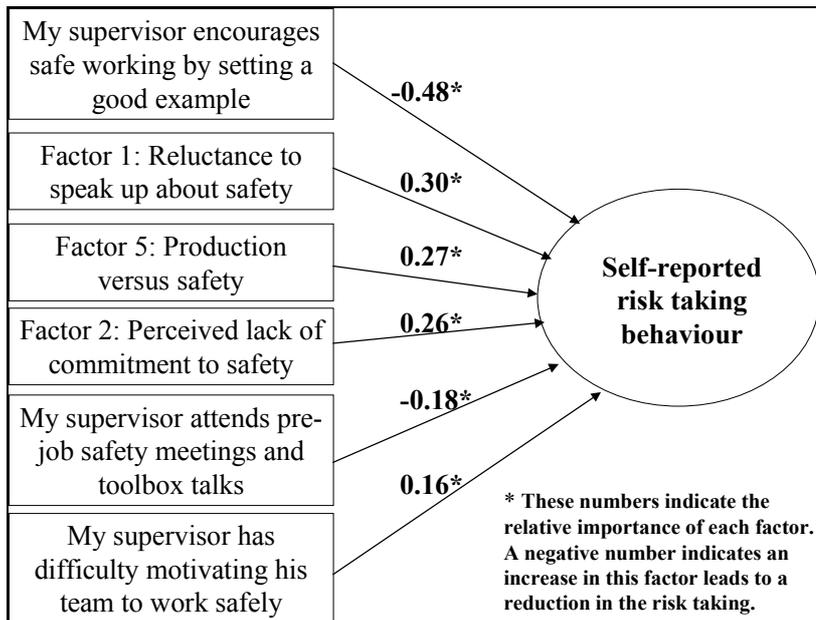


This finding indicates that supervisors who took the time to complete the supervisor questionnaire were perceived to be more concerned about safety by their subordinates. The fact that there are significant differences between the two groups in their subordinates' evaluation of their performance suggests that subordinates are aware of their supervisors' level of commitment to safety. This implies that subordinate perceptions can be used as a measure of supervisors' management of safety. It also indicates that those supervisors who did not return the questionnaire may be less effective in the management of safety. While this finding may not appear to have implications for improving supervisors' safety management, it does lend support to subordinates' evaluation of their supervisors' behaviour. This finding also has implication for the interpretation of the finding from the supervisor questionnaire as it suggests that the sample may be biased.

3.3 RELATIONSHIPS BETWEEN FACTORS FROM THE SUBORDINATE QUESTIONNAIRE

One of the ultimate objectives of this study was to identify the factors that influence offshore workers' level of safety. Accident involvement has been shown to be linked to offshore workers' self report levels of safety behaviour (Rundmo, 1995, Mearns et al, 1997). It is therefore important to identify the factors that influence workers' self report safety behaviour. A step wise regression analysis was carried out on the subordinate data set to identify the safety climate factors and the items from the supervisor safety management behaviour scale that influence respondents' self report risk taking behaviour. The results of this analysis are presented in figure 5. The analysis reveals that three safety climate factors and three supervisor safety leadership behaviour statements explain 48% of the variance in subordinate risk taking behaviour.

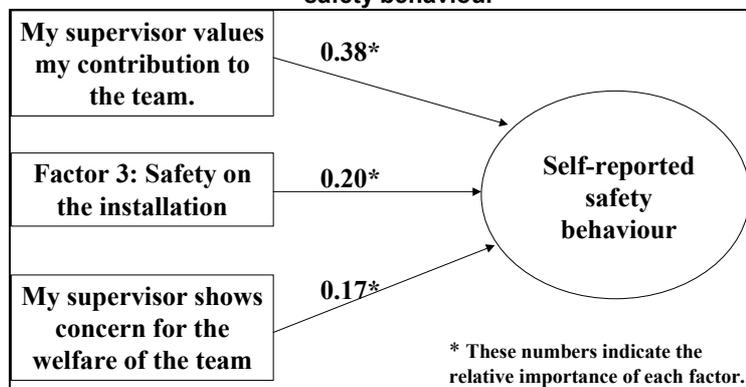
Figure 5
Regression analysis identifying the factors which influence subordinates self report 'risk taking behaviour'



The analysis revealed that three supervisor safety management behaviours influence subordinate risk taking behaviour. In fact, the most important variable in the equation was subordinates' perception of the amount their supervisor encouraged safe working by setting a good example. The two other supervisor behaviours were attending pre-job safety meetings and toolbox talks and the perception that the supervisor has difficulty in motivating the team to work safely. Three safety climate factors were found to influence subordinates self report risk taking behaviour these were 'Reluctance to speak up about safety, followed by Cost versus safety and Perceived lack of commitment to safety.

A further step wise regression analysis was carried out on the subordinate data set to identify the safety climate factors and the items from the supervisor safety management behaviour scale which influences respondents' self report safety behaviour. The results of this analysis are presented in figure 6. The analysis reveals that 19% of the variance in subordinate self-report safety behaviour is explained by one safety climate factors and two supervisor safety management behaviour statements.

Figure 6
Regression analysis identifying the factors which influence subordinates self report 'safety behaviour'



The analysis revealed that two supervisor safety management behaviours influence subordinate safety behaviour. In fact the most important variable in the equation was subordinates' perception of the amount their supervisor values their contribution to the team. The other supervisory behaviour in the model, was 'showing concern for the welfare of the team'. Factor 3 from the safety climate scale 'Safety on the installation' is the second variable in the equation.

3.4 EFFECTIVE AND LESS EFFECTIVE SUPERVISORS

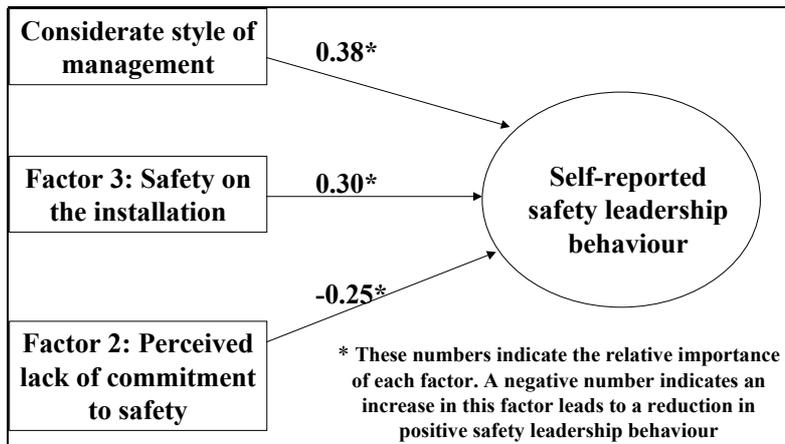
In the previous study, supervisors were as effective and less effective on the basis of their score on superior evaluation scale. Supervisors were separated into groups by putting their score on the superior evaluation scale into a hierarchical cluster analysis. This analysis revealed that the optimum solution for the data was a five cluster solution. After outlying groups were excluded, two groups remained one group with a high score (m=53) on the superior evaluation scale and another with a low score (m=40). These groups were therefore labelled as effective and less effective respectively.

A series of t-test were then performed to identify any differences between the groups on, their self report safety management behaviour, their safety management attitudes, the five factors from the safety climate scale, their scores on the two factors from the Fleishman leadership scale. This analysis revealed very few statistically significant differences between the two groups. The analysis revealed that less effective supervisors were significantly more likely than effective supervisors to agree with the statement 'Supervisors are often unfairly blamed if their subordinates are involved in an accident'. Less effective supervisors were also significantly more likely to agree with the statement 'My subordinates are not particularly better than other workers'. Less effective supervisors reported that they attend pre-job safety meetings significantly more frequently than effective supervisors. The less effective supervisors were significantly more likely to agree with the statements in factor 5 'Pressure for production' indicating that they feel under more pressure to put production before safety. These results must be treated with caution in light of the fact that 33 separate t-tests were performed and at a significance level of 0.05 one or two significant results would be expected by chance alone.

3.5 PREDICTORS OF SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR

The analysis of the responses from the subordinate questionnaire revealed seven subordinate behaviours that were related to their self-report level of safety. Supervisors' self-report of their performance on these seven leadership behaviours were summed to create a single safety leadership score. It was of interest to investigate which factors influence supervisors' safety leadership behaviour. A stepwise regression analysis was carried out on the supervisor data set. The seven factors included in the analysis included safety climate factors and the two factors from Fleishman management style scale. The analysis was performed to identify the factors that influence supervisors' self report on the seven safety leadership behaviours that the above analysis (section 3.2.3) revealed influence subordinate safety.

Figure 7
Regression analysis identifying the factors that influence supervisors' self report
'safety leadership behaviour'



The above indicates that supervisor self report safety leadership behaviour was influenced by their attitude to a considerate style of management, their perception that safety is seen to be important on the installation and that they do not perceive that management lack commitment to safety.

4. DISCUSSION

4.1 GENERAL

The results from the questionnaires indicate that in general both subordinates and supervisors have a positive perception of the 'climate for safety' on the nine offshore installations included in this study. The overall response rate of 33% was the same as the Mearns et al (1997) safety climate survey, but it was lower than the rate for the previous supervisors' study. This low overall response rate was primarily because only 27% of the subordinate questionnaires distributed were returned.

The safety climate scale used in this study appears to be a reasonably reliable measure, because it produced a similar picture of the conceptual structure of safety climate as that produced by Mearns et al (1997) in their offshore study. This indicates that this particular scale is becoming a robust measure of the safety climate on offshore installations. The analysis indicated that the scale could be further improved by removing some of the items that are measuring aspects of the safety climate that are covered by other items. The use of the safety climate questionnaire by more offshore researchers will facilitate the development of a set of offshore safety climate norm data. This data set could be used to track and monitor any changes in the safety climate offshore.

4.1.1 Supervisor questionnaire

The response rate for the supervisor questionnaire was 65%, which is good for a postal questionnaire. This response rate was similar to that of the previous supervisor study. The vast majority of supervisors indicated that they had a very positive perception of the safety climate on their installation.

They also tended to report, high levels (average item score of 3 where 5 is a maximum score) of "*consideration*" that were similar to the levels reported by the supervisors in the previous study. There was a greater amount of variance in the amount of "*initiating structure*" than there was in consideration. Overall, they tended to report similar levels of initiating structure as the supervisors in the previous study.

The supervisors in the present study reported that they had positive attitudes towards managing safety. In addition to this, they indicated that their leadership behaviour was also similar to that of supervisors that were classified as effective in the previous supervisors' study.

4.1.2 Subordinate questionnaire

The results indicated that subordinates in the current study had a more positive perception of safety than respondents did in the Mearns et al (1997) safety climate survey. Their responses tended to be similar or slightly less positive to the subordinates surveyed in the previous supervisor study. Respondents also reported low levels of risk taking behaviour and high levels of proactive safety behaviour. They indicated that in general their supervisor displayed high levels of leadership behaviour. These positive results suggest that the standard of safety on the participating installations is very high.

4.2 FACTORS WHICH INFLUENCE WORKER SAFETY

The aim of this study was to investigate if specific safety leadership behaviours carried out by offshore supervisors directly influence their subordinates' safety behaviour. These leadership behaviours were considered within the context of the installation's safety climate. The relative importance of both the supervisors' behaviour and the safety climate were examined. Although supervisors' behaviour was the focus of the study, the purpose of carrying out this research was to identify factors that influence workers' safety. It is therefore important to discuss all the factors that this study revealed influence workers' level of safety.

4.2.1 Accident versus non accident subordinates

A common procedure used to generate safety improvement actions is to investigate previous accidents so that common root causes can be identified. This approach assumes that if the root causes of previous accidents can be removed or controlled, future accidents can be avoided. It is therefore logical to compare the responses of accident and non-accident subordinates responses, on the major scales from the questionnaire.

This analysis revealed five significant differences between accident and non-accident personnel. Respondents who had previously been involved in an accident had a higher score on factor I (reluctance to speak up about safety) from the safety climate scale. This indicates that they felt personnel on their installation were reluctant to report accidents. This suggests that if a 'blame culture' is perceived to exist on an offshore installation then personnel may be more likely to be involved in an accident. This perception could promote the feeling that senior management is not truly committed to minimising the risk to personnel, but is only interested in the accident statistics being low. It is therefore important for companies to ensure that there is adequate feedback to the workforce about the steps taken to prevent incidents reoccurring.

The analysis also revealed significant differences between the two groups on two of the items from the safety behaviour scale. This finding supports the argument that self-report safety behaviour is a reasonable measure of the level of safety on an offshore installation. It is also interesting that one statement was positive 'I speak about safety with fellow workers and one was negative 'I break rules due to management pressure. The difference between the two groups on the positive statement is interesting as it could indicate that workers who speak about safety with their colleagues are less likely to be involved in an accident. The second finding which suggests that those who break rules are more likely to be involved in an accident is less surprising. These differences imply that by encouraging positive safety behaviour and reducing negative behaviour accident rates could be reduced.

The non-accident group also reported that their supervisors visited the worksite and involved them in risk assessments more often than the accident group reported. This suggests that supervisors could increase their subordinates' level of safety by visiting the worksite more frequently and involving their subordinates in safety and accident prevention activities. This finding confirms the findings from the Mearns et al (1997) supervisors study findings and is similar to some of the finding from other supervisor studies such as Simard and Marchand (1997). The more that safety is talked about the better as it keeps it on the agenda and in peoples' minds.

4.2.2 Predictors of subordinate risk taking behaviour

Previous studies (Mearns et al 1997, Rundmo, 1995) found that self report risk taking behaviour correlates with previous accident involvement. On the basis of these previous studies and the evidence presented above it is suggested that self

report risk taking behaviour is a reasonable measure of respondents' level of safety. Statistical analysis was performed in order to identify which measures from the questionnaire explained levels of subordinate safety behaviour. This analysis (stepwise regression) indicated that self report risk taking behaviour was influenced by three of the safety climate factors and three supervisor leadership behaviours. The three safety climate factors in the equation were: factor 1 'reluctance to speak up about safety' factor 5 'cost versus safety' and factor 2 'perceived lack of commitment to safety'. This indicates that if respondents perceived that there is a 'blame culture' and that safety is of less importance then they tend to report more risk taking behaviour. It therefore could be argued that risk taking behaviour could be reduced by convincing workers that safety is important and addressing any perception of the existence of a culture of recrimination or a 'blame culture'. Companies should endeavour to ensure that all employees are aware of that it is their personal safety that is important and the accident statistics.

