Lifting incident review 1998 - 2003

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Lifting incident review 1998 - 2003

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Sparrows Offshore Services Ltd, on behalf of the Health and Safety Executive Offshore Safety Division, have undertaken a review of lifting incidents occurring in the United Kingdom Continental Shelf (UKCS) with the objective of identifying any incident trends and also identifying whether the introduction of certain industry safety initiatives, such as the Lifting Operations and Lifting Equipment Regulations (LOLER) and Step Change in Safety have had a positive effect in decreasing the number of lifting incidents.

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EXECUTIVE SUMMARY

Sparrows Offshore Services Ltd, on behalf of the Health and Safety Executive Offshore Safety Division, have undertaken a review of lifting incidents occurring in the United Kingdom Continental Shelf (UKCS) with the objective of identifying any incident trends and also identifying whether the introduction of certain industry safety initiatives, such as the Lifting Operations and Lifting Equipment Regulations (LOLER) and Step Change in Safety have had a positive effect in decreasing the number of lifting incidents.

The key findings of this study were:

- Of the 4,624 incident reported to the HSE during the study period, 1st April 1998 to 31st March 2003, 861 incidents were identified as occurring during lifting operations.
- An average of 172 incidents associated with both mechanical and drilling handling equipment was reported each year, representing 18.6% of all incidents reported.
- 58.5% of lifting incidents were attributed to mechanical handling operations.
- 41.5% of lifting incidents were attributed to drilling handling operations.
- The root cause of 59% of lifting incidents was attributed to a human factor with 33.3% being caused by equipment failure. The remaining 7.7% could not be classified.
- Drilling handling incidents have shown an increasing trend, rising from 40.2% of lifting incidents to 43.1%.
- Mechanical handling incidents have shown a decreasing trend, falling from 59.8% of lifting incidents to 56.9%.
- Since the introduction of LOLER at the end of 1998, lifting incidents have decreased from 205 to 140 incidents per year (31.7%).

1. INTRODUCTION

At the request of the Health & Safety Executive (HSE), Sparrows Offshore Services Ltd were contracted to review and analyse incident data provided by the HSE Offshore Safety Division (OSD) for lifting incidents occurring in the United Kingdom Continental Shelf (UKCS) and identify any trends. The final report will also identify whether the introduction of certain industry safety initiatives, such as LOLER and Step Change in Safety have had a positive effect in decreasing the number of lifting incidents.

1.1 BACKGROUND

Sparrows Offshore Services Ltd were previously contracted by the HSE to undertake a review of lifting equipment and lifting operations in the UKCS Oil and Gas industry with the aim of making recommendations which would have a positive effect in decreasing the number of incidents occurring in this area, phase 1. The findings of this study are contained within HSE report OTO2000 024. The incidents that were reviewed were those that occurred during the period 1st April 1991 to 31st March 1998. Since that review the regulation SI 2307 "Lifting Operations and Lifting Equipment Regulation (LOLER) 1998", and its associated Approved Codes Of Practice (ACOP) have been introduced. These documents are targeted at all personnel who have an involvement with lifting equipment and lifting operations in the UK. This phase 2 study aims to identify whether the introduction of LOLER and other safety initiatives have had an effect on the number of lifting incidents in the offshore industry sector.

1.2 SCOPE OF WORK

The scope of the project was to follow on from Offshore Technology Report – OTO2000 024, 'Lifting Equipment Project' (phase 1), and review the HSE OSD incident data for the period 1st April 1998 to 31st March 2003, identifying all those incidents attributed to lifting equipment and lifting operations.

Following this selection process, the incidents were to be split between drilling and mechanical handling groups and then categorised as either those attributed as equipment failure or human factor. This categorisation would then allow any incident trends to be identified and highlight any areas where improved control measures are required.

The final section of the work scope is to review the various industry safety initiatives that have been introduced since phase 1 of this study was conducted and identify whether their introduction has had any effect on the number of incidents occurring in the UK Continental Shelf (UKCS) Oil and Gas industry.

2. REVIEW OF INCIDENT DATA

As with phase 1 of the Lifting Equipment Project, a copy of the Health and Safety Executives Offshore Safety Division incident database was transferred from the HSE offices at Bootle, Liverpool to the project team undertaking the second part of this study (based in Aberdeen). To ensure that there was no overlap of the data with phase 1, each year was taken as running from the 1st April to 31st March.

The range of incidents to be included within this project was clearly defined during phase 1, as well as the process used to categorise the incidents. To ensure the continuity between both phases of the study the incident categories and the categorisation process have carried over and used in this part of the study. The process used was as follows:

a) select incidents associated with lifting equipment or operations
b) split the incidents between those associated with drilling and mechanical handling
c) split the selected incidents into those caused by equipment failure or human factors
d) group incidents under categories to allow analysis and identify trends, where possible

2.1 DEFINITIONS

The definitions used to filter and categorise the data in phase 1 were also used in phase 2.

- **Lifting Equipment**

The definition within Statutory Instrument 1998 Number 2307, The Lifting Operations and Lifting Equipment Regulation 1998 (LOLER) was used to define "Lifting Equipment":

'work equipment for lifting or lowering loads and includes its attachments for anchoring, fixing or supporting it'.

- **Lifting Operation**

Again from SI 2307:

'an operation concerned with the lifting and lowering of a load'.

- **Drilling Handling Equipment**

The team undertaking the study recognised the need to mark the boundary between drilling and mechanical handling operations and, as drilling tends to be confined to a limited area on an installation the following definition was used:

'all equipment and operations within the drilling package, including the use of dedicated drill pipe handling equipment'

- **Mechanical Handling Equipment**

Defined as:

'all equipment not included within the drilling package'

2.2 SELECTION OF LIFTING EQUIPMENT INCIDENTS

The total number of incidents provided by the HSE OSD, covering all oil and gas production and exploration locations on the UK Continental Shelf (UKCS), for phase 2 of the study, for the period 1998 to 2003 was as follows:

Table 2.1
Number of incidents supplied by HSE OSD

Year	*Original Number of Incidents*
1998/99	1,046
1999/00	890
2000/01	959
2001/02	890
2002/03	839
	4,624

The layout of the incident data on the spreadsheet provided for phase 2 was of a similar format to that provided for phase 1. All the relevant columns that were used during the filtering process were still present on the new format, with the only real difference being that the coding used in each column was now replaced with the corresponding description. However, it was noted that the short description column had been replaced with a very brief incident title.

The first filtering process was to read the incident title for all 4,624 incidents to eliminate the obvious non-lifting incidents, for example the release of hydrocarbons. Following this, a second filtering process was carried out on the remaining incidents, the categories 'Incident Operation' (column n), 'Broad Incident Type' (column m) and the 'Incident Title' (column d) were selected to capture the lifting incidents to be analysed as part of the study. By utilising 'Drilling/Workover' and 'Deck Operations' from the 'Incident Operation' column, drilling related incidents could be selected. Likewise 'Lifting/Crane Operations' could be used to select mechanical handling incidents.

However, on studying the summary note text for the first year of phase 2 incidents, it was evident that if only these categories were used some lifting incidents, whether drilling or mechanical handling, would be overlooked, as well as the possibility of some non-lifting incidents being included in the final totals. It was also apparent that the 'Incident Title' did not provide adequate information to establish the root cause of the incidents, therefore the full incident summary text would have to be read for all lifting incidents following the filtering process. At this stage it was decided by the project team to read the full incident summary for all the incidents identified as possible lifting incidents following the first filtering process. This allowed the assigning of the incidents to categories to be undertaken at the same time as the final filtering process.

By utilising the lifting definitions and the full incident summary text it was possible to complete the filtering out of all non-lifting incidents. Examples of incidents discarded at this stage include (as per phase 1):

- manual handling
- falling objects – although incidents have been included where the dropped objects were as a direct result of lifting operations.
- operations involving the use of tongs, which although suspended and dynamic do not raise or lower a load
- marine operations and anchor handling

The number of lifting incidents retained for further study in phase 2 was as listed in Table 2.2:

Table 2.2
Lifting incidents included in study

Year	*Original Number of Incidents*	*Lifting Incidents*
1998/99	1,046	205
1999/00	890	170
2000/01	959	165
2001/02	890	181
2002/03	839	140
	4,624	861

The average number of incidents associated with lifting equipment or lifting operations was 172 per year.

2.3 DRILLING AND MECHANICAL HANDLING INCIDENTS

A simple split between drilling handling equipment and mechanical handling equipment, in line with the definitions in 2.1 above was undertaken.

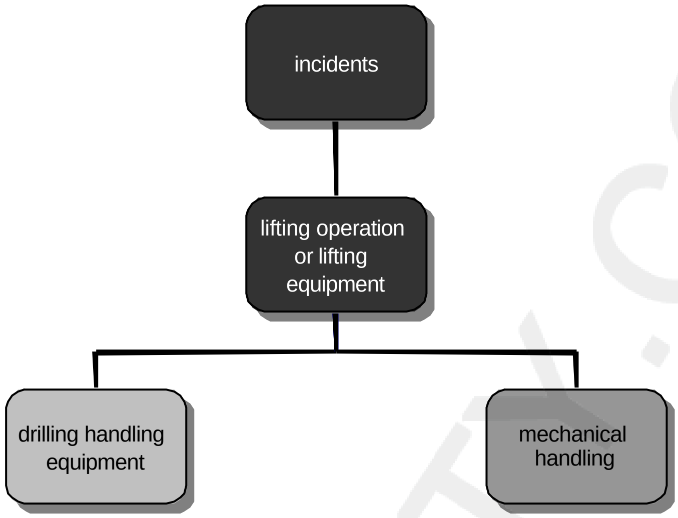

Figure 2.1 - First level of categorisation

The final distribution of incidents was as Table 2.3:

Table 2.3
Drilling handling / mechanical handling equipment

Year	*Drilling Handling Equipment*	*Mechanical Handling Equipment*	*Total Number of Lifting Incidents*
1998/99	83	122	205
1999/00	64	105	169
2000/01	75	90	165
2001/02	76	105	181
2002/03	59	81	140
	357	503	860

Note that all but one lifting incident could be classified between drilling or mechanical handling equipment.