The first variable in the equation was one of the supervisor safety leadership behaviours: 'My supervisor encourages safe working by setting a good example'. The other two supervisor leadership behaviours in the equation were: 'My supervisor attends pre job safety meetings' and 'My supervisor has difficulty motivating his subordinates to work safely'. This suggests that the level of subordinate risk taking behaviour can be reduced by supervisors encouraging and motivating subordinates to work safely and by demonstrating that safety is important to them by attending pre job safety meetings. This finding identifies a number of specific actions that are likely to reduce the level of risk taking behaviour and improve safety. Having said this it is important to be aware that this finding is based on the respondents' perceptions of their supervisors behaviour. It therefore will not be enough just to get the supervisor to change their behaviour, their subordinates will need to recognise the change and believe it to be genuine. It may be difficult for the work group to accept a sudden change in their supervisor's behaviour, therefore a more holistic approach to work group attitudes, beliefs and behaviours may be more fruitful. The most appropriate and effective approach is likely to be company or installation specific.

4.2.3 Predictors of subordinate safety behaviour

The second regression analysis revealed three variables, which influence respondents self report safety behaviour. This regression equation only explained 19% of the variance in self report safety behaviour compared with the 48% which was explained of risk taking behaviour. The three variables in the equation were: 'My supervisor values my contribution', factor 3 'Safety on the installation' and 'My supervisor values my contribution to the team'. If an individual feels that safety is perceived to be important on an installation, they are more likely to perform positive safety behaviours.

The two supervisor leadership behaviours that are in this equation are of interest. The items appear to relate to the interpersonal relationship between the supervisor and their subordinates and are not specifically safety related. This suggests that safety behaviour is not only influenced by supervisors' safety attitudes and behaviours but is also influenced by their relationship with their subordinates. It is therefore important for supervisors to create and maintain a positive relationship with their subordinates. While the supervisor's actions and beliefs are crucial to creating this environment, their subordinates have also to fulfil their part of the dynamic. It may be as difficult for them to change their perceptions of their supervisor, as it is for the supervisor to change his/ her behaviour.

4.3 COMPARISON WITH FINDINGS FROM THE PREVIOUS STUDY

The primary aim of this study was to investigate if the attitudes and behaviours which Mearns et al (1997) found distinguished effective from less effective supervisors would be confirmed using a different method and on a larger sample. When the performance indicators used in the Mearns et al study were used to classify supervisors, the findings of the previous study were not confirmed. When the effective and less effective supervisors were compared on their responses to the safety climate factors, management style, attitude to safety management and safety leadership behaviour no significant differences were revealed. There are a number of possible reasons why the Mearns et al (1997) findings were not confirmed, such as the different method or sample. The fact that over 50% of the supervisors that returned the questionnaires were excluded because of missing subordinate risk taking behaviour scores may have been important. This reduced sample meant there were less than 20 supervisors classified as effective. The low sample size make 'type two' errors (not identifying significant differences when they really exist) more likely.

In order to include a larger number of supervisors in the analysis they were classified as effective and less effective solely on the basis of their score on the superior evaluation scale. The supervisors, who were classified as effective and less effective supervisors on this basis, were compared on the above factors. This analysis revealed that the less effective supervisors tended to agree with the statement 'Supervisors are often unfairly blamed if their subordinates are involved in an accident' and the statement 'My subordinates are not particularly better than other workers'. In addition, they also tended to agree more with statements about cost being more important than safety. In contrast to this they reported that they 'Attended pre-job safety meetings' more frequently than effective supervisors indicated. These results must be treated with caution because there is a possibility of capitalising on chance because 33 t-tests were performed at least one result would be expected by chance alone. Having said this it is interesting that the less effective supervisors appeared to value their subordinates less, felt less responsible for their safety and felt under pressure to put production before safety. The fact that they indicated attending pre-job safety meetings more frequently than effective supervisors was an unexpected finding and is in conflict with other findings. It is possible that less effective supervisors wished to provide a positive impression of themselves. It is also possible that using the superior evaluation scale on its own is not a good performance indicator.

4.4 EFFECTIVE SUPERVISOR MANAGEMENT BEHAVIOURS

This study has identified seven supervisor safety leadership behaviours that are related to subordinates self report level of safety. These seven behaviour statements were designed to measure four of the factors that Mearns et al (1997) found were associated with effective supervisors. This suggests that at least four of factors identified in the previous study do influence subordinates' level of safety. These four factors include, valuing subordinates, visiting the worksite frequently, work group participation and safety communication. The seven behaviours are classified under the four factors that they are intended to measure in table 2.

Table 2
Supervisor behaviour that were found to be related to subordinate safety behaviour

Supervisor leadership statements	Relationship with subordinates' safety
<i>Valuing subordinates</i>	
Supervisor make it clear to each of my subordinates that I value their contribution to the team Supervisor show concern for team members' welfare	Subordinates that indicated that their supervisor valued their contribution also reported higher levels of safety behaviour Subordinates that indicated that their supervisor showed concern for their welfare also reported higher levels of safety behaviour
<i>Frequency of visiting worksite</i>	
Supervisor visit the worksite three or more times a shift	Non accident subordinates report that their supervisor visits the worksite more frequently than subordinates that have had an accident
<i>Work group participation</i>	
Supervisor involve workgroup members in risk assessments	Non accident subordinates report that their supervisor involves them in risk assessments more often than subordinates that have had an accident
<i>Communicating the importance of safety</i>	
Supervisor attend pre-job safety meetings and tool box talks Supervisor have difficulty motivating subordinates to work safety Supervisor encourage safe working by setting a good example	Subordinates that indicated that their supervisor frequently attended pre-job safety meeting also reported less risk taking behaviour Subordinates that indicated that their supervisor did not have difficulty motivating them to work safely also reported less risk taking behaviour Subordinates that indicated that their supervisor encouraged safe working also reported less risk taking behaviour

The above suggests that workgroup safety can be maximised by supervisors valuing their subordinates, involving them in decision making, visiting the worksite frequently and communicating their personal positive attitude to safety. This supports the conclusions of the Mearns et al study (1997).

A limitation of the above findings is that they are solely based on subordinate reports of supervisor behaviour and their accident and safety behaviour. There are a number of difficulties with findings based on self-report questionnaire studies. It could be argued that subordinates' evaluation of supervisory behaviour is biased or inaccurate. It is possible that it is subordinates own negative attitude to safety that causes them to report more risk taking behaviour and to indicate that their supervisor does not manage safety effectively. While it is difficult to reject this possibility there are a number of indicators that suggest that this is not the case.

Firstly, the relationship between the leadership behaviours and the safety indicators appeared to be very specific. For example, accident involvement was related to the supervisor visiting the worksite frequently and involving them in decision making. In addition, positive interpersonal relationships and not other factors influenced subordinate safety behaviour.

Secondly, the differences between the responses of subordinates that had supervisors who returned the questionnaire and those that did not, indicate that their evaluation of supervisor behaviour appears to be valid. The comparison between the two groups revealed that subordinates whose supervisors did not return their questionnaire reported that their supervisor; attended pre-job meeting less frequently, was less inclined to accept responsibility for their safety and was less likely to ensure that they understood their PTWs. In addition to this they had a lower score on factor four from the safety climate scale which indicates that they were less convinced of their supervisors commitment to safety. This finding suggests that subordinates are aware of their supervisors' commitment to safety.

The variables that were significantly different between the two groups were specific and discerning. This suggests that subordinates evaluations of supervisor behaviour may be a valid measure of their actual behaviour and attitude to safety. This allows more confidence that the supervisor behaviours outlined above do influence their subordinates' level of safety.

4.5 PREDICTING SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR

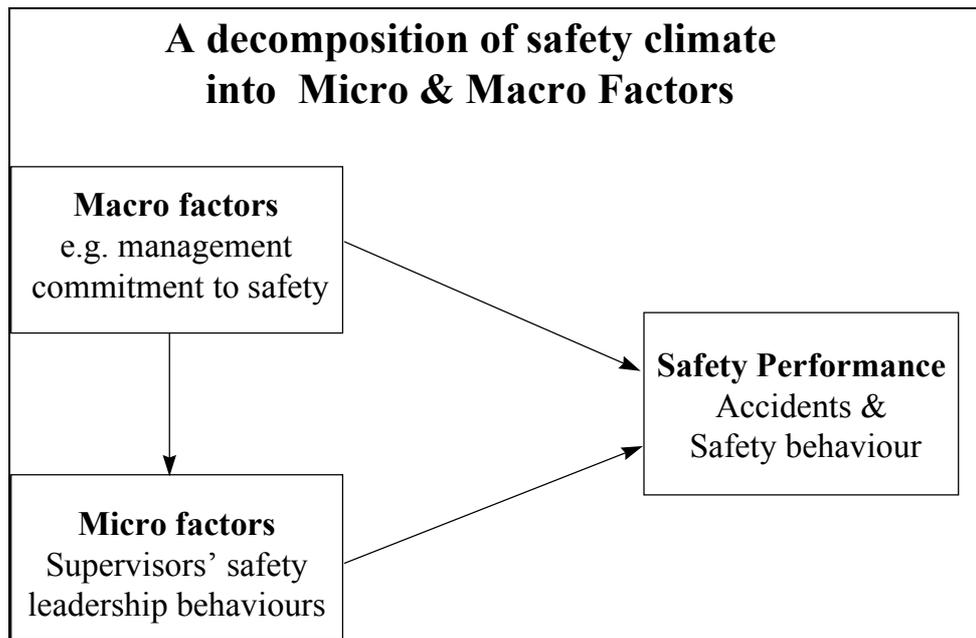
In order to be complete it was necessary to identify the drivers of the supervisor safety leadership behaviours, which had been linked to subordinate safety behaviour and previous accident involvement. A regression analysis was performed to identify the factors which influence supervisors' self-report of these behaviours. This analysis revealed that two safety climate factors and one of the leadership opinion factors influenced supervisor safety leadership behaviour. Specifically, it was found that supervisors who perceived that safety was important on their installation and that their management was committed to safety reported more positive safety leadership behaviours. Respondents who indicated that they believed supervisors should have a '*considerate*' management style also reported more positive safety leadership behaviours.

This suggests that while supervisors behaviours are important in determining the level of safety of their subordinates, the amount that they display these behaviours is influenced by a number of organisational and management style factors. It is not surprising that if a supervisor does not perceive that safety is seen as important within their organisation then supervisors are likely to display less safety leadership behaviour. It is interesting that positive safety behaviour is linked to the supervisors reported management style. It may be worth while exploring why some supervisors were less positive about a considerate style of management.

4.6 MICRO - MACRO SAFETY CLIMATE MODEL

This study has produced a number of findings that relate to various aspects of safety management in the offshore oil industry. It is therefore important to attempt to bring them together into a single model. Recent research in Canada by Simard and Marchand (1997) produced a micro- macro model of safety climate. They initially proposed that safety climate could be decomposed into macro company factors such as the development of the safety program, micro factors such as supervisor management style and worker safety behaviour. They proposed that subordinate safety behaviour is influenced by both micro and macro factors and that micro factors are influenced by macro factors. Based on their analysis of data obtained from 100 manufacturing companies and 1064 work groups they found that worker safety behaviour was only influenced by micro factors and not macro factors. They also found that micro factors were influenced by macro factors. Their initial theoretical model has been adapted so that it can be applied to the current study. The model presented in figure 8 indicates that the safety climate factors are considered to be macro factors, supervisor leadership behaviours are considered to be micro factors and safety performance is measured by self report safety behaviour and previous accident involvement.

Figure 8
A micro - macro safety climate model*

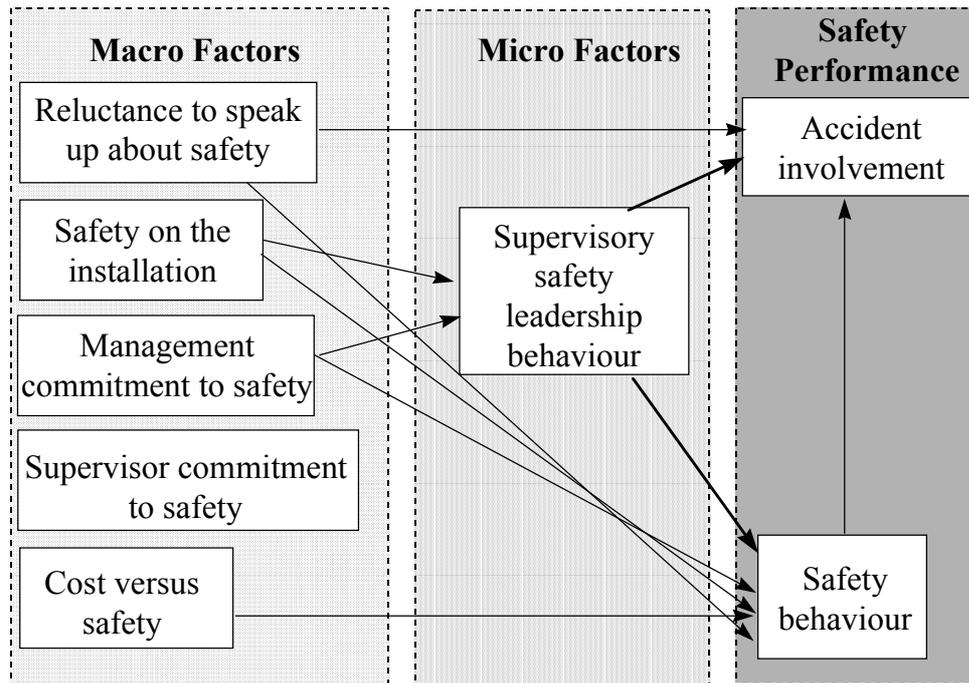


*Adapted from Simard and Marchand (1997).

The model presented in figure 9 presents an overall summary of the findings from this study within a macro - micro framework. The model presented is not a statistical model, it is merely representation of the main findings from this study. The model indicates that macro factor both directly and indirectly influence safety performance. It shows that accident involvement is influenced by the perception of a blame culture and supervisor safety leadership behaviour. It also indicates that safety behaviour is influenced by the perceived importance that is put on safety within the organisation and supervisors safety leadership behaviour.

The model also highlights that safety improvement programs need to be holistic in nature. They need to not only address the high level organisational factors but they also need to enable supervisors to display more positive leadership behaviours. To achieve this it is likely that the interpersonal dynamic of the workgroup may also need to be examined because this may prevent supervisors from changing their behaviour or subordinates perceiving the change.

Figure 9
Overall findings represented in terms of a micro - macro model



This research suggests that safety climate change programs should be focused on supervisors and their relationship with their workgroup. The supervisors on an installation are likely to be key because they will be able to provide information about the drivers for their own and their subordinates' behaviour. The organisational issues that they identify can be addressed and the supervisors could communicate this to their subordinates. In addition to this, a program could be developed to increase supervisor's ability to display positive safety leadership behaviours to a greater extent.

Another factor worthy of note was the fact that supervisors reported that they performed the majority of safety leadership behaviours to a high extent. This may suggest that supervisors know what behaviours they should be displaying but they do not display them as often as they should. If this is the case then providing supervisors with knowledge based training is not likely to work. A program which allows supervisors to address the factors which may be preventing them from carrying out these behaviours to the extent that know they should is likely to be more effective. In addition to this it may be important explore with them the type of interpersonal relationship they have with their subordinates. The supervisors may believe that they show their subordinates that they value their contribution but this may not be the reality for their subordinates. The program may explore aspects of self awareness and mechanisms for obtaining an accurate picture of there subordinates perception of their behaviour.

5. CONCLUSIONS AND RECOMMENDATIONS

- This study has provided further evidence of the importance of the supervisor in the management of safety.
- Four aspects of supervisor safety management were found to be important. These were: valuing subordinates; visiting the worksite frequently; a participative style of management and effective safety communication. It is suggested that the subordinates of supervisors who display these behaviours most frequently are less likely to be involved in an accident.
- Although this study has identified a limited number of behaviours associated with effective safety management, this should not be interpreted as evidence that these behaviours are sufficient to manage safety effectively. These four aspects of safety management are additional to all the other safety critical tasks performed by supervisors. They are the factors that distinguish good supervisors from excellent ones.
- Different factors appear to drive safe behaviour (i.e. encouraging fellow workers to work safely) than drive risk taking behaviour (taking short cuts). Positive safety behaviour can be encouraged by increasing the status of safety on the installation and by supervisors creating a supportive environment. Risk taking behaviour can be reduced by creating a learning culture on the installation and by supervisors communicating the importance of safety, setting a positive example and visiting the worksite frequently.
- The decomposition of safety climate into micro and macro factors may provide a framework for safety improvement programs. The model clearly highlights the central role that the first line supervisor will play in any change process. It could be argued that the first line supervisor sits at the culture behaviour interface. If a safety climate change initiative is to be effective then it will need supervisors' support for it to cross this interface.
- The findings from this study have implications for the development of supervisor training programs. It is suggested that the interpersonal aspects of supervisor safety management need to be addressed. Training programs should be practical as opposed to knowledge based and focus on the development of positive relationships with subordinates.
- It is also suggested that any program to improve supervisors' management of safety should take a holistic approach and include the workgroup in the process. It is important to recognise that there is a two-way relationship between supervisors and their subordinates. This relationship is likely to influence the supervisor's ability to change their safety leadership behaviour. In addition, for any change in their behaviours to be effective then subordinates will have to perceive the change.
- While this study has produced some interesting results, which have implications for both supervisor training and safety climate change, there are a number of limitations with these findings. There is a possibility of circularity, due to the reliance on subordinate self report safety behaviour and their evaluation of supervisors' leadership behaviour. It is possible that supervisors' leadership behaviour only co-varies with subordinate safety behaviour and does not actually impact on safety performance. This could be the case because the study results only show correlation and not causation. In order to remove this possibility it would be necessary to carry out an intervention study. This study would involve developing a workgroup safety performance

development program based on the findings from this study. The effectiveness of the safety program would be evaluated on the basis of the improvement of the safety performance of the participating work groups. A significant improvement would provide strong evidence to support the above results.

REFERENCES

- Andriessen, J.H.T.H. (1978). Safe Behaviour and Safety Motivation. *Journal of Occupational Accidents*, 1, 363-376.
- Carnegie, D. (1994). (listed as McGoldrick, D) First-line supervisors in the offshore oil industry. Paper (SPE 27295) presented at the Second SPE International Conference on Health, Safety and Environment, Jakarta, Indonesia.
- Carnegie, D. (1995). *Effective supervisors on offshore petroleum platforms*. Paper presented at the Fourth OIM Conference, 'Team Working', RGU, Aberdeen, April 27.
- Chew, D.C.E. (1988). Effective occupational safety activities: Findings in three Asian developing countries. *International Labour Review*, 111-124.
- Cohen, A., Smith, M.J. & Cohen, H.H. (1975). *Safety Program Practices in High versus Low Accident Plants*. Institute for Occupational Safety and Health, Cincinnati, Ohio
- Cohen, H. H. & Cleveland, R. J. (1983). Safety program practices in record - holding plants. *Professional Safety*, March, 26-33.
- Cox, S. & Cox, T. (1991). The structure of employee attitudes to safety: a European example. *Work and Stress*, 5, 93-106.
- Cox, S. & Cox, T. (1996). *Safety, systems and people*. Oxford: Butterworth-Heinemann.
- Cullen, W.D. (1990). *The Public Inquiry into the Piper Alpha Disaster*. Vols I & II. HMSO: London.
- Ferguson, E. & Cox, T.: (1993). Exploratory factor analysis: A users' guide. *International Journal of Selection and Assessment* vol 1, 84-94.
- Flanagan, J. C. (1954). The Critical Incident Technique. *Psychological Bulletin*, 51, 327-357.
- Fleishman, E. A. (1953). The measurement of leadership attitudes in industry. *Journal of Applied Psychology*, 37, 152-158.
- Fleming, M., Flin, R., Mearns, K. and Gordon, R. (1996). The offshore supervisor's role in safety management: law enforcer or risk manager. Paper (SPE 35906) presented at the Third SPE International Conference on Health, Safety and Environment, New Orleans, Louisiana.
- Fleming, M., Flin, R., Mearns, K. and Gordon, R. (1997). The offshore supervisors' management of safety. Paper presented at the HSE Human factors in the offshore oil industry. August, Norwich
- Flin, R., Mearns, K., Fleming, M. & Gordon, R. (1996a). *Risk Perception and Safety in the Offshore Oil and Gas Industry*. HSE, OSD Report OTH 94454. Suffolk: HSE Books.
- Flin, R., Mearns, K., Fleming, M. & Gordon, R. (1996b). Risk Perception and Safety in Offshore Workers. *Safety Science*, 22, 131-145.

- Heinrich, H. (1931). *Industrial Accident Prevention: A Scientific Approach*. 1st Ed. McGraw-Hill Publishing Co. Ltd, London
- Heinrich, H. (1959). *Industrial accident prevention*. 4th Ed. McGraw-Hill Publishing Co. Ltd, London
- Lee, T. (1993). *Psychological aspects of safety in the nuclear industry*. Paper presented at the Second Offshore Installation Management Conference on Managing Offshore Safety.
- Lee, T.R. (1995). *The role of attitudes in the safety culture and how to change them*. Paper presented at the Conference on 'Understanding Risk Perception'. Aberdeen: Offshore Management Centre, The Robert Gordon University.
- Mearns, K., Flin, R., Fleming, M. & Gordon, R. (1997) *Human and Organisational Factors in Offshore Safety*. HSE, OSD Report . Suffolk: HSE Books.
- Rasmussen, J. (1993). *Perspectives on the concept of human error*. Invited
- Reason, J. (1997) *Managing the risks of organizational accidents*. Aldershot: Ashgate.
- Robens, Lord. (1972). *Safety and Health at Work*. Report of the Robens Committee, HMSO, London.
- Simard, M. and Marchand, A. (1994). The behaviour of the first line supervisor in accident prevention and effectiveness in occupational safety. *Safety Science* **17**, 169-185.
- Simard, M., & Marchand, A. (1997) Workgroup's propensity to comply with safety rules: the influence of micro-macro organisational factors. *Ergonomics* **vol 40 (2)**, 172-188.
- Turner, B. and Pidgeon, N. (1997) *Man-made disasters (2nd Edition)* London: Butterworth.
- Weber, O. J. (1992). The front-line supervisor's role in safety. *Professional Safety* May 34-39.

A1. APPENDIX 1 DETAILED RESULTS

The following outlines the findings from the questionnaire study. Initially descriptive statistics for each item from the supervisor questionnaire will be presented followed by a summary of the responses to the subordinate questionnaire and the superior evaluation scale. Differences between groups will then be presented. Finally effective supervisors will be classified into effective and less effective and differences between the groups will be identified.

A1.1 DESCRIPTIVE STATISTICS

This section provides a general description of the data by summarising the responses given to each of the questions from both the supervisor and subordinate questionnaires. The combined number of questionnaires returned was 309 which is an overall response rate from both the supervisors (n=92) and the subordinates (n=217) questionnaires of 33%. This response rate is conservative because more questionnaires were sent than were distributed to offshore employees. This occurred because the sponsoring organisations could only provide an estimate of the number of personnel on board. It was important to ensure that there were sufficient questionnaires available, so more questionnaires were sent than were required. It was intended that the unused questionnaires would be returned but due to personnel changes, this did not occur. While the response rate is low it is similar to previous offshore studies, for example the Mearns et al (1997) study also had a response rate of 33%.

A1.1.1 Supervisor questionnaire

The 'supervisor safety management' questionnaire was returned by 92 of the 140 supervisors who participated in the study, which was a response rate of 65.7%. The questionnaire consisted of four main sections: (see appendix 3 for details).

1. Biographical questions,
2. Safety climate scale, (including ten safety management questions)
3. Fleishman leadership opinion questionnaire (Fleishman, 1957)
4. Supervisor safety management behaviour scale

A1.1.1.1 DEMOGRAPHIC INFORMATION

The biographical composition of the supervisor sample is described in table 1. The sample contains a slightly different occupational mixture, with more construction and less production supervisors than in previous offshore studies (e.g. Flin, Mearns, Fleming & Gordon, 1995). In addition to this a high percentage (91%) of the sample were employed by contracting companies. This is likely to be due the fact that a contracting company was one of the organisations providing access. A larger than expected percentage of supervisors had spent less than a year on their current installation. This is probably related the large percentage of construction supervisors in the sample. It is interesting that the majority (82%) of supervisors report that they work alongside their subordinates.

Table 1
Supervisors' General Information

Biographical Data	Categories	Frequency	Valid %
Job Category	Construction	29	32
	Admin / Catering	25	28
	Maintenance	21	23
	Production	12	13
	Drilling	4	4
	Other or Missing	1	-
Length of time as a supervisor	Less than 3 years	25	28
	From 3 to 9 years	20	22
	From 9 to 15 years	31	34
	More than 15 years	14	16
	Missing	2	-
Work along side subordinates	Yes	72	82
	No	16	18
	Missing	4	-
Number supervised	Less than 5 subordinates	15	19
	From 5 to 10 subordinates	29	36
	From 10 to 15 subordinates	18	22
	More than 15 subordinates	19	24
	Missing	11	-
Same discipline as subordinates	Yes	75	83
	No	15	17
	Missing	2	-
Employer	Operator	8	9
	Contracting Company	82	91
	Missing	2	-
Length with current employer	Less than 3 years	28	31
	From 3 to 9 years	23	26
	From 9 to 15 years	23	26
	More than 15 years	16	17
	Missing	2	-
Length of time on installation	Less than 1 year	27	30
	From 1 to 5 Years	27	30
	More than 5 years	35	40
	Missing	3	-
Length offshore	Less than 5 years	7	8
	From 5 to 10 years	8	9
	From 10 to 15 years	21	23
	More than 15 years	54	60
	Missing	2	-

A1.1.1.2 SAFETY CLIMATE (SECTION 2)

The same safety climate scale was used in both the subordinate and supervisor questionnaires. It was therefore possible to combine responses from both the questionnaires to create a single database of 309 responses. The combined data set was used for the factor analysis because the safety climate was developed on a sample that included both supervisory and non supervisory offshore employees. Principal Components Analysis reduced this 38 item scale into 9 factors with eigenvalues over 1.00. These 9 factors contained a number of single or two statement factors and therefore it was felt that this may not be the best factor solution. Ferguson and Cox (1993) argue that selecting the number of factors to extract on the basis of the eigenvalues being greater than one tends to produce many factors. An alternative method for identifying the number of factors to extract is to inspect a scree plot and identify a clear step change in the size of the eigenvalues (Ferguson and Cox, 1993). The inspection of the plot for this factor analysis suggested a five factor solution. The selection of the five factor solution is supported by the fact that this scale contained the five factors from the Mearns et al study which had cronbach's alpha values of above 0.70. The five factors that were revealed were slightly different from the original Mearns et al (1997) factor structure. The five factors revealed by the analysis were:

- I. Reluctance to speak up about safety
- II. Perceived lack of commitment to safety
- III. Safety on the Installation
- IV. Supervisor commitment
- V. Cost versus safety

Together these factors describe 45% of the data variance, with factor I describing 25% of the variance.

The factor loadings and reliability values are given in Table 2 along with the percentage of respondents who 'agreed' (combination of 'fully agree' and 'partially agree'); 'neither agreed nor disagreed' or 'disagreed' (combination of 'fully disagree' and 'partially disagree') with the statements. The factor loadings provide an indication of the item's membership to a particular group. Those items that have a loading of 0.50 or more essentially set the 'theme' for a particular group of items and determine the label given to that factor. The five factors are robust with reasonable internal reliability (Cronbach's alpha ranging from 0.63 to 0.83).

The safety climate scale used in the present study was taken from the Offshore Safety Questionnaire (OSQ) developed by Mearns et al (1997). In their study the OSQ was distributed to the staff on 16 installations and was completed and returned by 722 respondents. Of these 722 respondents, 33% indicated that they were supervisors. The supervisors that completed the OSQ (n=233) were separated out and the percentage that 'agreed' with these statements were included in table 2 for comparison. This safety climate scale also formed part of a self completion questionnaire used in the previous study of offshore supervisors' management of safety, where 40 supervisors were interviewed. This study was a subsection of the Mearns et al (1997) offshore safety study. The questionnaire responses from the supervisor section of the Mearns et al study (1997) are more comparable to those from the current because the supervisors' responses were not anonymous as they were in the main OSQ survey. The percentage of supervisors that 'agreed' with these statements were also included in table 2 for comparison.

Table 2a
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

I. Reluctance to speak up about safety	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=25) % Agree	(n= 233) % Agree
Minor accidents cause so much hassle they are quite often ignored	0.7032	63	4	33	26	26
People are reluctant to report accidents	0.6926	50	8	42	53	36
People are reluctant to report near-misses	0.6072	39	6	55	53	54
If you say too much about safety they might fire you	0.5975	86	3	11	17	29
When the operating companies start to lose money, unsafe working practices get overlooked	0.5820	63	14	23	11	22
Staff shortages sometimes result in rules being broken to get the job done	0.5681	65	2	33	32	44
My supervisor sometimes turns a blind eye when safety rules are broken	0.4871	73	9	18	16	23
I sometimes feel under pressure from my workmates to take chances	0.3958	89	7	4	10	14
Management listens to safety concerns, but nothing ever gets done	0.3452	72	9	19	11	23
The OIM is too busy to be involved in minor safety issues	0.3099	87	9	4	10	18
Chronbach's Alpha	0.83					

As can be seen in Table 2a the majority of respondents tended to disagree with statements, which suggest that employees do not speak up about safety. For example over 85% of respondents disagreed with the statements: *I sometimes feel under pressure from my workmates to take chances*; *The OIM is too busy to be involved in minor safety issues* and *If you say too much about safety they might fire you*. These results indicate that the majority of supervisors feel that safety is important. Table 2 also indicates that in general respondents from the current study felt that safety was equally as important as respondents from the previous studies. However, there are a number of statements which are still not very positive for example 55% of supervisors agreed with the statement: *People are reluctant to report near-misses*, 42% agreed with *People are reluctant to report accidents* and 33% agreed with *Minor accidents cause so much hassle they are quite often ignored*. This may indicate a bureaucratic accident and near miss reporting system, which makes reporting time consuming or it could be an indication of a perception of 'blame culture'.