2.4 EQUIPMENT FAILURE AND HUMAN FACTOR

As with the incident data for phase 1 each incident was reviewed and categorised as either:

- drilling handling incidents – equipment failure (DHE-EF)
- drilling handling incidents - human factor (DHE-HF)
- mechanical handling incidents - equipment failure (MHE-EF)
- mechanical handling incidents – human factor (MHE-HF)

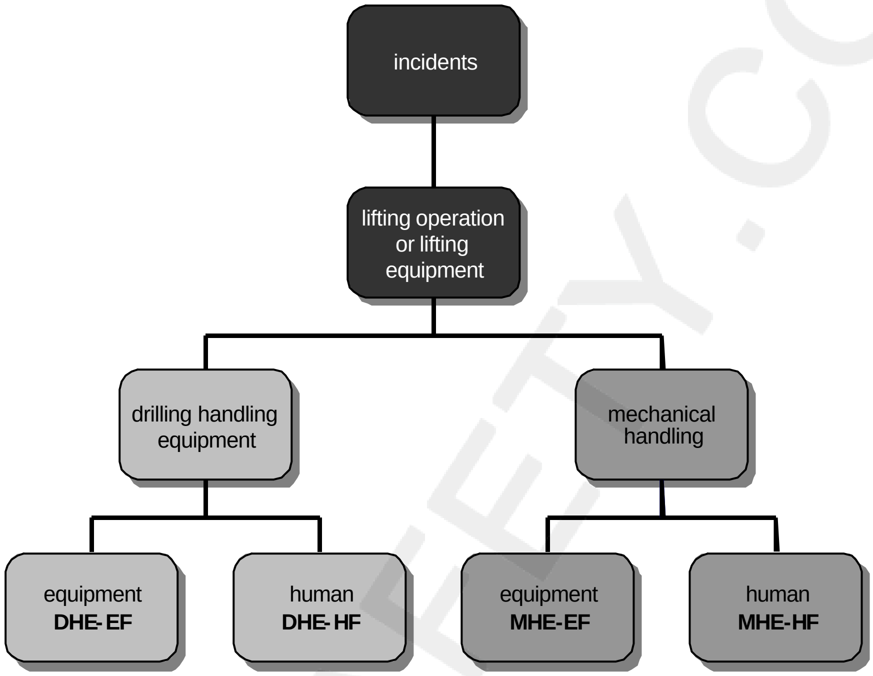

Figure 2.2 - Second level of categorisation

This categorisation was then applied to all incidents in phase 2 of the study.

The split was as follows:

Table 2.4
Equipment failure / human factors

Year	*DHE-EF*	*DHE-HF*	*MHE-EF*	*MHE-HF*	*Total Number of Lifting Incidents*
1998/99	30	47	30	85	192
1999/00	18	36	34	64	152
2000/01	30	39	25	56	150
2001/02	35	32	36	66	169
2002/03	24	35	27	46	132
	137	189	152	317	795

Again, due to the information provided in the incident text it was not possible to classify every lifting incident into one of the categories above.

Overall, the split between equipment failure and human factors was 287/508 (36%/64%).

2.5 CATEGORISATION OF INCIDENTS

To examine trends and analyse incident data, the four major categories (drilling – equipment failure, drilling – human factor, mechanical handling – equipment failure and mechanical handling – human factor) were further sub-divided into more detailed categories, as developed from phase 1 of the study. For completeness, these categories have been listed in Tables 2.5, 2.6, 2.7 and 2.8 with a short explanation of the scope of each category and examples, where appropriate.

Table 2.5
Drilling - equipment failure categories

Category Number	*DHE-EF Category Title*
DHE-EF1	Elevators
DHE-EF2	Compensators
DHE-EF3	Winches
DHE-EF4	Hoisting system
DHE-EF5	Wireline
DHE-EF6	Blow-out preventer (BOP)
DHE-EF7	Pipe handling

DHE-EF Category 1 – Elevators
A lifting accessory suspended from the travelling block (the lifting equipment) including the suspension and anchoring system.

DHE-EF Category 2 – Compensators
Although compensators are not lifting equipment in their own right failure of such equipment has a knock-on effect on lifting equipment within the drilling package, principally the drawworks and wire line equipment and the systems have many features in common with other lifting equipment studied.

DHE-EF Category 3 – Winches
All winch systems (including wire ropes and hooks) associated with the drilling package, including those for lifting of persons (man-riding).

DHE-EF Category 4 – Hoisting System
An extensive category including all equipment associated with the hoisting system, with the exception of the elevators. Included are the drawworks themselves and associated drilling line, crown block, travelling block, drilling hook and reserve line drum, see Figure 2.3 below:

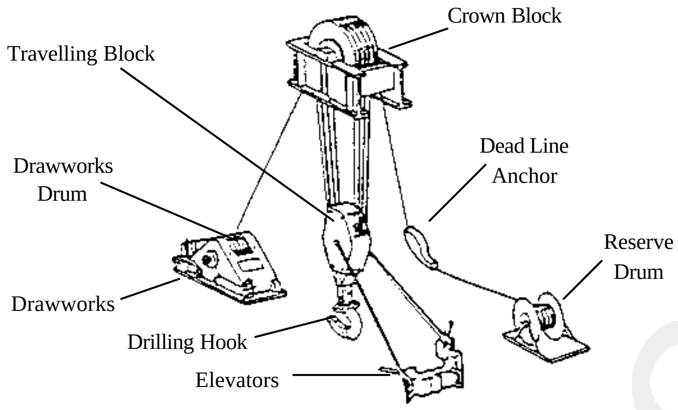

Figure 2.3
Hoisting system

DHE-EF Category 5 – Wireline
Primarily concerned with the lifting equipment associated with wire lining, i.e. the winch, line and load attachment system.

DHE-EF Category 6 – Blow-out Preventer (BOP)
This category covers the lifting equipment used to move the BOP's, rather than failure of unit itself.

DHE-EF Category 7 – Pipe Handling
The pipe handling category captures failure of the attachments on the drill string assembly used when lifting, for example collars and tool joints on the end of the string (i.e. failure of the load itself) and string handling equipment outwith the main hoisting system, for example pipe racking equipment.

Table 2.6
Drilling – human factor categories

Category Number	*DHE-HF Category Title*
DHE-HF1	Elevators
DHE-HF2	Compensators
DHE-HF3	Winches
DHE-HF4	Hoisting system
DHE-HF5	Wireline
DHE-HF6	Blow-out preventer (BOP)
DHE-HF7	Pipe handling

In Table 2.6 all incidents assigned to these categories were as a result of human factors, rather than equipment failure. The same categories were used for human factors as for equipment failure as the equipment within the drilling package readily splits itself into well-delineated groups.

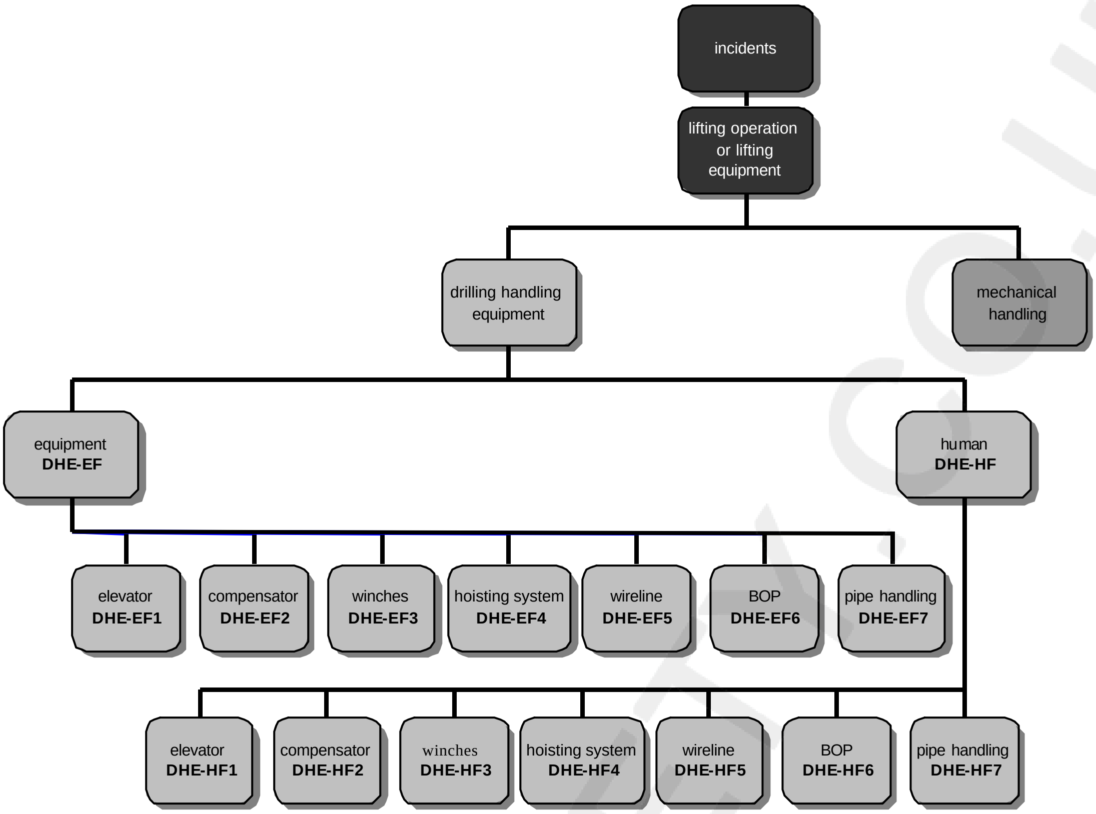

Figure 2.4
Drilling handling equipment categorisation

Similarly, for mechanical handling equipment:

Table 2.7
Mechanical handling – equipment failure categories

Category Number	*MHE-EF Category Title*
MHE-EF1	Pedestal crane – hoist function
MHE-EF2	Pedestal crane – boom function
MHE-EF3	Pedestal crane – slew function
MHE-EF4	Pedestal crane – power pack
MHE-EF5	Pedestal crane – ancillary equipment
MHE-EF6	Pedestal crane – accessories
MHE-EF7	Other cranes / Powered lifting appliances
MHE-EF8	Manual lifting equipment
MHE-EF9	Lifting accessories

MHE-EF Category 1 – Pedestal Crane – Hoist Function
All incidents associates with equipment failure on the hoist system including power take-off, winch drum, sheaves and control system.

MHE-EF Category 2 – Pedestal Crane – Boom Function
All equipment associated with the boom hoist system.

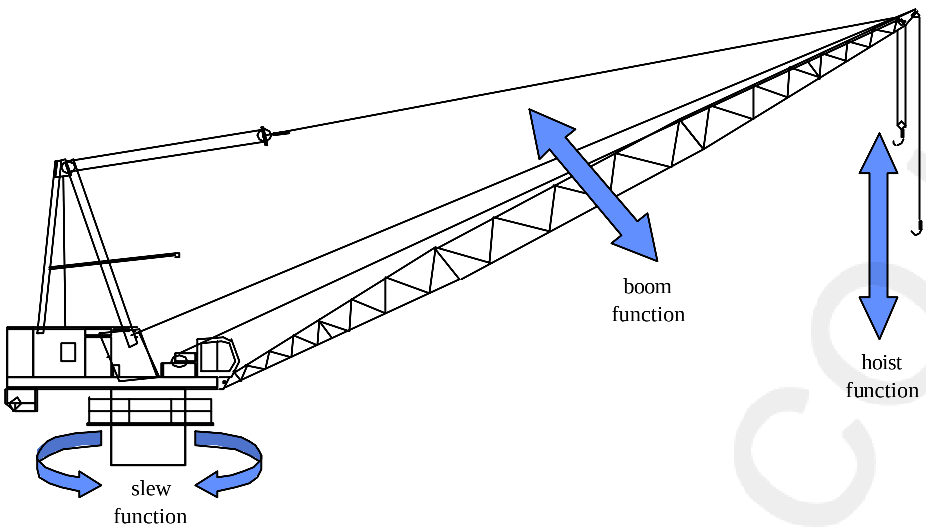

Figure 2.5 – Typical pedestal crane functions

MHE-EF Category 3 – Pedestal Crane – Slew Function
All equipment associated with the slew system.

MHE-EF Category 4 – Pedestal Crane – Power Pack
The prime mover used to power crane primary systems.

MHE-EF Category 5 – Pedestal Crane – Ancillary Equipment
Equipment not directly in the load path of the crane, for example safety cut-outs.

MHE-EF Category 6 – Pedestal Crane – Accessories
Running gear associated with the pedestal crane, for example wire ropes, hook blocks.

MHE-EF Category 7 – Other Cranes / Powered Lifting Appliance
Includes all other cranes found offshore which are not classed as pedestal cranes, for example ROV handling crane, overhead gantry as well as other powered lifting appliances, such as air hoists.

MHE-EF Category 8 – Manual Lifting Equipment
Portable lifting equipment such as chain and lever hoists which require physical effort to operate.

MHE-EF Category 9 – Lifting Accessories
As per the LOLER description, items used to connect the lifting equipment (crane, chain hoist) to the load, for example slings, shackles, spreader beams, etc.

Table 2.8
Mechanical handling – human factor categories

Category Number	***MHE-HF Category Table***
MHE-HF1	Pedestal crane – platform lifts
MHE-HF2	Pedestal crane – sea lifts
MHE-HF3	Installation - pedestal crane operations
MHE-HF4	Marine - pedestal crane operations
MHE-HF5	Other lifting appliances – powered
MHE-HF6	Other lifting appliances – manual
MHE-HF7	Pedestal crane - maintenance

MHE-HF Category 1 – Pedestal Crane – Platform Lifts
Incidents occurring on board the installation in which the human factor attributed to the incident lay with the crane operator.

MHE-HF Category 2 – Pedestal Crane – Sea Lifts
Incidents occurring during lifting operations to or from a sea going vessel in which the human factor attributed to the incident lay with the crane operator.

MHE-HF Category 3 – Installation – Pedestal Crane Operations
Incidents occurring on board the installation in which the human factor was not attributed to the crane operator, rather to a third party associated with the lifting operation.

MHE-HF Category 4 – Marine – Pedestal Crane Operations
Incidents occurring during lifting operations to or from a sea going vessel in which the human factor was not attributed to the crane operator, rather to a third party associated with the sea going vessel.

MHE-HF Category 5 – Other Lifting Appliances – Powered
Incidents caused by human factors associated with cranes other than the pedestal crane and powered lifting appliances.

MHE-HF Category 6 – Other Lifting Appliances – Manual
Incidents caused by human factors associated with portable lifting equipment and accessories.

MHE-HF Category 7 – Pedestal Crane - Maintenance
Incidents involving pedestal cranes where maintenance activities were the root cause.

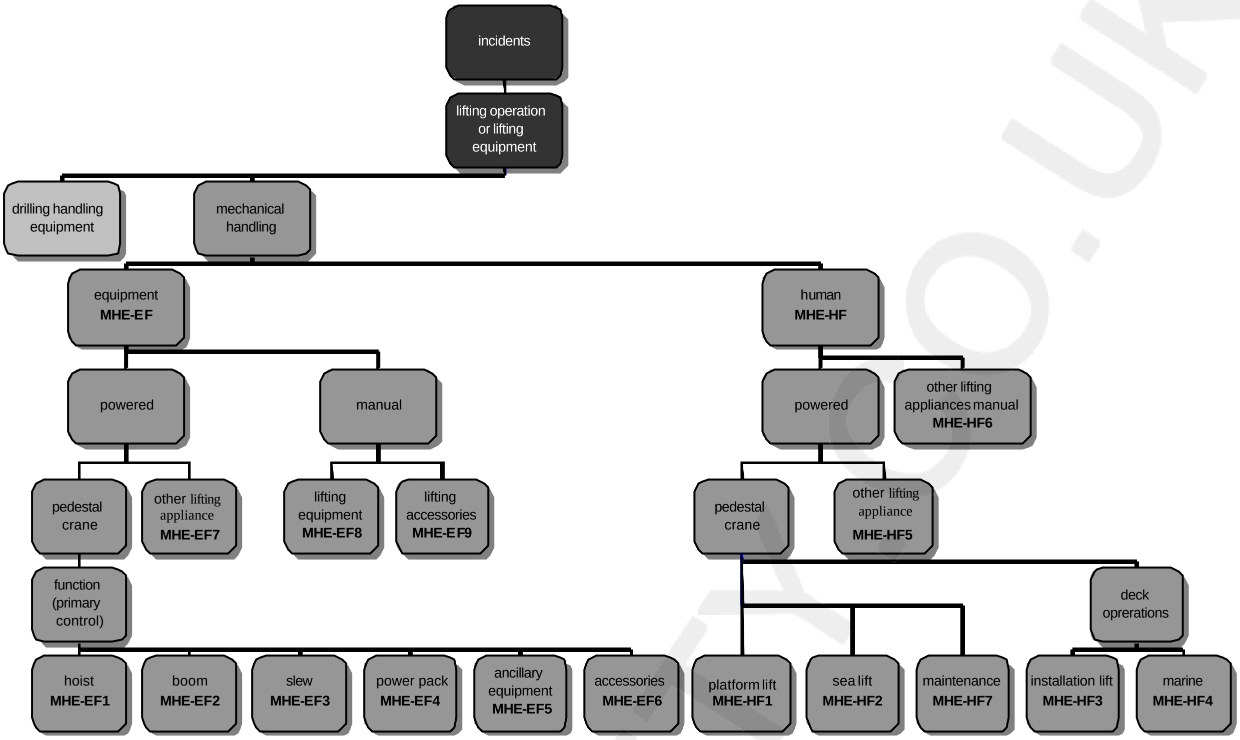

Figure 2.6
Mechanical handling equipment categorisation

2.6. ASSIGNMENT OF INCIDENTS TO CATEGORIES

The project team undertook allocation of the 861 lifting incidents to the categories described earlier. However, as with phase 1 it became evident that not every incident could be positively assigned to a category as the text for these incidents did not provide enough information to either identify the specific type of lifting equipment being used or the results of any investigations / examinations of failed equipment carried out at the time of the incident. It was decided by the project team that, since the incident text did not provide enough information to fully classify these incidents, they should be set aside as unclassified lifting incidents and no further investigation undertaken. However, so as not to distort the final analysis, these incidents would still be included in the total number of lifting incidents reported.

Setting aside these incidents produced the following results:

- The final number of fully classified lifting incidents was reduced by 66, from 861 to 795.
- Drilling handling equipment incidents reduced by 31, from 357 to 326
- Mechanical handling equipment incidents reduced by 34, from 503 to 469
- The ratio of equipment failure and human factor as the root cause was 36/64

The categorisation of incidents was finalised as shown in Tables 2.9 and 2.10 below:

Table 2.9
Drilling lifting incidents by year

Category		*98/99*	*99/00*	*00/01*	*01/02*	*02/03*	*Total*
Equipment Failure							
Wireline	DHE-EF5	1	7	9	11	5	33
Pipe Handling	DHE-EF7	6	6	5	5	7	29
Hoisting system	DHE-EF4	8	0	7	8	4	27
Winches	DHE-EF3	8	3	5	6	3	25
Elevators	DHE-EF1	4	1	3	3	5	16
BOP	DHE-EF6	2	1	1	2	0	6
Compensators	DHE-EF2	1	0	0	0	0	1
SUB-TOTAL		30	18	30	35	24	137
Human Factor							
Winches	DHE-HF3	21	6	11	5	9	52
Pipe Handling	DHE-HF7	8	8	10	8	9	43
Hoisting system	DHE-HF4	4	13	8	8	6	39
Elevators	DHE-HF1	12	4	4	8	5	33
Wireline	DHE-HF5	1	3	5	2	5	16
BOP	DHE-HF6	1	2	1	1	1	6
Compensators	DHE-HF2	0	0	0	0	0	0
SUB-TOTAL		47	36	39	32	35	189
TOTAL		77	54	69	67	59	326

Table 2.10
Mechanical handling lifting incidents by year

Category		*98/99*	*99/00*	*00/01*	*01/02*	*02/03*	*Total*
Equipment Failure							
Manual lifting equipment	MHE-EF8	6	13	3	6	3	31
Lifting accessories	MHE-EF9	9	6	3	3	5	26
Hoist	MHE-EF1	2	4	2	8	7	23
Other cranes	MHE-EF7	3	3	7	5	3	21
Boom	MHE-EF2	5	0	6	5	2	18
Ancillary equipment	MHE-EF5	1	2	3	8	2	16
Accessories	MHE-EF6	3	5	1	1	3	13
Power pack	MHE-EF4	1	1	0	0	1	3
Slew	MHE-EF3	0	0	0	0	1	1
SUB-TOTAL		30	34	25	36	27	152
Human Factor							
Installation lifts	MHE-HF3	36	20	25	29	18	128
Other – manual	MHE-HF6	15	13	6	10	8	52
Sea lifts	MHE-HF2	9	9	10	7	5	40
Platform lifts	MHE-HF1	9	6	8	9	4	36
Marine	MHE-HF4	6	7	4	7	5	29
Other – powered	MHE-HF5	7	6	2	2	0	17
Maintenance	MHE-HF7	3	3	1	2	6	15
SUB-TOTAL		85	64	56	66	46	317
TOTAL		115	98	81	102	73	469

3. DATA ANALYSIS

Following the final assignment of each of the 795 incidents associated with phase 2 of this study into the broad categories mentioned earlier, each category was then analysed to identify any trends.