Table 2b
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

II. Perceived lack of commitment to safety	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al study	
					(n=25) % Agree	(n= 233) % Agree
The safety manager only appears when there is a problem	0.7012	66	10	24	21	26
Safety Officers are in management's pocket	0.6566	61	19	20	11	29
Some rules are only there to cover management's back	0.6562	47	20	33	16	46
The safety officer gets tucked away in an office when a dangerous job is being done	0.6303	67	18	15	10	23
The PTW system is just a way of covering people's backs	0.5641	78	10	12	11	23
Safety reps do a pretty good job	-0.4624	17	17	66	78	59
Job insecurity means that people on this installation like to keep info. to themselves	0.4580	49	16	35	21	51
The written safety rules and instructions are too complicated for people to follow	0.4136	58	14	28	21	33
People are rushing jobs on this installation	0.4045	68	11	21	11	36
There is sometimes pressure to put production before safety on this installation	0.3917	66	11	23	5	30
Chronbach's Alpha	0.83					

The second factor contains statements that refer to the confidence the respondents have in their management's commitment to safety. It can clearly be seen in table 2b that over 50% of respondents disagreed with the majority of statements that suggest a lack of management commitment to safety. For example 78% disagreed with the statement *The PTW system is just a way of covering people's backs* and 68% disagreed with the statement *People are rushing jobs on this installation*. There are however two statements with which less than 50% of supervisors disagree: *Some rules are only there to cover management's back* (47% disagree) and *Job insecurity means that people on this installation like to keep information to themselves* (49% disagree). It is concerning that more than 50% of supervisors do not disagree with a statements suggesting that management create rules just to cover their back. In general it appears that the supervisors in the present study agree with the statements less than supervisors in the Mearns et al (1997) safety climate survey yet they appear to agree more than the 25 respondents in the previous supervisor study.

Factor three presented in table 2c contains statements that refer to the respondents' perception of the status of safety on their installation. In general the supervisors report that they feel safety is perceived to be important and that there is a high standard of safety on their installation. For example 89% of supervisors agreed with the statement *'Safety is taken seriously on this installation, it's not just a cosmetic exercise'* and 90% agree with the statement *The standard of safety is very high at my place of work*. One interesting point to note is that less supervisors agreed with statements that refer to management behaviour. For example 65% agreed with *The OIM is always on the look out for safety rule violations* and 71% agreed with *I feel that the management on this installation are concerned about my general welfare*. Having said this very few supervisors actively disagree with these statements. It is interesting to note that while they are positive about the state of safety they are less positive about management's' role in creating this positive state of safety.

Table 2c
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

III. Status of safety on the installation	Factor Loading	%	%	%	Mearns et al study	
					(n=25) % Agree	(n= 233) % Agree
Safety is taken seriously on this installation, it's not just a cosmetic exercise	0.6455	7	4	89	100	80
The standard of safety is very high at my place of work	0.6402	4	6	90	95	86
There is a good attitude to safety on this installation	0.6370	3	3	94	100	82
The crew is always given feedback on accidents that occur on this installation	0.6169	7	1	92	95	80
People on this installation refuse to do work if they feel the task is unsafe	0.5893	4	11	89	95	76
Management onshore are genuinely concerned about workers' safety	0.5003	8	14	78	84	59
The OIM is always on the look out for safety rule violations	0.4814	13	22	65	63	64
I feel that the management on this installation are concerned about my general welfare	0.3969	16	13	71	63	65
Whenever I see safety regulations being broken I point it out on the spot	0.3776	2	0	98	84	73
Chronbach's Alpha	0.78					

The statements in factor four (see table 2d) refer to the respondents' perception of their supervisors. In general the supervisors indicate they have a positive opinion of supervisors. It is interesting that while over 50% of respondents agree with all the statements only 59% agreed with 'My supervisors care about safety more than the average worker' and 68% agreed with 'My supervisors aren't scared of taking the blame for their errors'. This interesting because one would assume that supervisors would be more positive about supervision in general. It is also interesting to note that the item 'This installation has a 'no-blame culture' is contained within this factor as this suggests that level of a no blame culture is determined by supervisors.

Table 2d
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

IV. Supervision	Factor Loading	%	%	%	Mearns et al study	
					(n=25) % Agree	(n= 233) % Agree
I trust my supervisors	0.8164	8	18	74	78	64
Supervisors are sensitive to the personal problems of members of their work group	0.7185	18	10	72	63	44
My supervisors aren't scared of taking the blame for their errors	0.6805	12	20	68	68	49
My supervisors care about safety more than the average worker	0.5571	18	23	59	68	57
This installation has a 'no-blame culture'	0.4055	18	12	61	58	42
Chronbach's Alpha	0.74					

Factor five is the final factor and is presented in table 2e. These concepts appear refer to the conflict between getting operations completed on time and doing them safely. This concept has been identified by many safety climate researchers and has been referred to as 'protection versus production' by Reason (1997). It is interesting and concerning to note that 68% of supervisors report that *The rules do not always describe the safest way of working*. This suggests that supervisors do not have confidence in them and therefore are not likely to ensure that their subordinates adhere to them. It is important to investigate why supervisors do not feel that the rules describe the safest way of working. It is also worrying to note that over 50% agree with the statement *Some jobs would be impossible to perform if all the rules were followed to the letter*.

Table 2e
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed' with statements about safety and accident prevention at work

V. Pressure for production	Factor	%	%	%	Mearns et al (1997)	
					(n=25)	(n= 233)
	Loading	Disagree	Neither	Agree	% Agree	% Agree
If I didn't take a risk now and again, the job wouldn't get done	0.6598	79	4	17	32	27
Some jobs would be impossible to perform if all the rules were followed to the letter	0.5331	43	5	52	-	-
Sometimes it is necessary to ignore safety regulations to keep production going	0.4674	81	9	10	5	16
The rules do not always describe the safest way of working	0.3713	16	16	68	16	43
Chronbach's Alpha	0.63					

A1.1.1.3 SUPERVISORS' MANAGEMENT OF SAFETY (SECTION 2)

Within the safety climate scale a number of statements were included to investigate if the attitudes that Mearns et al (1997) concluded separated effective supervisors from less effective have an impact on supervisory performance. The responses given by supervisors are presented in table 3. In general, the majority of respondents reported a safety management style that was similar to the effective supervisors identified in the Mearns et al study. This illustrated by the fact that over 90% of supervisors agreed with the statements: *It is important to be aware of how my subordinates are thinking and feeling and I protect my subordinates from feeling under pressure from production deadlines*. In contrast to this there were three statements where the responses of over 50% of the supervisors suggested that they had different attitudes as those reported by the effective supervisors in the Mearns et al study. For example only 41% disagree with the statements *Supervisors are often unfairly blamed if their subordinates are involved in an accident* and *My subordinates are not particularly better than other workers on this installation* and only 26% agree with the statement *I feel that I am more safety conscious than other supervisors on this installation*.

Table 3
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or 'disagreed' with safety management attitude statements

Safety management attitudes	% Disagree	% Neither	% Agree
It is important to be aware of how my subordinates are thinking and feeling	0	3	97
I visit the work site frequently to encourage safe working	4	4	92
It important for a supervisor to dictate what safety precautions must be taken when their work group are carrying out a job.	6	3	91
I protect my subordinates from feeling under pressure to meet deadlines	3	7	90
I am as safety conscious at home as I am offshore	15	8	77
I feel that I am more safety conscious than other supervisors on this installation	26	48	26
It is better not to visit the worksite often, as it makes people feel that they are being spied upon	77	8	15
Supervisors are often unfairly blamed if their subordinates are involved in an accident	41	26	33
My subordinates are not particularly better than other workers on this installation	41	30	29
I often have to speak to my subordinates about their performance not meeting the required standard	54	12	36

A1.1.1.4 FLEISHMAN LEADERSHIP SCALE (SECTION 3)

The Fleishman leadership scale was developed in America in the 1950's to measure the aspects of first line supervisors' leadership style which influence performance. The scale measures two factors 'Consideration' and 'Initiating Structure' which have been linked with supervisory performance on a number of different indicators (Fleishman, 1953). Supervisors that report high levels of 'consideration' tend to have lower levels of staff turn over and absenteeism (Fleishman and Harris, 1962). Employees with supervisors that report high level of initiating structure, tend to be more productive. It was initially felt that scoring high on one scale precluded a high score on the other scale but later research has found that the most effective supervisors scored highly on both factors (Cummins, 1971). This scale was used in the previous study of offshore supervisors by Mearns et al (1997) but no significant differences between effective and less effective supervisors on the two scales were identified. The effective supervisors had a higher mean score for 'consideration' and a lower score on the 'initiating structure' scale.

As can be seen in table 4a the majority of respondents reported that they felt supervisors should show high levels of consideration. For example 91% of supervisors indicated that they felt that supervisors should never or seldom 'Change the duties of people in the work group without first talking it over with them' and 80% indicated that supervisors should often or always 'Back up what people under you do'. In contrast to this 41% of respondents indicated that they felt that supervisors should never or seldom 'Give in to others in discussions with your work group'. The table also shows that the supervisors in the current study reported similar levels of consideration as did the supervisors in the previous study by Mearns et al (1997).

Table 4 a
Percentage of respondents who indicated that they 'Never / seldom', 'Occasionally' or 'Always / often' carry out the behaviours described in the Fleishman leadership scale

Consideration	% Seldom	% Occasionally	% Often	<i>Mearns et al (1997) (n=25) % Often</i>
Refuse to compromise on a point	67	28	5	0
Do personal favours for people in the work group*	53	37	10	20
Speak in a manner not to be questioned	77	22	1	5
Ask for more than members of the work group can get done*	85	13	2	5
Help people in the work group with their personal problems*	14	32	54	50
Stand up for those in the work group under you, even though it makes you unpopular with others	5	42	53	55
Insist that everything is done your way	72	23	5	15
Reject suggestions for change	79	21	0	0
Change the duties of people in the work group without first talking it over with them*	91	8	1	0
Resist changes in ways of doing things**	73	26	1	0
Refuse to explain your actions*	95	3	2	0
Act without consulting the work group*	80	17	3	5
Back up what people under you do	2	18	80	90
Be slow to accept new ideas	92	7	1	0
Treat all people in the work group as equal	3	1	96	90
Criticise a specific act rather than a particular member in the work group	8	28	64	70
Be willing to make changes	1	9	90	80
Put suggestions made by people in the work group into operation	0	42	58	70
Get the approval of the work group on important matters before going ahead	12	25	63	63
Give in to others in discussions with your work group*	41	49	10	20

* Scale read: Often, fairly often; Occasionally; Once in a while, very seldom

** Scale read: A great deal, fairly much; To some degree; comparatively little, Not at all

As can be seen in table 4b there is more variance between respondents in the level of 'initiating structure' that they report. For example 35% of respondents reported that they felt that supervisors should never or seldom 'Encourage slow working people in the work group to work harder'. While 25% report that they felt that supervisors should always or often 'Encourage slow working people in the work group to work harder'. It is interesting that there is a greater amount of variance in the initiating structure scale than in the consideration scale. This suggests that supervisors are in less agreement about ideally how supervisors should manage the production aspects of their role.

Table 4b

Percentage of respondents who indicated that they 'Never / seldom', 'Occasionally' or 'Always / often' carry out the behaviours described in the Fleishman leadership scale

Initiating Structure	% Never	% Occasionally	% often	Mearns et al (1997) (n=25) % Often
Encourage overtime work*	62	21	17	5
Tryout your own new ideas in the work group*	34	43	23	37
Rule with an iron rod	80	17	3	0
Criticise poor work	16	42	42	30
Talk about how much should be done**	6	42	52	53
Encourage slow working people in the work group to work harder*	35	40	25	10
Wait for people in the work group to push new ideas	37	49	14	15
Assign people in the work group to a particular tasks	0	19	81	84
Ask for sacrifices from the men under you for the good of the entire section*	66	21	13	5
Ask that people under you follow to the letter those standard routines handed down to you	9	21	70	53
Offer new approaches to problems*	6	25	69	84
Put the sections welfare above the welfare of any member in it	48	25	27	26
Insist that you be informed on decisions made by people in the work group under you	7	22	71	74
Let others do their work the way they think best	17	39	44	42
Stress being ahead of competing work groups**	77	19	4	0
"Needle" people in the work group for greater effort**	89	11	0	0
Emphasise the meeting of deadlines**	25	44	31	26
Decide in detail what shall be done and how it shall be done by the work group	12	22	66	68
Meet with the group at regularly scheduled times	0	12	88	95
See to it that people in the work group are working up to capacity	8	13	79	53

* Scale read: Often, fairly often; Occasionally; Once in a while, very seldom

** Scale read: A great deal, fairly much; To some degree; comparatively little, Not at all

A1.1.1.5 EFFECTIVE SUPERVISOR SAFETY MANAGEMENT

The previous study investigating offshore supervisors' management of safety identified a number of different behaviours that separated effective from less effective supervisors. One of the primary aims of this study was to investigate the findings of the Mearns et al study using a different method; therefore a safety leadership scale was developed based on the factors which were identified as important in the previous study. In general respondents report that their behaviour is similar to that of the effective supervisors in the previous study. For example 95% of the respondents indicated that they often or always 'accept responsibility for my subordinates' safety' and 89% indicated that they often or always 'I show concern for team members' welfare'. While overall the respondents present a very positive picture of their safety management behaviour a small percentage of supervisors were less positive. For example 33% of supervisors indicated that they occasionally 'find it difficult to know how my subordinates are thinking and feeling' 21% indicated that they 'occasionally have difficulty motivating subordinates to work safety' and only

73% indicated that never or seldom 'have to put pressure on my subordinates to get the job done on time.'