3.1 HIGH LEVEL ANALYSIS

Analysing the high level data the number of incidents attributed to lifting equipment or operations (Tables 2.9 and 2.10) were plotted on a year-by-year basis for the phase 2 study period, see Figure 3.1 below:

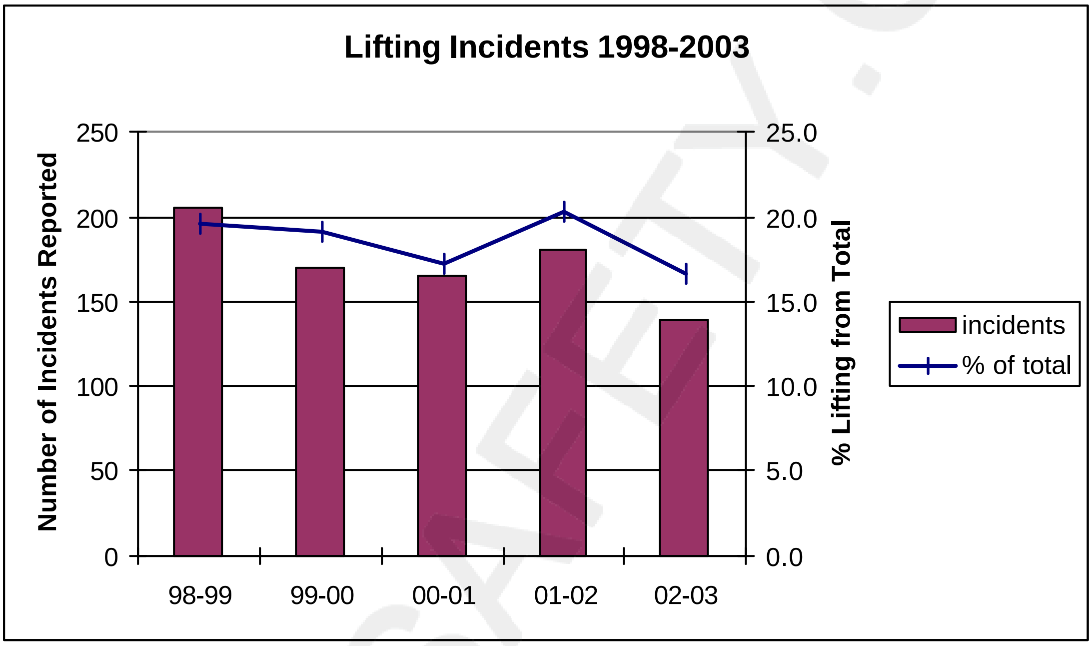

Figure 3.1
Lifting incidents reported 1998-2003

The number of lifting incidents, and their percentage of all incidents reported (averaging just under 19% of total), appears to show a slight fall over the phase 2 study period, however there was a 'spike' in this trend during 2001/02.

Although the lifting incident frequency has shown a reduction it is worth noting that activity levels over the study period, and hence exposure to risk, have also shown a decline, therefore it could be expected that the number of incidents occurring would drop. However, the change in attitude towards safety and the reporting of incidents, particularly following the introduction of the Step Change in Safety initiative, means that more incidents are likely to be reported than previously, especially those in which personal injury did not occur.

The initial split in lifting data was between drilling and mechanical handling incidents. The trends in these incidents are shown in figure 3.2:

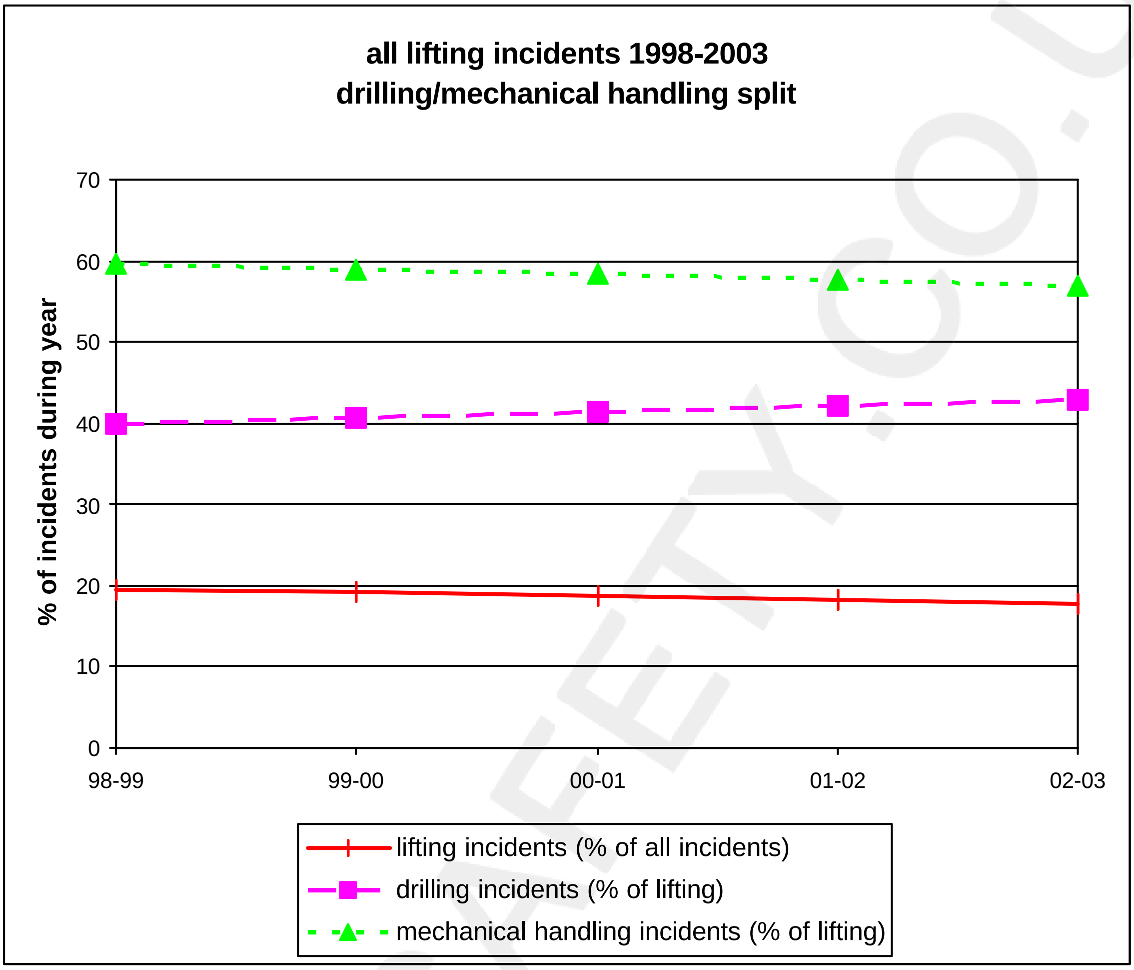

Figure 3.2

Lifting incidents reported – drilling / mechanical (best fit lines) – 1998 to 2003

Averaged over phase 2 of the study period, 59% of all lifting incidents were attributed to mechanical handling and 41% to drilling.

As mentioned earlier the percentage of all lifting incidents against all incidents reported has shown a slight fall, around 3%. Although the proportion of lifting incidents attributed to mechanical handling is the greatest, this category has shown an improvement over the study period, falling by 3% overall. Conversely, the proportion of incidents attributed to drilling operations and equipment has risen by a similar percentage.

The best fit profiles for equipment failure and human factor incidents, for all lifting incidents over the study period have revealed the following trends:

Figure 3.3

Equipment failure / human factor incidents (best fit lines) – 1998 to 2003

As can be seen in Figure 3.3 above, incidents attributed to human factors account for the largest proportion of all lifting incidents. However, this category has shown a marked improvement over the study period, reducing by approximately 7%. On the other hand, the number of incidents attributed to equipment failure has seen a significant increase in percentage, 9.1%, of all lifting incidents over the study period. In categorising the incidents between those caused by human factor or due to equipment failure it was not always possible to decide for certain which category best fitted an incident as the description provided did not include any further investigation into a specific incident that may have taken place. Where a human factor was clearly the root cause, then these incidents were easily categorised. However for many of those incidents ultimately assigned to equipment failure all that could be determined with any certainty was that the equipment had indeed failed. It is possible that, with a more detailed investigation of these incidents, some of them could be re-categorised as having human factor as the root cause, for example an item of lifting equipment failing due to improper use or specification. Unfortunately the nature of the data held by HSE OSD did not readily allow further investigation of those incidents where some doubt existed.