Table 5
Percentage of respondents who indicated that they 'Never / seldom', 'Occasionally' or 'Always / often' carry out effective safety leadership behaviours

Safety leadership behaviours	% Seldom	% Occasionally	% Often
I make it clear to each of my subordinates that I value their contribution to the team	3	17	80
I accept responsibility for my subordinates' safety	1	4	95
I have difficulty motivating subordinates to work safety	74	21	5
I carry out safety inspections with my subordinates	7	15	78
I have to put pressure on my subordinates to get the job done on time	73	23	3
I visit the worksite three or more times a shift	7	17	76
I find it difficult to know how my subordinates are thinking and feeling	65	33	2
I involve my subordinates in decision making	3	18	79
I show concern for team members' welfare	2	9	89
I talk more about safety than productivity	3	16	81
I visit worksites to check that my subordinates are working	25	30	45
I attend pre-job safety meetings and tool box talks	1	10	89
I involve workgroup members in risk assessments	3	9	88
I ensure that my subordinates understand the PTWs that they work under	1	6	93
I encourage safe working by setting a good example	0	1	99
I feel my subordinates take short cuts which involve little or no risk	72	24	4

A1.1.2 Subordinate questionnaire

The offshore safety management questionnaire was returned by 217 of the 800 subordinate questionnaire that were sent offshore, which was a response rate of 27%. This response rate is conservative because more questionnaires were sent than were distributed to offshore employees. The questionnaire consisted of four main sections, these included: (see appendix 4 for details).

1. Section one contained biographical information,
2. Section two safety climate scale,
3. Section three contained the safety behaviour scale
4. Section four contained a supervisor safety management behaviour scale

A1.1.2.1 SECTION 1 BIOGRAPHICAL DATA

The biographical composition of the sample is described in table 6. This table indicates that the sample is broadly similar to previous offshore samples in terms of accident involvement and length of time offshore. The sample contains a slightly different occupational mixture, with more construction employees than would be expected. In addition to this a high percentage (91%) of the sample are employed by contracting companies. This is likely to be due to the fact that the sample only included non supervisory staff in addition to the fact that a contracting company was one of the organisations providing access. It is interesting that 60% of subordinates indicated that their supervisor was the same discipline as them while 83% of supervisors reported they were the same discipline as their subordinates. This may suggest that the supervisors have a wider perspective of their discipline e.g. construction, while subordinates are more specific e.g. pipe-fitter. It is also possible that supervisors that

were the same discipline as subordinates were more likely to complete their questionnaire. The supervisors' and subordinates' samples appear to have different occupational composition, because 37% of subordinates classified themselves as maintenance staff while only 21% of the supervisors came from maintenance.

Table 6
Subordinates' General Information

Biographical Data	Categories	Frequency	Valid %
Job Category	Maintenance	80	37
	Construction	56	26
	Production	30	14
	Admin /Catering	18	8
	Drilling	11	5
	Other	19	9
	Missing	4	-
Supervisor same discipline	Yes	127	60
	No	87	40
	Missing	7	-
Length of time working with supervisor	Less than 1 year	110	52
	From 1 to 5 years	67	32
	More than 5 years	34	16
	Missing	7	-
Length of time with employer	Less than 1 year	76	36
	From 1 to 3 years	28	13
	From 3 to 9 years	65	31
	More than 9 years	44	21
	Missing	5	-
Length of time offshore	Less than 5 years	43	20
	From 5 to 10 years	64	30
	From 10 to 15 years	37	17
	More than 15 years	69	32
	Missing	5	-
Length of time on the platform	Less than 1 year	106	50
	From 1 to 3 years	24	11
	From 3 to 9 years	54	26
	More than 9 years	28	13
	Missing	6	-
Employer	Operator	19	9
	Contracting Company	193	91
	Missing	6	-
Accidents	Yes	60	29
	No	149	71
	Missing	9	-
Accident occurred working for current supervisor	Yes	22	17
	No	106	83
	Missing	90	-
Accident initiated by	Injured person	21	62
	Work group member	5	15
	Other crew member	8	24
	Missing	184	-
High potential incident	Yes	61	29
	No	152	71
	Missing	5	-

A1.1.2.2 SAFETY CLIMATE

The factor analysis of the safety climate scale, which included subordinates' responses was described in section 3.1.1.2. In the following section the percentage of respondents that indicated that they 'disagreed', 'neither agreed or disagreed' or 'agreed' with the statements from the questionnaire. In addition as a point of comparison the percentage of respondents from both the supervisors' section and safety climate section of the Mearns et al (1997) study is provided.

Table 7a
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

I. Reluctance to speak up about safety	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=112) % Agree	(n= 722) % Agree
Minor accidents cause so much hassle they are quite often ignored	0.7032	37	10	53	44	31
People are reluctant to report accidents	0.6926	29	11	60	58	40
People are reluctant to report near-misses	0.6072	21	7	72	46	55
If you say too much about safety they might fire you	0.5975	57	16	27	31	37
When the operating companies start to lose money, unsafe working practices get overlooked	0.5820	47	17	36	37	35
Staff shortages sometimes result in rules being broken to get the job done	0.5681	42	10	48	42	52
My supervisor sometimes turns a blind eye when safety rules are broken	0.4871	77	9	14	10	26
I sometimes feel under pressure from my workmates to take chances	0.3958	81	10	9	9	13
Management listens to safety concerns, but nothing ever gets done	0.3452	54	19	27	43	25
The OIM is too busy to be involved in minor safety issues	0.3099	82	11	7	8	16
Chronbach's Alpha	0.83					

As can be seen in Table 7a over 50% of respondents tended to disagree with the majority of statements that suggest people are reluctant to speak up about safety and that safety is unimportant. For example over 75% of respondents disagreed with the statements: *I sometimes feel under pressure from my workmates to take chances*; *The OIM is too busy to be involved in minor safety issues* and *My supervisor sometimes turns a blind eye when safety rules are broken*. These results indicate that the majority of respondents feel that safety is seen as being important and are willing to speak up about safety. Table 7a also indicates that in general respondents from the current study felt that safety was equally as important as respondents from the previous studies. However, there are a number of statements that are less positive for example 72% of subordinates agreed with the statement: *People are reluctant to report near-misses*, 60% agreed with *People are reluctant to report accidents* and 53% agreed with *Minor accidents cause so much hassle they are quite often ignored*. This may indicate a bureaucratic accident and near miss reporting system that makes reporting time consuming. From a more negative perspective it could indicate a perception of 'blame culture'.

The second factor (table 7b) contains statements that refer to the confidence the respondents have in their management's commitment to safety. It can clearly be seen in table 7b that over 50% of respondents disagreed with the majority of statements that suggest a lack of management commitment to safety. For example 67% disagreed with the statement *The PTW system is just a way of covering people's backs* and 57% disagreed with the statement *People are rushing jobs on this installation*. There are however two statements with which less than 50% of the respondents disagree: *Some rules are only there to cover management's back* (37% disagree) and *Job insecurity means that people on this installation like to keep information to themselves* (36% disagree). It is concerning that more than 50% of respondents do not disagree with statements suggesting that management create rules just to cover their own back. In general, it appears that the respondents in the present study agree

with the statements less than respondents in the Mearns et al (1997) safety climate survey and less than the 112 respondents in the previous supervisor study.

Table 7b continued
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or 'disagreed' with statements about safety and accident prevention at work

II. Perceived lack of commitment to safety	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=112) % Agree	(n= 722) % Agree
The safety manager only appears when there is a problem	0.7012	54	22	24	33	30
Safety Officers are in management's pocket	0.6566	45	28	27	40	33
Some rules are only there to cover management's back	0.6562	37	21	42	66	48
The safety officer gets tucked away in an office when a dangerous job is being done	0.6303	57	20	23	27	21
The PTW system is just a way of covering people's backs	0.5641	67	12	21	20	27
Safety reps do a pretty good job	-0.4624	13	22	65	58	55
Job insecurity means that people on this installation like to keep inf. to themselves	0.4580	36	20	44	46	56
The written safety rules and instructions are too complicated for people to follow	0.4136	63	18	19	30	29
People are rushing jobs on this installation	0.4045	57	21	22	32	37
There is sometimes pressure to put production before safety on this installation	0.3917	65	20	15	26	37
Chronbach's Alpha	0.83					

Factor three (table 7c) contains statements that refer to the respondents' perception of the status of safety on their installation. In general respondents report that they perceive safety to be important and that there is a high standard of safety on their installation. For example 87% of respondents agreed with the statement '*Safety is taken seriously on this installation, it's not just a cosmetic exercise*' and 85% agree with the statement *The standard of safety is very high at my place of work*. One interesting point to note is that less respondents agree with statements that refer to management behaviour. For example 71% agreed with *The OIM is always on the look out for safety rule violations* and 54% agreed with *I feel that the management on this installation are concerned about my general welfare*. Having said this very few respondents actively disagree with these statements. Interestingly while they are positive about the state of safety they are less positive about their management's role in creating this positive state of safety.

Table 7c continued
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

III. Safety on the installation	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=112) % Agree	(n= 722) % Agree
Safety is taken seriously on this installation, it's not just a cosmetic exercise	0.6455	6	7	87	83	72
The standard of safety is very high at my place of work	0.6402	6	9	85	92	70
There is a good attitude to safety on this installation	0.6370	1	9	90	93	76
The crew is always given feedback on accidents that occur on this installation	0.6169	8	3	89	91	77
People on this installation refuse to do work if they feel the task is unsafe	0.5893	7	13	80	81	61
Management onshore are genuinely concerned about workers' safety	0.5003	19	22	59	71	46
The OIM is always on the look out for safety rule violations	0.4814	9	20	71	71	55
I feel that the management on this installation are concerned about my general welfare	0.3969	25	21	54	52	55
Whenever I see safety regulations being broken I point it out on the spot	0.3776	16	15	69	66	64
Chronbach's Alpha	0.78					

The statements in factor four (table 7d) refer to the respondents' perception about their supervisors. In general they indicated that they have a positive opinion of supervisors. It is interesting that while over 50% of respondents agree with all the statements only 67% agreed with 'My supervisors care about safety more than the average worker' and 62% agreed with 'My supervisors aren't scared of taking the blame for their errors'. It is also interesting to note that the item 'This installation has a 'no-blame culture' is contained within this factor as this suggests that level of a no blame culture is determined by supervisors.

Table 7d continued
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed'
with statements about safety and accident prevention at work

IV. Supervision	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=112) % Agree	(n= 722) % Agree
I trust my supervisors	0.8164	11	20	69	83	57
Supervisors are sensitive to the personal problems of members of their work group	0.7185	17	14	69	76	42
My supervisors aren't scared of taking the blame for their errors	0.6805	17	21	62	70	39
My supervisors care about safety more than the average worker	0.5571	11	22	67	77	46
This installation has a 'no-blame culture'	0.4055	30	19	51	56	34
Chronbach's Alpha	0.74					

The final factor (table 7e) refers to the conflict between getting operations completed on time and doing them safely. This concept has been identified by many safety climate researchers and has been referred to as 'protection versus production' by Reason (1997). It is interesting and concerning to note that 68% of respondents report that *The rules do not always describe the safest way of*

working. This suggests that they do not have confidence in the rules and therefore are not likely adhere to them. It is therefore important to investigate why supervisors do not feel that the rules describe the safest way of working. It is also worrying to note that less than 50% disagree with the statement *Some jobs would be impossible to perform if all the rules were followed to the letter*.

Table 7e continued
Percentage of respondents who 'agreed', 'neither agreed nor disagreed' or disagreed' with statements about safety and accident prevention at work

V. Pressure for production	Factor Loading	% Disagree	% Neither	% Agree	Mearns et al (1997)	
					(n=112) % Agree	(n= 722) % Agree
If I didn't take a risk now and again, the job wouldn't get done	0.6598	59	13	28	24	54
Some jobs would be impossible to perform if all the rules were followed to the letter	0.5331	46	9	45	-	-
Sometimes it is necessary to ignore safety regulations to keep production going	0.4674	74	10	16	19	60
The rules do not always describe the safest way of working	0.3713	16	16	68	65	44
Chronbach's Alpha	0.63					

A1.1.2.3 SAFETY BEHAVIOUR

Tables 8 and 9 show the proportion of respondents who reported that they 'never' (combination of 'never' and 'seldom'), 'occasionally' or 'often' (combination of 'often' and 'very often') carried out both positive and negative safety actions. In general respondents reported a low level of risk taking behaviour and a high amount of safety behaviour. It is interesting to note that less than 10% of respondents admit to carrying out the following activities '*I carry out activities which are forbidden*', '*I bend the rules to achieve a target*' and '*I ignore safety regulations to get the job done*'. In contrast only 63% of respondents indicated that the never or seldom '*take shortcuts which involve little or no risk*'.

Table 8
Percentage of respondents that indicate that they never, occasionally and often carrying out the following risk taking behaviours

I Risk taking behaviour	Factor Loading	% Never	% Occasionally	% Often	Mearns et al (1997)	
					(n=112) % never	(n= 722) % never
I break rules due to management pressure	0.8075	86	11	3	-	
I bend the rules to achieve a target	0.7229	94	5	1	91	51
I take shortcuts which involve little or no risk	0.6965	63	30	7	-	
I ignore safety regulations to get the job done	0.6968	94	5	1	96	55
I carry out activities which are forbidden	0.6839	97	3	0	97	76
Chronbach's Alpha	0.80					

In general, respondents indicated that they are proactive about safety. For example over 70% of respondents indicated that they '*encourage fellow workers to work safely*' and '*talk about safety with fellow workers*'. Interestingly only 55% of respondents indicated that they would often perform the following activity '*if I see someone breaking safety procedures I confront them*'.

Table 9
Percentage of respondents that indicate that they never, occasionally and often carrying out the following safety behaviours

II Safety behaviour	Factor loading	% Never	% Occasionally	% Often
If I see someone breaking safety procedures I confront them	0.8129	10	35	55
I talk about safety with fellow workers	0.8081	4	26	70
I encourage fellow workers to work safely	0.7760	6	20	74
Chronbach's Alpha	0.73			

A1.1.2.4 SUBORDINATE PERCEPTIONS OF SUPERVISOR SAFETY MANAGEMENT BEHAVIOUR

Table 10 shows the proportion of respondents who reported that their supervisor 'never' (combination of 'never' and 'seldom'), 'occasionally' or 'often' (combination of 'often' and 'always') carried out both positive and negative safety management behaviours. In general subordinates' responses indicate that their supervisors frequently perform activities that have been linked to effective supervision and infrequently perform activities that have been linked to less effective supervision. For example over 70% of subordinates indicated that their supervisors either often or always carried out the following activities: 'Ensures that I understand the PTWs that I work under' 'Accepts responsibility for my safety' 'Show concern for team members' welfare' and 'Encourage safe working by setting a good example'. In addition less than 10% of respondents (7% Often) reported that their supervisor often or always *Has difficulty motivating subordinates to work safety* and *Puts pressure on me to get the job done on time*.

Table 10
Percentage of respondents that indicate that their supervisor never, occasionally and often carry out the following behaviours

My Supervisor:	% Never Seldom	% Occasionally	% Often Always
Makes it clear to me that he/ she values my contribution to the team	8	22	70
Accepts responsibility for my safety	10	12	78
Has difficulty motivating subordinates to work safety	82	11	7
Carries out safety inspections with me	31	24	45
Puts pressure on me to get the job done on time	76	16	8
Visits the worksite three or more times a shift	18	20	62
Finds it difficult to know how his subordinates are thinking and feeling	14	22	64
Involve me in decision making	14	27	59
Show concern for team members' welfare	8	17	75
Talks more about safety than productivity	11	26	63
Visits the worksite to check that we are working	22	35	43
Attends pre-job safety meetings and tool box talks	12	18	70
Involves me in risk assessments	14	27	59
Ensures that I understand the PTWs that I work under	7	13	80
Encourage safe working by setting a good example	8	19	73

A1.1.3 Superior evaluation scale

The superior evaluation scale was returned for 129 of the 140 superior evaluation forms that were sent out, which is a response rate of 92%. Table 11 shows the proportion of the superiors that rated supervisors as unsatisfactory (combination of unsatisfactory and below satisfactory), Satisfactory (combination of entirely

satisfactory and a good performer) and very good performer (combination of very good performer and an outstanding performer). It is clear from the table below that the majority of superiors surveyed rated supervisors as satisfactory. In general there was very little variance in the superiors' evaluation on the different skills, except for 'technical ability' where 41% of the supervisors evaluated were rated as a very good performer.

Table 11
Percentage of superiors that rate supervisors as unsatisfactory, satisfactory and a very good performer

	% unsatisfactory	% satisfactory	% very good
Technical Ability	1	58	41
Judgement	1	82	17
Adaptability	2	81	16
Communication skills	5	83	12
Relationships	6	73	21
Concerned about safety	-	77	23
Admits mistakes	7	81	12
Gives clear instructions	4	81	15
Is interested in their workforce	2	74	24
Is a good listener	6	81	13
Is approachable	5	81	14
Overall	-	84	16

A1.2 MULTI VARIATE ANALYSIS

The above section provided an overall description of the data from both the supervisor and subordinate questionnaires. In addition to these descriptive statistics it is important to investigate the relationships between variables (e.g. supervisor management behaviour and safety behaviour) and differences between groups (e.g. accident versus non accident). The following section will initially describe the differences between groups and go on to present a regression model, which identifies the factors that influence subordinate safety behaviour.

A1.1.1 Differences between groups

A1.2.1.1 SUPERVISORS VERSUS NON SUPERVISORS

It has been possible to compare the responses of supervisors with non supervisors on the safety climate scale because the same scale was used in their respective questionnaires. A series of t-tests were performed to investigate if there were differences between supervisors and non-supervisors on the five factors from the safety climate scale. This analysis revealed two significant difference between the two groups on the safety climate scale.

There was a significant difference between the groups on Factor 1 'Reluctance to speak up about safety' (DF 1/263; t=-3.70; p<0.05), were supervisors (m=-.33) indicated that they perceived safety to be more important than non supervisors (m=.15). There was also a significant difference between the groups on factor 3 'Safety on the installation' (DF 1/263 t=2.43 p<0.05) where supervisors (m=.22) indicated that they had a more positive perception of the state of safety on the installation than non supervisors (m=-.10). The tests did not reveal significant differences between the two groups on the other factors; factor 2 'Perceived lack of commitment to safety' (DF 1/263 t=-.56; p=0.57); Factor 4 'Supervision' (DF 1/263; t=-1.13; p=0.28); Factor 5 'Production versus safety' (DF 1/263 t=-1.76 p=0.08).

A1.2.1.2 DIFFERENCES BETWEEN ACCIDENT AND NON ACCIDENT SUBORDINATES

In section one of the questionnaire subordinates were asked if they had ever been involved in an accident. Of the 217 respondents that completed the questionnaire, 60 (29%) indicated that they had previously been involved in accident. A series of t-test were performed to identify any significant differences between respondents that reported they had previously been involved in an accident and those that indicated that have never been involved in an accident. The two groups were compared on the following variables: five safety climate factors; the eight safety behaviour statements and the fifteen supervisor safety management behaviour items. These 28 t-test revealed 5 significant differences between the accident and non accident respondents.

Table 12
Differences between accident and non accident respondents

Statement	Statistics	Accident mean score	Non Accident mean score
Factor 1: Reluctance to speak up about safety	(DF 1/115; t=2.56; p<0.05)	0.399	0.0194
I talk about safety with fellow workers	(DF 1/205; t=2.11; p<0.05)	2.72	2.99
I break the rules due to management pressure	(DF 1/86; t=2.92; p<0.05)	0.833	0.418
My supervisor visits the work site three or more times a shift	(DF 1/205; t=-2.26; p<0.05)	2.36	2.80
My supervisor involves me in risk assessments	(DF 1/204; t=-2.28; p<0.05)	2.81	3.19

Table 12 summaries the results of the tests that revealed a significant difference between the two groups. These results must be treated with a certain amount of caution because the large number of test performed creates the possibility of capitalising on chance. A confidence level of 0.05 implies that if 20 t-tests are performed then one significant result would be expected by chance alone. It is therefore possible that one of the findings presented in table 12 is spurious.

It is interesting to note that factor 1 'Reluctance to speak up about safety' was the only safety climate factor where there was a significant difference between accident and non-accident groups. This indicates that non-supervisory staff who believe that people on the installation are reluctant to speak up about safety are more likely to have been involved in an accident. While this finding does not show causation, it is not unreasonable to conclude that employees are more likely to be involved in an accident if they believe that people are reluctant to speak up about safety, which implies a blame culture or that safety is not important.

The analysis also revealed a significant difference between the groups on two of the safety behaviour items, one positive 'I talk about safety with fellow workers' and one negative 'I break rules due to management pressure'. This indicates that subordinate safety behaviour is related previous accident involvement, again the direction of causation cannot be shown. Having said that it seems reasonable to conclude that if offshore employees talk about safety with fellow workers and do not break rules due to management pressure they are also less likely to be involved in an accident.

The two supervisor behaviours, which non accident respondents report more frequently are supervisors visiting the work site more than 3 times a shift and supervisors involving them in risk assessments. This indicates that supervisors who manage safety effectively are more likely to visit the worksite frequently and involve their subordinates in decision making. This finding supports two of the primary conclusions from the Mearns et al (1997) study.

A1.2.1.3 INVOLVEMENT IN HIGH POTENTIAL INCIDENTS

In addition to previous accident involvement subordinates were also asked about their involvement in high potential incidents. Of the 217 respondents 50 (25%) reported that they had been involved in a high potential incident. A series of t-test were performed to identify any significant differences between respondents that reported they had previously been involved in a high potential incident and those that indicated that have never been involved in one. The two groups were compared on the following variables: five safety climate factors; the eight safety behaviour statements and the fifteen supervisor safety management behaviour items. These 28 t-test did not reveal any significant differences between the two groups. It is possible that respondents were unsure of what was meant by the term 'high potential incident'. It is also possible that an individual could have been involved in an incident without necessarily having any involvement in initiating the event.

A1.2.1.4 DIFFERENCES BETWEEN OCCUPATIONS

The 217 subordinates that completed and returned the 'Offshore Safety Management Questionnaire' were categorised into one of five occupational groups. The five groups were; Administration and catering; Production; Maintenance; Drilling and Construction. A series of one way ANOVAs were performed to identify any difference between the groups on the five safety climate factors, the eight safety behaviour statements and the 15 supervisor safety management statements. The seven significant differences between the five occupational groups revealed by 28 tests are presented in table 13.

**Table 13
Differences between occupational groups**

Statement	DF	F ratio	p value	Mean and occupational group	Mean and occupational group
Factor 2: Perceived lack of commitment to safety	4/156	3.54	<0.05	Drilling 1.00	Construction -0.25
If I see someone breaking safety rules I confront them	4/189	3.38	<0.05	Maintenance 2.78	Admin/ catering 2.00
Visits the worksite more than 3 times a shift	4/189	2.51	<0.05	Construction 3.02	Maintenance 2.37
Supervisor involves subordinates in risk assessments	4/188	3.02	<0.05	Maintenance 3.3	Construction 2.7
Supervisor visits the worksite to check that we are working	4/188	2.83	<0.05	Construction 2.46	Production 1.66
Is aware of how subordinates are thinking and feeling	4/189	3.28	<0.05	Maintenance 2.84	Drilling 1.73
Ensures that I understand the PTW I work under	4/184	2.58	<0.05	Construction 3.44	Admin/ Catering 2.5

It is concerning that drillers indicated that they had less confidence in management's' commitment to safety as they have one of the more hazardous occupations on an offshore installation. This finding may be linked to the fact that drillers also report that their supervisors are less aware of how they are thinking and feeling. These findings are worthy of further investigation. The other occupational differences appear to be due to variations in the type of work performed by the different groups. For example it is likely that administration and catering staff have less need to use PTW's and therefore have a lower mean score on this item.

A1.2.1.5 SUPERVISORS THAT RESPONDED VERSUS THOSE WHO DID NOT

Every effort was made (individually addressed letters, follow up phone calls and a second letter with a replacement questionnaire), to ensure that supervisors completed and returned their questionnaire. It could be argued that not returning the questionnaire may indicate that safety is not a priority for this supervisor. It was therefore decided to create a variable in the subordinate database to identify respondents whose supervisors did not return a questionnaire. This was done so that it would be possible to compare the responses of subordinates with supervisors that did return the questionnaire with those who had supervisors that did not return the questionnaire. Three categories were created, 1, returned the questionnaire; 2, did not return the questionnaire and 3, supervisor identified by the subordinate was not sent a questionnaire. This revealed that the supervisors of 110 of the respondents had returned the questionnaire and 39 of the respondents had supervisors that did not return the questionnaire. The remaining 50 respondents either did not identify a supervisor or named a supervisor that had not been sent a questionnaire. A series of t tests were performed to investigate if there was a difference between the two groups in terms of their evaluation of their supervisors management of safety. The four significant differences between the two groups revealed by the 16 tests are presented in table 14.

Table 14
Comparison of supervisors that responded with those that did not, on the basis of their subordinates' evaluation of their safety management behaviours

Statement	DF	t value	p value	Returned mean	Did not return mean
My supervisor attends pre-job safety meetings	1/148	-2.09	<0.05	3.20	2.64
My supervisor accepts responsibility for the safety of the workgroup	1/147	-2.84	<0.05	3.38	2.87
My supervisor ensures that I understand the PTWs I work under	1/144	-2.49	<0.05	3.51	3.10
Factor 4 Supervisors commitment to safety	1/122	2.00	<0.05	0.24	-0.23

This finding indicates that supervisors who took the time to complete the supervisor questionnaire were perceived to be more concerned about safety by their subordinates. The fact that there are significant differences between the two groups in their subordinates evaluation of their performance suggests that subordinates are aware of their supervisors' level of commitment to safety. This implies that subordinate perceptions can be used as a measure of supervisors' management of safety. It also indicates that those supervisors who did not return the questionnaire may be less effective in the management of safety. While this finding may not appear to have implications for improving supervisors' safety management it does lend support to subordinates' evaluation of their supervisors' behaviour. This finding also has implication for the interpretation of the finding from the supervisor questionnaire as it suggests that the sample may be biased.

A1.1.2 Relationships between factors from the subordinate questionnaire

One of the ultimate objectives of this study was to identify the factors that influence offshore workers' level of safety. Accident involvement has been shown to be linked to offshore workers' self report levels of safety behaviour (Rundmo, 1995, Mearns et al, 1997). It is therefore important to identify the factors that influence workers' self report safety behaviour. A step wise regression analysis was carried out on the subordinate data set to identify the safety climate factors and the items from the supervisor safety management behaviour scale that influence respondents' self

report risk taking behaviour. The results of this analysis are presented in table 15. The analysis reveals that 48% of the variance in subordinate risk taking behaviour is explained by three safety climate factors and three supervisor safety leadership behaviour statements.

Table 15
Regression analysis identifying the factors which influence subordinates self report 'risk taking behaviour'

Variable	DF	β	R ²	F	signif. F
My supervisor encourages safe working by setting a good example	1/169	-0.48	.23	50.63	<0.001
Factor 1 Reluctance to speak up about safety	2/168	0.30	.30	38.93	<0.001
Factor 5 Production versus safety	3/167	0.27	.38	35.53	<0.001
Factor 2 Perceived lack of commitment to safety	4/166	0.26	.44	34.72	<0.001
My supervisor attends pre-job safety meetings and toolbox talks	5/165	-0.18	.47	30.75	<0.001
Has difficulty motivating his team to work safely	6/164	0.16	.48	27.49	<0.001

The analysis revealed that three supervisor safety management behaviours influence subordinate risk taking behaviour. In fact the most important variable in the equation was subordinates' perception of the amount their supervisor encouraged safe working by setting a good example. The two other supervisor behaviours were attending pre-job safety meetings and tool box talks and the perception that the supervisor has difficulty in motivating the team to work safely. Three safety climate factors were found to influence subordinates self report risk taking behaviour these were 'Reluctance to speak up about safety, followed by Cost versus safety and Perceived lack of commitment to safety.

A further step wise regression analysis was carried out on the subordinate data set to identify the safety climate factors and the items from the supervisor safety management behaviour scale which influences respondents' self report safety behaviour. The results of this analysis are presented in table 16. The analysis reveals that 19% of the variance in subordinate self report safety behaviour is explained by one safety climate factors and two supervisor safety management behaviour statements.

Table 16
Regression analysis identifying the factors which influence subordinates self report 'safety behaviour'

Variable	DF	β	R ²	F	signif. F
My supervisor values my contribution to the team.	1/170	0.38	.14	29.02	<0.001
Factor 3; Safety on the installation	2/169	0.20	.17	18.58	<0.001
My supervisor shows concern for the welfare of the team	3/168	0.17	.19	13.99	<0.001

The analysis revealed that two supervisor safety management behaviours influence subordinate safety behaviour. In fact the most important variable in the equation was subordinates' perception of the amount their supervisor values their contribution to the team. The other supervisory behaviour in the model, was 'showing concern for the welfare of the team'. Factor 3 from the safety climate scale 'Safety on the installation' is the second variable in the equation.