Further splitting the data for both equipment failure and human factor incident in to those attributed to mechanical handling and drilling handling incidents the following trends have been revealed:

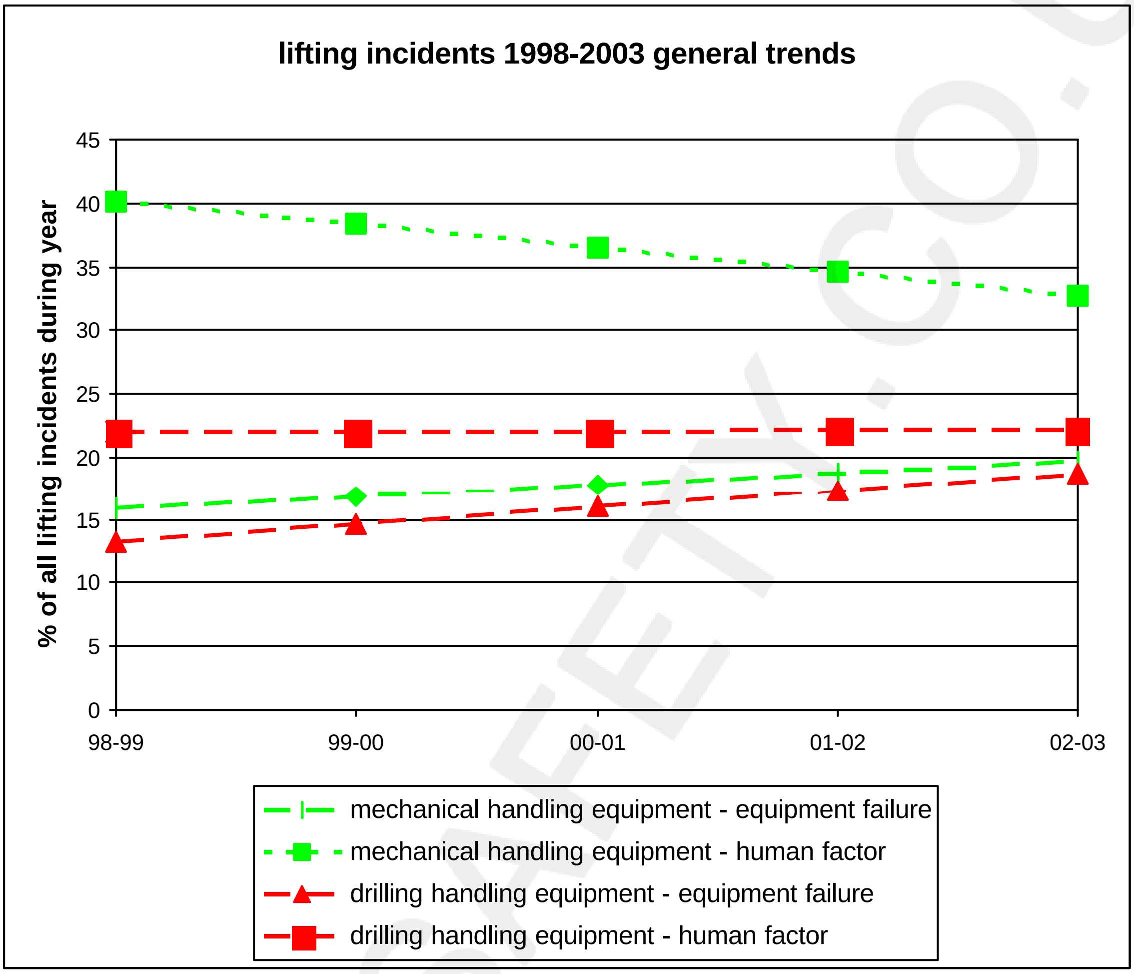

Figure 3.4
Drilling / mechanical incidents (best fit lines) – 1998 to 2003

Figure 3.4 above clearly shows that incidents attributed to mechanical handling – human factor account for the largest proportion of lifting incidents. However this was also the only category that has shown an improvement in the number of incidents occurring, as a percentage of all lifting incidents over the study period, falling by nearly 9%. The number of equipment failure incidents under mechanical handling has shown a slight increase, however this has not be significant enough to reverse the overall downward trend of mechanical handling incidents, shown earlier in figure 3.2.

Looking at the trends for the drilling handling incidents, both those caused by human factors and equipment failure have increase over the study period, this further backs up the increasing trend for the drilling handling incidents, again shown earlier in figure 3.2.

Detailed charts showing the year-on-year number of incidents and their percentage of all lifting incidents for drilling and mechanical handling, equipment failure and human factors can be found in Appendix 2.

Splitting the incidents in to the final categories described in Section 2 and as shown in Tables 2.9 and 2.10 produces the following charts:

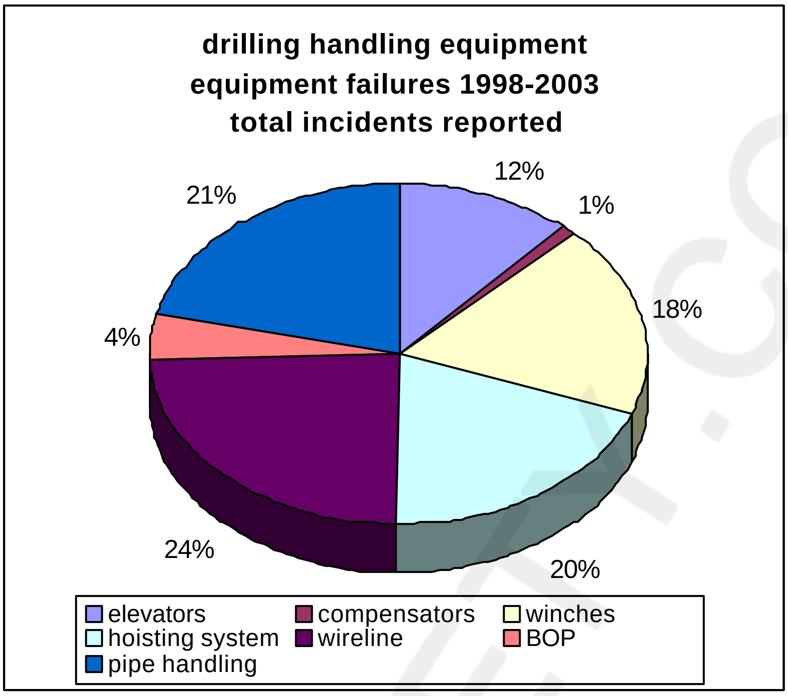

Figure 3.5
Drilling handling incidents – equipment failure – 1998 to 2003

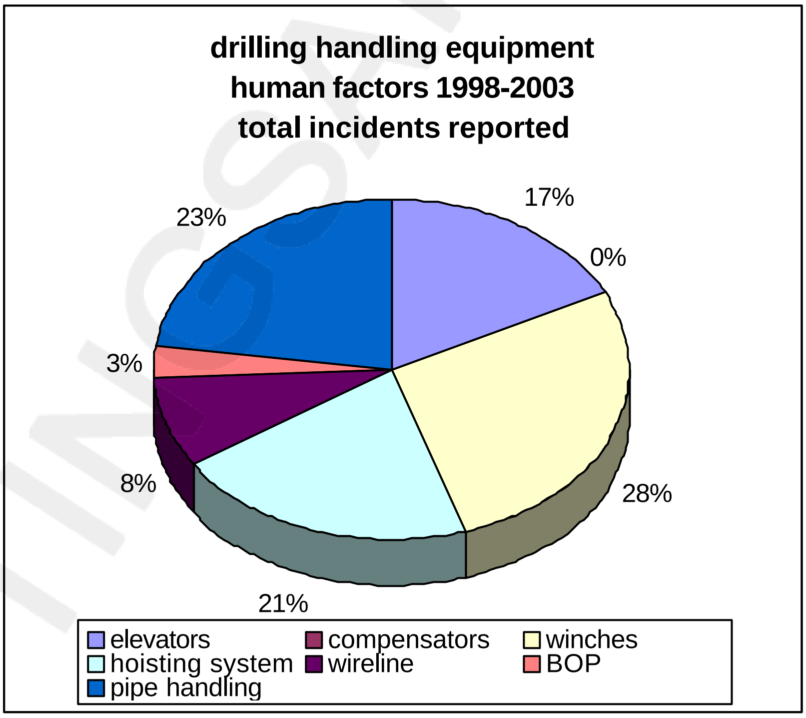

Figure 3.6
Drilling handling incidents – human factors – 1998 to 2003

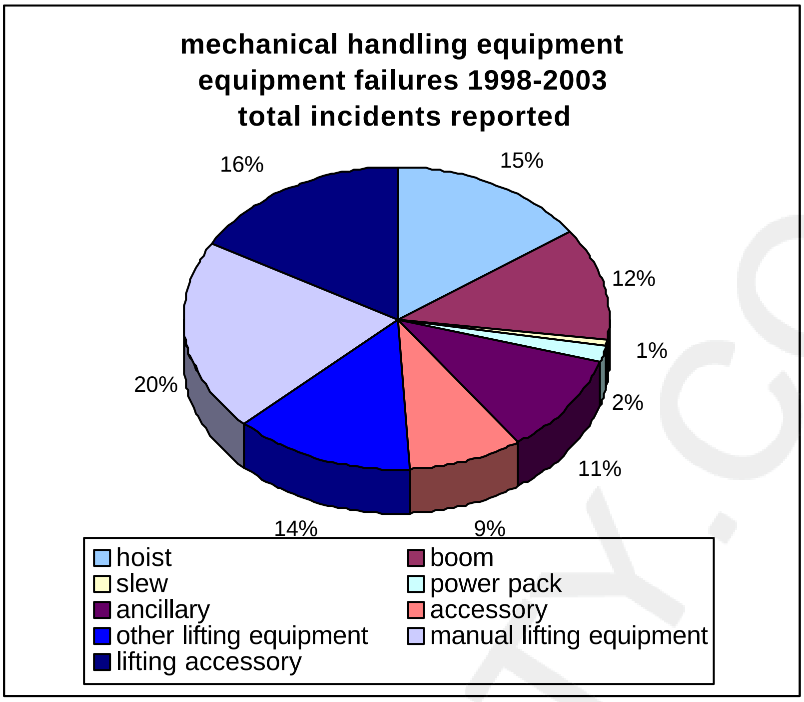

Figure 3.7
Mechanical handling incidents – equipment failure – 1998 to 2003

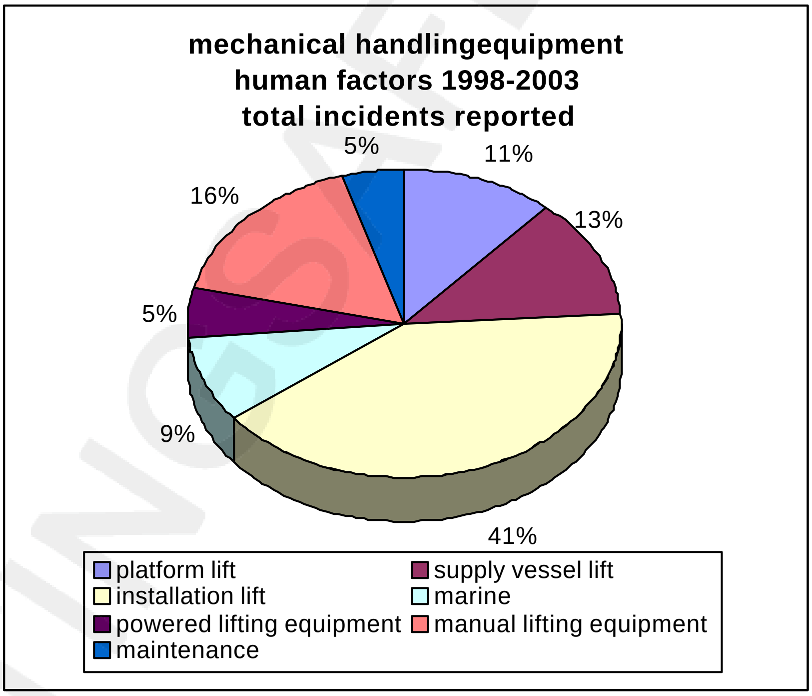

Figure 3.8
Mechanical handling incidents – human factors – 1998 to 2003

The following two sections of this report give a more detailed analysis of the incidents within the final categories identified previously.