A1.1.3 Supervisors' self report behaviour compared with subordinate evaluation of supervisor behaviour

A series of paired sample t-tests were performed to investigate the relationship between supervisors' self report behaviours and subordinate evaluation of supervisor behaviour. This was possible because the supervisor safety leadership behaviour scale was mirrored in the subordinate questionnaire. The 44 supervisors whose subordinates had returned a questionnaire were selected from the supervisor database and added to a database containing the responses from their subordinates. Each subordinate had the responses given by their supervisor to the 'supervisor management of safety scale' added into their line of data. The 16 t-test revealed a number of significant differences between the two groups and these are presented in table 17 below.

Table 17
Comparison of supervisors reported safety leadership behaviours with their subordinates' evaluation of their safety management behaviours

Statement	DF	t value	p value	Supervisor mean	Subordinate mean
Talk more about safety than production	1/105	3.75	<0.05	3.15	2.75
Carry out safety inspections with subordinates	1/109	4.87	<0.05	2.96	2.36
Encourage safe working by setting a good example	1/108	6.29	<0.05	3.83	3.24
Accepts responsibility for subordinate safety	1/109	2.85	<0.05	3.68	3.38
Ensures subordinates understand PTW they work under	1/109	3.39	<0.05	3.84	3.50
Difficulty motivating subordinates	1/109	3.49	<0.05	1.17	0.72
Put pressure on subordinates to get the job done	1/109	2.93	<0.05	1.03	0.69
Subordinates take short cuts which involve little or no risk	1/109	-2.57	<0.05	0.9	1.2

In general supervisors' indicate that they perform positive leadership behaviours to a greater extent than is reported by their subordinates. This is not very surprising as supervisors are likely to wish to present a positive impression of themselves. It is interesting to note that subordinates feel that supervisors have less difficulty to motivate them to work effectively and that they put less pressure on them to get the job done.

A1.3 EFFECTIVE AND LESS EFFECTIVE SUPERVISORS

In the previous study supervisors were classified as effective and less effective on the basis of their subordinates' self report safety (risk taking) behaviour and their score on superior (OIM) evaluation scale. This study is replicating the Mearns et al (1997) study using a different method, therefore these criteria were used in the current study to classify supervisors as effective and less effective. In the current study subordinates' self report safety behaviour scale was adjusted to include both risk taking statements and positive safety behaviours. When this scale was factor analysed it revealed two factors, factor 1 'risk taking' and factor 2 'safety behaviour'. The 'risk taking' factor alone was used as the safety behaviour measure because it similar to that used in the Mearns et al (1997) study.

Mean scores were obtained for each supervisor's work group for this factor. Workgroup mean scores were only obtained for 44 of the 92 supervisors that returned a supervisor questionnaire. The remaining supervisors did not receive a workgroup mean score because either none of their subordinates returned a

subordinate questionnaire or their subordinates identified a different individual as their supervisor. This was unfortunate as it meant that over 50% of the supervisors' responses were excluded due to missing data. Supervisors were separated into groups by putting their score on these measures into a hierarchical cluster analysis. These scores were converted into Z scores before putting them into the cluster analysis as this analysis is sensitive to size. The results revealed that a three cluster solution was optimum for the data.

Table 18
Mean scores for the superior evaluation scale and work group
safety behaviour scale

Group	Number in Group	Superior evaluation scale	Risk taking behaviour scale
1	10	53	1
2	22	45	4
3	11	40	6

The above table suggests that group 1 could be considered as the effective group as they received a high score on the superior evaluation scale and their subordinates reported a low level of risk taking behaviour. Group two were classified as the less effective as they received a low score on the superior evaluation scale and their subordinates reported a higher level of risk taking behaviour. The third group could not be classified as effective or less effective as they received a low score on the superior evaluation scale and their subordinates reported a low level of risk taking behaviour.

A series of t-test were performed to test for differences between the effective and less effective supervisors on the five safety climate factors, the two factors from the Fleishman scale, the ten safety management attitudes and the 15 safety management behaviours. These 33 t-test did not reveal any significant differences between effective and less effective supervisors. It is possible that the lack of significant differences was due to the low sample size (n=32).

In light of the fact that a large number of supervisors who responded to the questionnaire were not included in the above analysis due to missing data, it was decided to classify supervisors as effective and less effective solely on the basis of their score on superior evaluation scale. Supervisors were again separated into groups by putting their score on the superior evaluation scale into a hierarchical cluster analysis. This analysis revealed that the optimum solution for the data was a five cluster solution. After outlying groups were excluded, two groups remained one group with a high score (m=53) on the superior evaluation scale and another with a low score (m=40). These groups were therefore labelled as effective and less effective respectively.

A series of t-test were then performed to identify any differences between the groups on, their self report safety management behaviour, their safety management attitudes, the five factors from the safety climate scale, their scores on the two factors from the Fleishman leadership scale. This analysis revealed very few statistically significant differences between the two groups. The analysis revealed that less effective supervisors were significantly (DF 1/58 t= 2.02; p>0.05) more likely than effective supervisors to agree with the statement 'Supervisors are often unfairly blamed if their subordinates are involved in an accident'. Less effective supervisors were also significantly (DF 1/58 t= 2.01; p>0.05) more likely to agree with the statement 'My subordinates are not particularly better than other workers'. Less effective supervisors reported that they attend pre-job safety meetings significantly (DF 1/56 t= 2.59; p>0.05) more frequently than effective supervisors. The less effective supervisors were significantly (DF 1/58 t= 2.97; p>0.05) more likely to agree with the statements in factor 5 'Pressure for

production' indicating that they feel under more pressure to put production before safety.

Table 19
Significant differences between effective and less effective supervisors

Statement	DF	t value	p value	Effective mean	Less effective mean
Supervisors are often unfairly blamed if their subordinates are involved in an accident	1/58	2.02	0.05	2.35	3.07
My subordinates are not particularly better than other workers.	1/58	2.01	0.05	2.28	3.02
Attend pre-job safety meetings	1/56	2.59	0.05	3.14	3.63
Factor 5 'Pressure for production'	1/58	2.97	0.05	-0.69	-.036

The above results must be treated with caution in light of the fact that 33 separate t-tests were performed and at a significance level of 0.05 one or two significant results would be expected by chance alone.

A1.4 PREDICTORS OF SUPERVISOR SAFETY LEADERSHIP BEHAVIOUR

The analysis of the responses from the subordinate questionnaire revealed seven subordinate behaviours that were related to their self report level of safety. Supervisors' self report of their performance on these seven leadership behaviours were summed to create a single safety leadership score. It was of interest to investigate which factors influence supervisors' safety leadership behaviour. A step wise regression analysis was carried out on the supervisor data set. The seven factors included in the analysis included safety climate factors and the two factors from Fleishman management style scale. The analysis was performed to identify the factors that influence supervisors' self report on the seven safety leadership behaviours that the above analysis (section 3.2.3) revealed influence subordinate safety.

Table 20
Regression analysis identifying the factors that influence supervisors' self report 'safety leadership behaviour'

Variable	DF	β	R ²	F	signif. F
Considerate style of management	1/73	0.38	.27	23.23	<0.001
Factor 3 Safety on the installation	2/72	0.30	.20	15.46	<0.001
Factor 2 Perceived lack of commitment to safety	3/71	-0.25	.44	12.18	<0.001

The above indicates that supervisor self report safety leadership behaviour was influenced by their attitude to a considerate style of management, their perception that safety is seen to be important on the installation and that they do not perceive that management lack commitment to safety.

APPENDIX 2 SUPERVISOR LETTER

November 20 1997

Mr. XX
Construction Superintendent
Platform

Aberdeen

Dear Mr. XX

Offshore Safety Study

I am writing to ask for your help with a research project, which aims to identify some practical ways of improving offshore safety. This project is being sponsored by three oil companies (AMEC, BP, and Phillips) and the Offshore Safety Division of HSE. I would be extremely grateful if you would spare some of your time to complete the enclosed questionnaire and return it to us in the envelope provided. The enclosed 'supervisor safety management questionnaire' asks about your role in safety management and will take about 15 minutes to complete.

As you will see there is a number (001) printed on the third page of your questionnaire, this is your personal number. This means that only the research team knows who completed the questionnaire and I can assure you that your replies will be kept confidential. This number will enable us to group your responses with the responses given by your team in the Offshore Safety Questionnaire. The OSQ measures how the people feel about safety, and it will be sent to all the non-supervisory staff on your platform and on other participating installations.

Over the next two weeks I will attempt to contact you by phone, to answer any questions that you might have before participating in the study. If I have not succeeded in contacting you, then please feel free to phone me on 01224 263119. In the mean time could you please complete and return the questionnaire.

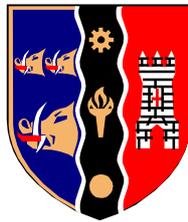
The objective of this study is to identify best supervisory practice and the environment required for supervisors to manage safety effectively on the, and other installations on the UKCS. On completion of the study we will prepare a report for XX, which will contain summary results from your platform. A separate report which summaries the responses from all the participating companies will be produced for the HSE. If you would like further information about the project, please contact me at the above address.

Yours sincerely

Mark Fleming
Project Manager

APPENDIX 3 SUPERVISOR QUESTIONNAIRE

Confidential



THE
ROBERT GORDON
UNIVERSITY
ABERDEEN

*Supervisor Safety Management
Questionnaire*

The Robert Gordon University
The Offshore Management Centre
Aberdeen

READ THIS BEFORE YOU FILL IN THE QUESTIONNAIRE

PLEASE NOTE:

1. THE NUMBER ON YOUR QUESTIONNAIRE IS TO ALLOW YOUR RESPONSES TO BE LINKED WITH THE RESPONSES OF YOUR WORK GROUP
2. YOUR QUESTIONNAIRE WILL NOT BE SEEN BY ANYBODY FROM AN OFFSHORE OIL OR GAS COMPANY UNDER ANY CIRCUMSTANCES
3. ALL YOUR REPLIES WILL BE TREATED AS CONFIDENTIAL TO THE RESEARCH TEAM AND THE ROBERT GORDON UNIVERSITY
4. THE AIM IS TO IMPROVE SAFETY FOR YOU AND OTHERS ON OFFSHORE INSTALLATIONS

Your company and the Health and Safety Executive are funding this project. The aim of this project is to identify the critical aspects of team safety management and safety culture.

INSTRUCTIONS

1. PLEASE ANSWER ALL THE QUESTIONS AS COMPLETELY POSSIBLE
2. PLEASE BE FRANK AND HONEST IN YOUR ANSWERS
3. ALL YOUR REPLIES WILL BE TREATED AS CONFIDENTIAL
4. PLEASE RETURN YOUR COMPLETED QUESTIONNAIRE IN THE ENVELOPE PROVIDED

Thank you for your help

Mark Fleming, Researcher, The Robert Gordon University, Kepplestone Mansion
Aberdeen (01224) 263119

1) Number: _____

2) Name of Installation: _____

3) What is your job category:

Admin/Management ... Production ... Maintenance Deck crew... Medic....
Drilling... Catering ... Other _____

4) How long have you worked as a supervisor: _____

5) Do you work alongside your subordinates Yes No

6) How many people do you supervise: _____

7) Do you supervise workers from different disciplines than yourself: Yes No

8) Who is your current employer: _____

9) How long have you been working for your current employer: _____

10) How long have you worked on this installation: _____

11) How long have you worked offshore: _____

12) What, if any, supervisory training have you received: _____

13) What, if any, safety training courses have you been on: _____

14) What are the skills that you possess, which makes you an effective supervisor: _____

You will find below statements about safety and accident prevention at work. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

	FULLY DISAGREE	PARTIALLY DISAGREE	NEITHER AGREE NOR DISAGREE	PARTIALLY AGREE	FULLY AGREE
Whenever I see safety regulations being broken I point it out on the spot	1	2	3	4	5
I protect my subordinates from feeling under pressure to meet deadlines	1	2	3	4	5
Some jobs would be impossible to perform if all the rules were followed to the letter	1	2	3	4	5
My supervisor sometimes turns a blind eye when safety rules are broken	1	2	3	4	5
I sometimes feel under pressure from my workmates to take chances	1	2	3	4	5
Staff shortages sometimes result in rules being broken to get the job done	1	2	3	4	5
If I didn't take a risk now and again, the job wouldn't get done	1	2	3	4	5
It is better not to visit the worksite often, as it makes people feel that they are being spied upon	1	2	3	4	5
People are reluctant to report near-misses	1	2	3	4	5
If you say too much about safety they might fire you	1	2	3	4	5
Minor accidents cause so much hassle they are quite often ignored	1	2	3	4	5
I feel that I am more safety conscious than other supervisors on this installation	1	2	3	4	5
Job insecurity means that people on this installation like to keep information to themselves	1	2	3	4	5
It is important to be aware of how my subordinates are thinking and feeling	1	2	3	4	5
Supervisors are often unfairly blamed if their subordinates are involved in an accident	1	2	3	4	5
The OIM is too busy to be involved in minor safety issues	1	2	3	4	5
My supervisor is not scared of taking the blame for his/ her errors	1	2	3	4	5
Rules do not always describe the safest way of working	1	2	3	4	5
I trust my supervisor	1	2	3	4	5
Safety Officers are in management's pocket	1	2	3	4	5
This installation has a 'no-blame culture'	1	2	3	4	5

You will find below statements about safety and accident prevention at work. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

	FULLY DISAGREE	PARTIALLY DISAGREE	NEITHER AGREE NOR DISAGREE	PARTIALLY AGREE	FULLY AGREE
My supervisor cares about safety more than the average worker	1	2	3	4	5
I visit the work site frequently to encourage safe working	1	2	3	4	5
Management are concerned about my general welfare	1	2	3	4	5
The safety officer gets tucked away in an office when a dangerous job is being done	1	2	3	4	5
Written safety rules and instructions are too complicated for people to follow	1	2	3	4	5
The safety manager only appears when there is a problem	1	2	3	4	5
My subordinates are not particularly better than other workers on this installation	1	2	3	4	5
Supervisors are sensitive to the personal problems of members of their work group	1	2	3	4	5
People are rushing jobs on this installation	1	2	3	4	5
Safety reps do a pretty good job	1	2	3	4	5
Management listens to safety concerns, but nothing ever gets done	1	2	3	4	5
Some rules are only there to cover management's back	1	2	3	4	5
The crew is always given feedback on accidents that occur on this installation	1	2	3	4	5
The OIM is always on the look out for safety rule violations	1	2	3	4	5
Safety is taken seriously on this installation, it's not just a cosmetic exercise	1	2	3	4	5
There is a good attitude to safety on this installation	1	2	3	4	5
I am as safety conscious at home as I am offshore	1	2	3	4	5
There is sometimes pressure to put production before safety on this installation	1	2	3	4	5
It important for a supervisor to dictate what safety precautions must be taken when their work group are carrying out a job.	1	2	3	4	5
Management onshore are genuinely concerned about workers' safety	1	2	3	4	5
People on this installation refuse to do work if they feel the task is unsafe	1	2	3	4	5

Section 2**Safety Climate**

You will find below statements about safety and accident prevention at work. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

	FULLY DISAGREE	PARTIALLY DISAGREE	NEITHER AGREE NOR DISAGREE	PARTIALLY AGREE	FULLY AGREE
The PTW system is just a way of covering people's backs	1	2	3	4	5
Sometimes it is necessary to ignore safety regulations to keep production going	1	2	3	4	5
People are reluctant to report accidents	1	2	3	4	5
When the operating companies start to lose money, unsafe working practices get overlooked	1	2	3	4	5
I often have to speak to my subordinates about their performance not meeting the required standard	1	2	3	4	5
The standard of safety is very high at my place of work	1	2	3	4	5

Section 3**Leadership Opinion**

Could you please indicate for each of the following items how frequently you feel supervisors *should do* what each of the items describes, which may not be what you actually do in practice (Circle one number on each line).

Supervisors should:	VERY SELDOM	ONCE IN A WHILE	OCCASIONALLY	FAIRLY OFTEN	OFTEN
Do personal favours for people in the work group	0	1	2	3	4
Ask for more than members of the work group can get done	0	1	2	3	4
Refuse to explain your actions	0	1	2	3	4
Help people in the work group with their personal problems	0	1	2	3	4
Change the duties of people in the work group without first talking it over with them	0	1	2	3	4
Give in to others in discussions with your work group	0	1	2	3	4
Act without consulting the work group	0	1	2	3	4
Encourage overtime work	0	1	2	3	4
Try out your own new ideas in the work group	0	1	2	3	4
Encourage slow working people in the work group to work harder	0	1	2	3	4
Ask for sacrifices from the men under you for the good of the entire section	0	1	2	3	4
Offer new approaches to problems	0	1	2	3	4

Could you please indicate for each of the following items how frequently you feel supervisors *should do* what each of the items describes, which may not be what you actually do in practice (*Circle one number on each line*).

Supervisors should:	NEVER	SELDOM	OCCASIONALLY	OFTEN	ALWAYS
Get the approval of the work group on important matters before going ahead	0	1	2	3	4
Put suggestions made by people in the work group into operation	0	1	2	3	4
Refuse to compromise on a point	0	1	2	3	4
Speak in a manner not to be questioned	0	1	2	3	4
Stand up for those in the work group under you, even though it makes you unpopular with others	0	1	2	3	4
Insist that everything is done your way	0	1	2	3	4
Reject suggestions for change	0	1	2	3	4
Back up what people under you do	0	1	2	3	4
Be slow to accept new ideas	0	1	2	3	4
Treat all people in the work group as equal	0	1	2	3	4
Criticise a specific act rather than a particular member in the work group	0	1	2	3	4
Be willing to make changes	0	1	2	3	4
Rule with an iron rod	0	1	2	3	4
Decide in detail what shall be done and how it shall be done by the work group	0	1	2	3	4
Criticise poor work	0	1	2	3	4
Wait for people in the work group to push new ideas	0	1	2	3	4
Assign people in the work group to particular tasks	0	1	2	3	4
Ask that people under you follow to the letter those standard routines handed down to you	0	1	2	3	4
Put the section's welfare above the welfare of any member in it	0	1	2	3	4
Insist that you be informed on decisions made by people in the work group under you	0	1	2	3	4
Let others do their work the way they think best	0	1	2	3	4
Meet with the group at regularly scheduled times	0	1	2	3	4
See to it that people in the work group are working up to capacity	0	1	2	3	4

Section 3

Leadership Opinion

Could you please indicate for each of the following items how frequently you feel supervisors *should do* what each of the items describes, which may not be what you actually do in practice. (Circle one number on each line).

Supervisors should:	NOT AT ALL	COMPARATIVELY LITTLE	TO SOME DEGREE	FAIRLY MUCH	A GREAT DEAL
Resist changes in ways of doing things	0	1	2	3	4
Talk about how much should be done	0	1	2	3	4
Stress being ahead of competing work groups	0	1	2	3	4
"Needle" people in the work group for greater effort	0	1	2	3	4
Emphasise the meeting of deadlines	0	1	2	3	4

Section 4

Leadership Behaviour

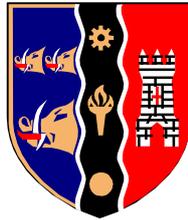
Please indicate how often YOU carry out the following actions in your job.

(Circle one number on each line)

	NEVER	SELDOM	OCCASIONALLY	OFTEN	ALWAYS
I make it clear to each of my subordinates that I value their contribution to the team	0	1	2	3	4
I accept responsibility for my subordinates' safety	0	1	2	3	4
I have difficulty motivating subordinates to work safely	0	1	2	3	4
I carry out safety inspections with my subordinates	0	1	2	3	4
I have to put pressure on my subordinates to get the job done on time	0	1	2	3	4
I visit the worksite three or more times a shift	0	1	2	3	4
I find it difficult to know how my subordinates are thinking and feeling	0	1	2	3	4
I involve my subordinates in decision making	0	1	2	3	4
I show concern for team members' welfare	0	1	2	3	4
I talk more about safety than productivity	0	1	2	3	4
I feel my subordinates take short cuts which involve little or no risk	0	1	2	3	4
I visit worksites to check that my subordinates are working	0	1	2	3	4
I attend pre-job safety meetings and tool box talks	0	1	2	3	4
I involve workgroup members in risk assessments	0	1	2	3	4
I ensure that my subordinates understand the PTWs that they work under	0	1	2	3	4
I encourage safe working by setting a good example	0	1	2	3	4

APPENDIX 4 SUBORDINATE QUESTIONNAIRE

Confidential



THE
ROBERT GORDON
UNIVERSITY
ABERDEEN

Offshore Safety

Management Questionnaire

The Robert Gordon University
The Offshore Management Centre
Aberdeen

READ THIS BEFORE YOU FILL IN THE QUESTIONNAIRE

PLEASE NOTE:

1. YOUR QUESTIONNAIRE WILL NOT BE SEEN BY ANYBODY FROM AN OFFSHORE OIL OR GAS COMPANY UNDER ANY CIRCUMSTANCES
2. YOUR NAME IS NOT REQUIRED
3. ALL YOUR REPLIES WILL BE TREATED AS CONFIDENTIAL TO THE RESEARCH TEAM AND THE ROBERT GORDON UNIVERSITY

Your company and the Health and Safety Executive are funding this project. The aim of this project is to identify the critical aspects of team safety management and safety culture.

INSTRUCTIONS

1. ANSWER ALL THE QUESTIONS AS COMPLETELY POSSIBLE
2. PLEASE BE FRANK AND HONEST IN YOUR ANSWERS
3. RETURN THE QUESTIONNAIRE TO IN THE PREPAID ENVELOPE TO MARK FLEMING.
4. ALL INDIVIDUAL QUESTIONNAIRES WILL BE TREATED AS CONFIDENTIAL. SUMMARISED DATA BE USED IN A COMPANY AND HSE REPORT.

Thank you for your help

Mark Fleming, Researcher, The Robert Gordon University, Kepplestone Mansion
Aberdeen (01224) 263119

Section 1**Demographic information**

- 1) Name of Installation: _____
- 2) Supervisor's (foreman's) Name: _____
- 3) What is your job category:
- Admin/Management ... Production .. Maintenance Deck crew... Drilling crew... Medic Catering... Other _____
- 4) Is your supervisor from the same discipline as you: Yes No
- 5) How long have you worked with this supervisor: _____
- 6) Who is your current employer: _____
- 7) How long have you been working for your current employer: _____
- 8) How long have you worked on this installation: _____
- 9) How long have you worked offshore: _____
- 10) Have you had a reportable accident (required a visit to the medic) Yes No
If **Yes** go to Q11
If **No** go to Q15
- 11) Have you had an accident while working for your current supervisor Yes No
If Yes, how many accidents have you had in the last two years _____
- 12) Who initiated the most recent accident you have had working for your current supervisor
Yourself Work group member Other crew member
- 13) How serious was the injury _____
- 14) What was the underlying cause of the accident _____

- 15) Have you been involved in a high potential incident? (e.g. Gas release) Yes No
If Yes, how many have occurred in the last two years _____
- 16) Give details of the most serious: _____

You will find below statements about safety and accident prevention at work. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

	FULLY DISAGREE	PARTIALLY DISAGREE	NEITHER AGREE NOR DISAGREE	PARTIALLY AGREE	FULLY AGREE
If I didn't take a risk now and again, the job wouldn't get done	1	2	3	4	5
People are reluctant to report near-misses	1	2	3	4	5
Sometimes it is necessary to ignore safety regulations to keep production going	1	2	3	4	5
Some jobs would be impossible to perform if all the rules were followed to the letter	1	2	3	4	5
My supervisor sometimes turns a blind eye when safety rules are broken	1	2	3	4	5
I sometimes feel under pressure from my workmates to take chances	1	2	3	4	5
Staff shortages sometimes result in rules being broken to get the job done	1	2	3	4	5
Whenever I see safety regulations being broken I point it out on the spot	1	2	3	4	5
People are reluctant to report accidents	1	2	3	4	5
If you say too much about safety they might fire you	1	2	3	4	5
Minor accidents cause so much hassle they are quite often ignored	1	2	3	4	5
When the operating companies start to lose money, unsafe working practices get overlooked	1	2	3	4	5
Job insecurity means that people on this installation like to keep information to themselves	1	2	3	4	5
There is sometimes pressure to put production before safety on this installation	1	2	3	4	5
The PTW system is just a way of covering people's backs	1	2	3	4	5
The OIM is too busy to be involved in minor safety issues	1	2	3	4	5
My supervisor is not scared of taking blame for his errors	1	2	3	4	5
I trust my supervisor	1	2	3	4	5
My supervisor is sensitive to the personal problems of members of the work group	1	2	3	4	5

You will find below statements about safety and accident prevention at work. For each statement please indicate whether or not you personally agree. (Circle one number on each line)

	FULLY DISAGREE	PARTIALLY DISAGREE	NEITHER AGREE NOR DISAGREE	PARTIALLY AGREE	FULLY AGREE
My supervisor cares about safety more than the average worker	1	2	3	4	5
Management onshore are genuinely concerned about workers' safety	1	2	3	4	5
Management are concerned about my general welfare	1	2	3	4	5
This installation has a 'no-blame culture'	1	2	3	4	5
Rules do not always describe the safest way of working	1	2	3	4	5
The safety officer gets tucked away in an office when a dangerous job is being done	1	2	3	4	5
Written safety rules and instructions are too complicated for people to follow	1	2	3	4	5
The safety manager only appears when there is a problem	1	2	3	4	5
Safety Officers are in management's pocket	1	2	3	4	5
People are rushing jobs on this installation	1	2	3	4	5
Safety reps do a pretty good job	1	2	3	4	5
Management listens to safety concerns, but nothing ever gets done	1	2	3	4	5
Some rules are only there to cover management's back	1	2	3	4	5
The crew is always given feedback on accidents that occur on this installation	1	2	3	4	5
The OIM is always on the look out for safety rule violations	1	2	3	4	5
Safety is taken seriously on this installation, it's not just a cosmetic exercise	1	2	3	4	5
There is a good attitude to safety on this installation	1	2	3	4	5
People on this installation refuse to do work if they feel the task is unsafe	1	2	3	4	5
The standard of safety is very high at my place of work	1	2	3	4	5

Please indicate how often you carry out the following actions in your job.

(Circle one response on each line, e.g. Seldom)

	NEVER	SELDOM	OCCASIONALLY	OFTEN	VERY OFTEN
If I see someone breaking safety procedures I confront them	0	1	2	3	4
I take shortcuts which involve little or no risk	0	1	2	3	4
I talk about safety with fellow workers	0	1	2	3	4
I ignore safety regulations to get the job done	0	1	2	3	4
I encourage fellow workers to work safely	0	1	2	3	4
I carry out activities which are forbidden	0	1	2	3	4
I bend the rules to achieve a target	0	1	2	3	4
I break rules due to management pressure	0	1	2	3	4

Could you please indicate for each of the following items how frequently you feel your supervisor does what each of the items describes (Circle one number on each line).

MY SUPERVISOR:	NEVER	SELDOM	OCCASIONALLY	OFTEN	ALWAYS
Involves work group members in decision making	0	1	2	3	4
Talks more about safety than productivity	0	1	2	3	4
Has difficulty motivating the team to work safely	0	1	2	3	4
Visits the worksite three or more times a shift	0	1	2	3	4
Carries out safety inspections with me	0	1	2	3	4
Encourages safe working by setting a good example	0	1	2	3	4
Puts pressure on me to get the job done on time	0	1	2	3	4
Attends pre-job safety meetings and tool box talks	0	1	2	3	4
Shows concern for the welfare of the team	0	1	2	3	4
Accepts responsibility for the safety of the workgroup	0	1	2	3	4
Involves work group members in risk assessments	0	1	2	3	4
Values my contribution to the team	0	1	2	3	4
Visits the worksite to check that we are working	0	1	2	3	4
Is aware of how the team is thinking and feeling	0	1	2	3	4
Ensures that I understand the PTWs I work under	0	1	2	3	4

APPENDIX 5 SUPERIOR EVALUATION FORM

Supervisor's job performance scale

For each of the scales, please indicate the appropriate level of job performance.

- 6 = An outstanding performer
- 5 = A very good performer
- 4 = A good performer
- 3 = Performance is entirely satisfactory
- 2 = Performs somewhat below a satisfactory level
- 1 = A poor performer

NOTE: Please use the full scale range. A 6 for an item on the scale would represent an individual who stands out from the others that have worked for you. A 1 for an item on the scale would indicate that the supervisor would have to improve their performance in this area, it would be an issue discussed in their yearly review.

Supervisor's name: _____

- TECHNICAL/ SPECIALIST ABILITY: *Knowledge and skills demonstrated in the job*
- JUDGEMENT: *Ability to interpret situations, facts, figures and opinions before taking actions*
- ADAPTABILITY: *Ability to cope with and adjust to changing demand*
- COMMUNICATION: *Ability to put across ideas and information verbally or in writing*
- RELATIONSHIPS: *Ability to supervise and to work with others as part of a team*
- CONCERNED ABOUT SAFETY: *Is more concerned about safety than the average worker*
- ADMITS MISTAKES: *Takes responsibility for their own errors and does not attempt to blame others*
- GIVES CLEAR INSTRUCTION: *Explains what they want done, with most of the details*
- INTERESTED IN THEIR WORKERS: *Is concerned for their workers' welfare and has got time for them*
- LISTENER: *Actively seeks input from their subordinates when planning an operation*
- APPROACHABLE: *Workers are able approach them if they are having difficulty or are concerned about something*
- OVERALL JOB PERFORMANCE:

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