3.2 DETAILED ANALYSIS OF DATA – DRILLING HANDLING INCIDENTS

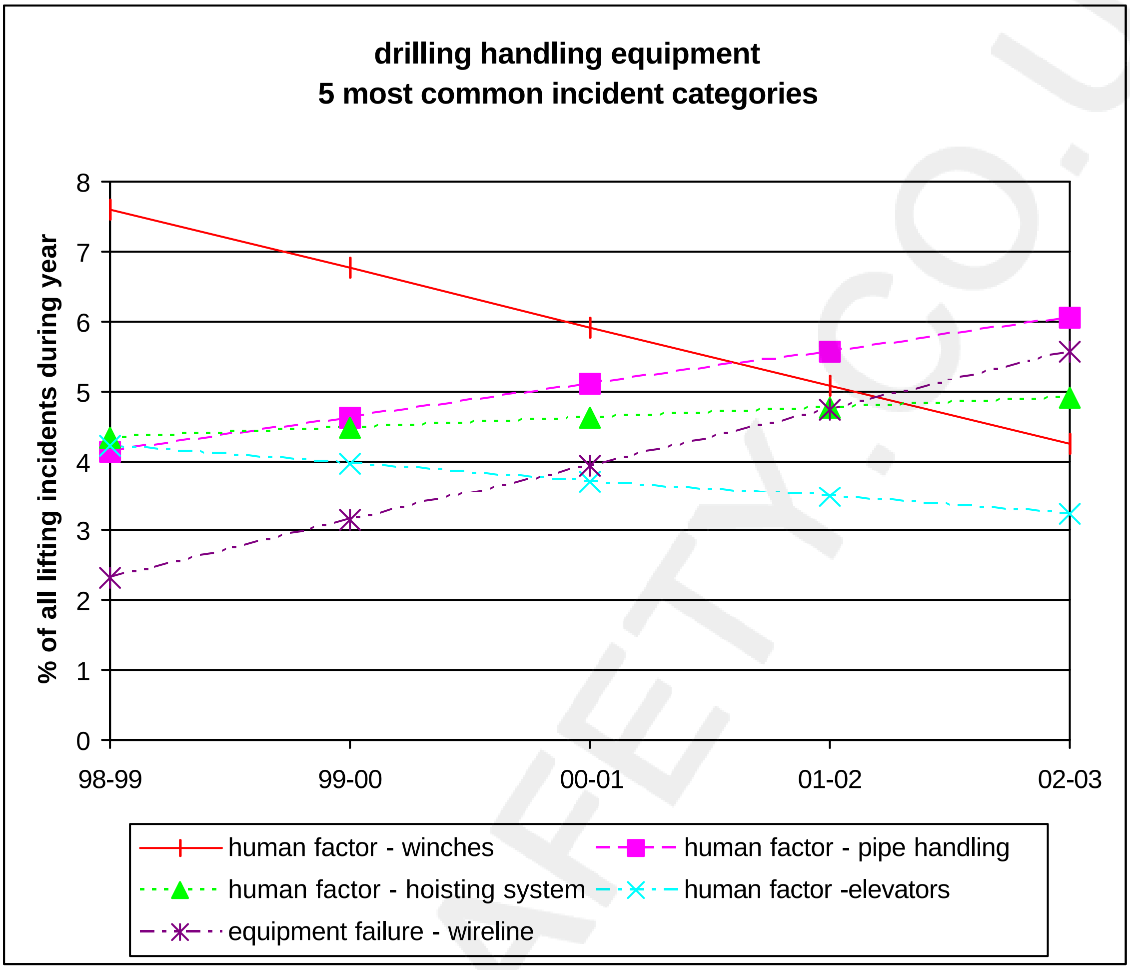

Figure 3.9

Drilling handling incidents – top 5 incident categories (best fit lines) – 1998 – 2003

Figure 3.9 above shows the 5 most common incident categories associated with drilling handling equipment. As can be seen 3 out of the 5 categories have shown an increase in frequency over the study period, with the most significant being those caused by failure of wireline equipment. However, as mentioned previously further investigation of these incidents could result in some of these incidents being attributed to human factor.

Although the category for human factor – winches was the largest contributor to drilling handling incidents over the whole study period, this category has shown a marked fall in the number of incidents, as a percentage of all lifting incidents.

To follow is a more detailed look at each incident category associated with drilling handling equipment. Detailed charts showing year-on-year incident numbers can be found in Appendices 3 and 4.

Drilling incidents – equipment failure

DHE–EF1 – Elevators

Over the study period the number of incidents where failure of the elevator was deemed as the root cause has increased.

The most common result (9 of 16, 56%) of elevator failure is a dropped load (drilling string or pipe). The remaining 44% of incidents resulted in parts of the elevator, (bolts, nuts and pins) falling down inside the derrick. This was possibly due to excess vibration during drilling operations.

DHE–EF2 – Compensators

This section covers incidents associated with failure of both the compensator and tensioner system as, although neither is strictly speaking, lifting equipment the systems employed both have characteristics in common with other equipment in the study; primarily the use of wire ropes.

There was only 1 incident within this study that has been assigned to this category, which concerned part of the compensator assembly breaking loose and falling to the drill floor.

DHE–EF3 – Winches

Incidents involving equipment failure of winches and their associated ancillaries within the drilling package have seen a slight falling trend over the full study period.

The most common result, 13 of 25 incidents, of equipment failure was a dropped object, as part of the lifting equipment fell down inside the derrick. These being wire rope (5), sheave (4), chain (1) and part of the winch itself on three occasions.

In 8 out of 25 incidents, the result was a dropped load due to failure of the lifting accessories (4), wire rope (3) and wire termination (1). Of the remaining 4 incidents, 2 resulted in a temporary loss of control of the load and in the other 2 the failure occurred before the load had been lifted off the deck.

Of the four incidents resulting in the parting of the wire rope or the termination there was insufficient evidence to say definitely whether an overload had been induced in the line.

DHE–EF4 – Hoisting System

This category covers an extensive amount of lifting equipment from the Drawworks through to the travelling block and the attached Top drive, see figure 2.3 presented earlier.

Splitting the incidents between the various items of equipment within the hoisting system identifies the following equipment as the root cause:

- Drawworks 9 of 27 incidents (33%)
- Top drive 6 of 27 incidents (22%)
- Unknown 5 of 27 incidents (19%)
- Travelling block 3 of 27 incidents (11%)
- Crown block 3 of 27 incidents (11%)
- Dead line anchor 1 of 27 incidents (4%)

Of the 9 incidents attributed to failure of the Drawworks, 5 of these were deemed to be caused due to failure or slipping of the brake, resulting in an uncontrolled descent of the load / block until the load either contacted the drill floor or the back-up brakes were applied.

Over half of the incidents (15 of 27) resulted in a dropped object, usually part of the lifting equipment falling down inside the derrick.

The overall trend for incidents in this category has been upwards, however the final year of the study, 2002/03 has seen a marked improvement, halving the number of incidents from the previous years.

DHE–EF5 - Wireline

The largest category within the drilling equipment failure section with 33 incidents reported. This represents 4% of all lifting incidents and just less than one quarter (24%) of drilling equipment failure.

Of the 33 incidents within this category 26 were as a result of the wireline parting, which resulted in either the tool being dropped to the drill floor or lost down hole. However the detailed descriptions provided for many of these incidents was not sufficient to determine any root cause for the failure of the wire, all that is known is that the wire parted.

Over the study period, the trend of incidents within this category has been upwards and it is the only equipment failure category that appears within the 5 most common drilling handling incidents. However, as with failures of the hoisting system, the final year of the study has seen a considerable reversal of this trend.

DHE-EF6 – Blow-Out-Preventer (BOP) Lifting Equipment

The second smallest category, after compensators, within the drilling equipment failure section with 6 incidents reported was BOP lifting equipment failure, this represents less than 1% of all lifting incidents. The trend over the study period for this category has been downwards with no incidents reported in 2002/03.

The results of failure of this type of equipment were dropped load (3), dropped object (2) and equipment damage (1).

DHE-EF7 – Pipe Handling

This category includes failures of the pipe handling equipment such as mechanical racking systems and failure of the drill string tool joints, for example collars and threads.

The most common cause (12 of 29, 41%) of equipment failures were attributed to parts of the mechanical pipe handling / racking systems. There were 10 incidents where the drill string failed (tool joint), rather than the lifting equipment.

As might be expected, the results of equipment failure within this category were dropped load (14), dropped object (12) and injured personnel (2). Under dropped objects, there were 9 instances of parts falling from the pipe handling / racking equipment, most commonly bolts and pins that had either sheared or vibrated loose.

The trend for incidents within this category is upwards and it accounts for the second highest category within the drilling equipment failure section with 29 incidents reported, representing

3% of all lifting incidents and 21% of drilling equipment failures. This increasing trend could be due to the increasing mechanisation of the pipe racking process.

Drilling incidents – human factors

DHE-HF1 – Elevators

This is the fourth highest category (17%) within the drilling handling equipment, human factor group, and shows there has been a steady downward trend since 1998/99, with the exception of 2001/02 that saw a slight increase in the number of incidents.

Two major root causes were identified as:

- Operator error 15 of 33 incidents (45%)
- Positioning / action of injured party 14 of 33 incidents (42%)

The most common outcome of an incident within this category was an injury to one of the drill crew (14 of 33 incidents). In 10 of these 14 cases, the injured party had their fingers, thumb or hand caught and crushed, either in the elevators as they opened or closed, or between the elevator and the load.

On three occasions, the operator accidentally operated the automatic elevator release function, resulting in the suspended load being dropped to the drill floor.

DHE-HF2 – Compensators

There were no reported incidents during the study period that fell in to this category.

DHE-HF3 – Winches

The largest category within the human factor group with 53 incidents (6.2% of all lifting incidents and 28% of those attributed to drilling equipment – human factors). However, this category has seen one of the most dramatic downward trends since 1998/99, apart from a couple of poor years, 2000/01 and 2002/03.

It was possible to attribute the root causes of the incidents in this category as follows:

- Operator Error 22 of 52 incidents (42%)
- Procedures 13 of 52 incidents (25%)
- Positioning of injured party 10 of 52 incidents (19%)
- Banking 4 of 52 incidents (8%)
- Rigging 3 of 52 incidents (6%)

The results of these incidents were as follows:

- Dropped object 21 of 52 incidents (40%)
- Injured party 16 of 52 incidents – either trapped or struck by load (31%)
- Dropped Load 10 of 52 incidents (19%)
- Equipment damage 5 of 52 incidents (10%)

DHE-HF4 – Hoisting System

Overall the incidents within this category have shown a slightly increasing trend over the study period, this is partly due to a significant increase in incidents during 1999/00. Since then there has been a slight decrease over the remaining years, however this has not returned to the level at the start of the study.

The root causes were determined as:

- Operator error 30 of 39 incidents (77%)
- Rigging 5 of 39 incidents (13%)
- Positioning 3 of 39 incidents (8%)
- Maintenance 1 of 39 incidents (2%)

Looking at all the root causes, the most significant factor is operator error when using any of the elements within the hoisting system. Of these incidents, 24 involved the operation of the travelling block; most frequently the block catching on other equipment in the derrick resulting in either equipment damage or a dropped object.

There were 5 incidents that resulted in injury to personnel, these being either trapped limb due to poor positioning of the individual or as a result of being struck by a dropped object.

DHE-HF5 – Wireline

This category has seen a steadily increasing trend in the number of incidents occurring as with those attributed to failure of the wireline equipment. With 16 incidents due to human factors compared to 33 equipment failure it may appear that the main area of concern should be with the equipment currently in use. However, when considering that 79% of equipment failures were the direct result of the wireline parting, and the fact that due to the level of information provided in the incident text it was impossible to determine the root cause of the failure, it is possible that with further investigation some of these incidents could in fact be attributed to human factors. This is further substantiated by the fact that 11 of the 16 human factor incidents (69%), occurred due to operator error and that in all but one of these incidents the wireline had been subjected to over tensioning and resulted in the wire parting.

The root causes were attributed to:

- Operator error 11 of 16 incidents (69%)
- Positioning 4 of 16 incidents (25%)
- Maintenance 1 of 16 incidents (6%)

The most common result (11 occasions), of an incident was the wireline tool being dropped either to the drill floor or down hole. On 10 of these occasions the root cause was the operator over hoisting the wireline causing the wire to part, and on the other occasion was due to incorrect maintenance of the equipment.

DHE-HF6 – Blow-Out-Preventer (BOP) Lifting Equipment

As with the equipment failure section, this is the second smallest category within the drilling equipment human factor group with only 6 incidents reported over the five years of this study and the maximum incidents reported in any single year being 2.

The main cause of incidents, (4 out of 6) was deemed to be due to the use of poor procedures or poor pre-task planning. These incidents could have been avoided had better control measures been in place. The other 2 incidents were attributed to banking during the lifting operation.

DHE-HF7 – Pipe Handling

The second largest category within the drilling handling equipment – human factor group, with 43 incidents (5% of all lifting incidents). This category was the most common of the drilling handling group over the last two years of the study.

The two most common causes of the incidents were poor positioning of the injured party (17 of 43, 40%) and operator error (16 of 43, 37%). All of the poor positioning incidents resulted in personnel injury due to the injured party having their fingers, hands or arms trapped as a result of handling the drill pipe / collars. The information contained in the incidents text show there to be a lack of awareness by the derrickhand of both inertia and momentum of the various drill pipes when they are being handled in and out of the monkey board fingers. The incidents attributed to operator error were due to incorrect or careless operation of the mechanical pipe handling equipment and usually resulted in either a dropped load (9 of 16) or a dropped object (5 of 16).

With the increasing mechanisation of the pipe handling process (for example mechanical racking systems) it would have been expected that the incidents in this category should have decreased over the study period, however this has not been the case. Instead this category has become the most likely incident to occur within the drilling operations. As mentioned earlier the biggest cause is due to carelessness of the derrickhand or the operator of the mechanical pipe handling equipment.

3.3 DETAILED ANALYSIS OF DATA – MECHANICAL HANDLING INCIDENTS

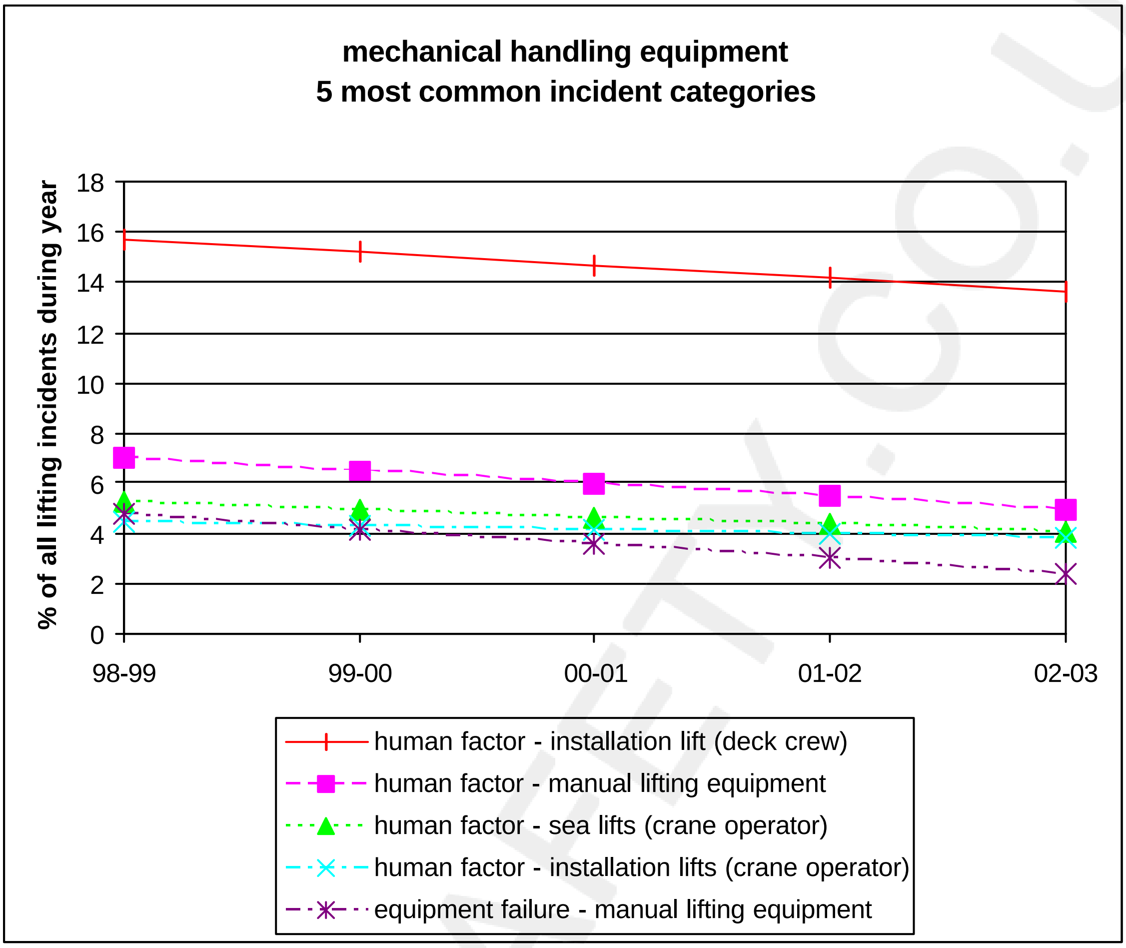

Figure 3.10

Mechanical handling incidents – top 5 incident categories (best fit lines) - 1998 - 2003

Figure 3.10 above shows the 5 most common incident categories associated with mechanical handling equipment and operations. As can be seen, 4 of the 5 incident categories are attributed to human factors with 3 of these categories involving the operation of pedestal cranes.

All of the 5 most common incidents have seen slight improvements over the study period, which further backs up the fact that the mechanical handling group has seen a downward trend in the number of incidents occurring each year.

To follow is a more detailed look at each incident category associated with mechanical handling equipment. Detailed charts showing year-on-year incident numbers can be found in Appendices 5 and 6.

Mechanical handling incidents – equipment failure

MHE-EF1 – Pedestal Crane – Hoist Function

A total of 23 incidents have been attributed to failure of equipment associated with either the main or auxiliary hoist of pedestal cranes. Although only the fourth largest category within the mechanical handling equipment failure group it has seen a sharp rising trend in the number of incidents occurring each year and is now the most likely category of incident to occur within this group.

The results of equipment failure within the hoist system are:

- Dropped Load 10 of 23 incidents

emergency system operator unable to prevent uncontrolled descent of load

- Loss of control 9 of 23 incidents

unplanned descent of load until arrested by operator or emergency system

- Loss of motion 2 of 23 incidents

operator unable to hoist or lower load

- Equipment damage 2 of 23 incidents

control over load maintained by operator but part of hoist system damaged

Due to the lack of detailed description provided for these incidents it was impossible to determine the root cause for all 23 incidents, all that is known is that part of the hoist system failed. Of the root causes that could be determined these include failure or slipping of the hoist brake (4), hydraulic leak due to a burst hose or fitting (4) and failure of the hoist motor (1).

MHE-EF2 – Pedestal Crane – Boom Function

The overall trend of incidents within this category has been a slight increase, however the last two years of the study have seen an improvement in the number of incidents occurring.

The results of equipment failure of the boom system are:

- Uncontrolled rising of boom 6 of 18 incidents
- Dropped boom 5 of 18 incidents
- Boom motion opposite to control 2 of 18 incidents
- Dropped object 2 of 18 incidents
- Loss of control 2 of 18 incidents

unplanned descent of the boom until arrested by safety system or operator

- Equipment damage 1 of 18 incidents

In 5 of the 6 incidents where the boom continued to rise after the controls had been returned to the neutral position, the boom was pulled into the backstops before the operator could apply the emergency stop and arrest the luffing motion. These incidents resulted in damage to the foot section of the boom. The description provided for these incidents was insufficient to identify the reasons for their occurrence.

Of the incidents resulting in a dropped boom, 3 of the 5 incident were as a result of brake failure and 1 incident occurred due to the winch drum shaft shearing. There was insufficient information to determine the cause of the final incident. On 2 occasions the boom was dropped over the side of the platform resulting in major damage to both the boom and the installation.

MHE-EF3 – Pedestal Crane – Slew Function

There was only 1 incident (0.1% of all lifting incidents) within this study that has been attributed to a failure in the pedestal crane slew system. The cause of the incident was identified as a failure of a hydraulic fitting within the slew system and as a result of this the operator lost control of the slew motion and had to use the emergency stop facility to avert the boom contacting the drilling derrick.

MHE-EF4 – Pedestal Crane – Power Pack

As with Pedestal Crane – Slew Function, the number of incidents associated with failure of the power pack is very low, with only 3 incidents reported (0.3% of all lifting incidents).

In all 3 incidents equipment damaged occurred, either to the load or to the crane. The result of 1 incident was an uncontrolled decent of the load until it landed on the deck of the vessel.

Due to the small number of incidents within this category and the fact that no two incidents had the same cause it was not possible to identify any significant trends.

MHE-EF5 – Pedestal Crane – Ancillary Equipment

This category has seen an increasing trend over the study period and by the final year is the third most likely incident to occur within the mechanical handling equipment failure group. Of the 16 incidents, 14 resulted in a dropped object (87%), these objects were found to be various fitting mounted to the crane, such as floodlights, cable trays and mounting bolts / pins. It was not possible to identify whether these incidents occurred as a direct result of performing a lift with the crane or due to general wear and tear of the different components.

MHE-EF6 – Pedestal Crane – Accessories

Over the study period the general trend of incidents has been downward, although the final year has seen as slight increase in incident frequency. The most common failure (5 of the 13 incidents) was found to be the crane hook, on every occasion the sling or pennant slipped out of the hook when the line was slackened after landing the load even though a safety catch was fitted. On investigation of the hooks, no obvious defects could be determined.

In 4 incidents, part of the main block (3) or overhaul ball (1) sheared off and resulted in a dropped object. On three occasions the object fell on to the deck, luckily there were no personnel in the vicinity at the time.

MHE-EF7 – Other Lifting Appliance

This category covers all other power lifting appliances which are not classified as pedestal cranes. Given the wide range of equipment included in this category it is perhaps surprising that this is only the fourth largest category within the mechanical handling equipment failure group. However, due to the increasing trend (as a percentage of lifting incidents) this category was the second most likely to occur within the equipment failure group by the end of the study.

The types of lifting appliances were as follows:

- Overhead gantry crane 10 of 21 incidents (48%)
- Pneumatic winch 6 of 21 incidents (28%)
- ROV handling crane 4 of 21 incidents (19%)
- Pipe handling crane 1 of 21 incidents (5%)

In 10 of the 21 incidents the result was a dropped load. On 7 of these occasions the operator was unable to arrest the descent of the load before it either contacted the deck or landed in the sea.

MHE-EF8 – Manual Lifting Equipment

The largest category within the mechanical handling equipment – equipment failure group accounting for 31 of the 152 incidents (20%). However since a high in 1999/00 a downward trend in incidents has occurred. This category is the only equipment failure category within the 5 most common mechanical handling incidents.

The types of manual lifting equipment that failed were:

- Chain hoist / block 23 of 31 incidents (74%)
- Lever hoist 6 of 31 incidents (20%)
- Manual winch 1 of 31 incidents (3%)
- Other 1 of 31 incidents (3%)

The fact that this is the largest equipment failure group is quite alarming given the fairly rigorous periodic examinations carried out on portable lifting equipment. Therefore it seems likely that a degree of equipment abuse or negligence would be at the centre of the failures. If this is the case a large portion of these incidents could be reassigned to be attributed to human factors.

It was not possible to further investigate the root cause of these incidents as the details provided did not include the findings of any post failure investigation / examination of the equipment. It would now be very difficult and time consuming, if not impossible to trace these incidents back to the duty holders and review any of these investigations.

MHE-EF9 – Lifting Accessories

This is the second largest category within the mechanical handling equipment failure group, however this category includes a wide range of lifting equipment. Lifting accessories were taken as all items connecting the load to the lifting equipment, as defined in the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998, SI 2307.

The failure of an accessory generally led to a dropped or unbalanced load (19 of 26 incidents). On a further 5 incidents the accessory failed before the load had been lifted off the deck.

The most common accessories that were found to have failed during the study were slings / sling sets, both wire rope (11) and webbing straps (2).

Due to the detail of the information provided it was not possible to determine whether these items failed due to defective manufacture or due to being subjected to an overload.

Mechanical handling incidents – human factors

MHE-HF1 – Pedestal Crane – Platform Lifts (Operator Error)

The use of pedestal cranes on offshore installations is the primary method of performing lifting operations outside the drill floor and account for 37% of all lifting incidents.

All 36 incidents within this category occurred during lifting operations onboard an offshore installation in which the incidents are attributed as having operator error as the root cause.

The results of these incidents were as follows:

- Dropped Object 15 of 36 incidents
- Dropped load 10 of 36 incidents
- Equipment damage 7 of 36 incidents
- Injured personnel 4 of 36 incidents

Of the incidents resulting in a dropped object, this occurred on 9 occasions due to the load contacting an item of plant or a section of the installation and subsequently the damaged piece falling to the deck.

Injury to personnel has occurred where the operator has been unaware of the injured party's location until it was too late to avoid striking them with either the load or the hook. On 3 occasions the injured party was not part of the crew undertaking the lifting operation.

MHE-HF2 – Pedestal Crane – Sea Lifts (Operator Error)

This category has seen a steady decline in the incident frequency over the study period, although there is a slight blip during 2000/01.

Again in all 40 incidents the root cause has been attributed to the operator.

The results of the incidents are:

- Equipment damage 13 of 40 incidents
- Dropped load 11 of 40 incidents
- Dropped object 10 of 40 incidents
- Sling shedding 3 of 40 incidents
- Injured personnel 2 of 40 incidents
- Loss of control 1 of 40 incidents

There is always an increased risk when performing lifting operations to or from a sea going vessel due to the vessels motion as it rolls with the waves. 24 of the 40 incidents were attributed to the operator misjudging the roll of the vessel. On 18 occasions this resulted in the load being snagged on part of the vessel as it heaved on a wave inducing an overload situation. The resulting overload lead to, dropped load (6), broken leg of sling set (8) and damage to the vessel (4). The remaining 7 incidents were the operator misjudge the vessel motion resulted in 2 dropped loads (where the container was tipped and the contents spilled across the deck), 2 personal injuries, 1 occasion of equipment damage (container landed too hard on deck) and 1 incident where the operator lost control of the load and it was dragged down the length of the vessels deck.

There were 8 incidents where the operator allowed the load to contact either the vessel or another item of cargo which resulted in a dropped object due to the damage sustained.

In 2 of the 3 incidents resulting in sling shedding, a pennant was left attached to the main line whist the operator proceeded to use the whipline to perform a lift. During this operation the pennant detached itself from the main block and fell to the deck of the vessel below. The remaining incident occurred when the operator accidentally lowered the hook block into the sea, resulting in the pennant slipping out of the hook.

MHE-HF3 – Installation – Pedestal Crane Operation

Undoubtedly the largest category from both mechanical and drilling handling groups with 128 incidents (14.8% of all lifting incidents, 27.3% of mechanical handling incidents and 40.4% of mechanical handling human factor incidents).

The root causes of the incidents were found to be:

- Positioning 64 of 128 incidents (50%)
- Banking 20 of 128 incidents (16%)
- Slinging 17 of 128 incidents (13%)
- Procedures 15 of 128 incidents (12%)
- Packing 12 of 128 incidents (9%)

In all 64 incidents where the positioning of the deck crew was deemed to be the root cause of the incident, personal injury occurred. As with the drilling pipe handling incidents attributed to human factor, the deck crew seem to have a lack of awareness of both inertia and momentum of a load being lifted by a pedestal crane. On many occasions the injury occurred when a member of the deck crew attempted to arrest or guide a swinging or spinning load manually, even if the load weighed several tonnes.

There were another 13 incidents that resulted in personal injury, giving a total of 77 (60%) incidents within this category. Of these 4 occurred as a result inadequate slinging of the load causing it to either drop to the deck or to swing violently and strike the injured party. Another 3 were attributed to banking, where during a blind lift the load contacted part of the platform and rebounded into the injured party. The remaining 6 incidents were attributed to poor procedures during the lifting operation, usually involving a lack of communication between all the involved personnel or a lack of pre task planning. Of the incidents attributed to inadequate slinging of the load, all but one resulted in a dropped load.

MHE-HF4 – Marine – Pedestal Crane Operations

This category is similar to the above but relates to lifting operations to and from a sea going vessel, where the human factor was attributed to the vessel crew. The root causes identified are similar to those for MHE-HF3

The root causes of the incidents were attributed to:

- Inadequate packing 11 of 29 incidents
- Positioning 7 of 29 incidents
- Slinging 6 of 29 incidents
- Banking 3 of 29 incidents
- Procedures 2 of 29 incidents

As shown above the largest cause of incidents was due to inadequate packing of the cargo, causing various dropped objects as the load was lifted up to the installation. Although the vessel crew would not have originally packed the cargo, it is the responsibility if the vessel captain to reject all cargo that is not packed both safely and securely.

All the incidents caused by poor positioning resulted in personal injury, usually caused by the injured party becoming trapped between the load on part of the vessel or another item of stowed cargo. This is not unexpected given the motion of the vessel and the congested nature of the deck.

The incident frequency trend has remained steady throughout the study period with a maximum number of 7 incidents being reported in one year.

MHE-HF5 – Other Lifting Equipment – Powered

The second smallest category within the mechanical handling – human factor group with 17 incidents (5% of mechanical handling-human factor) over the study period. The incident trend has been steadily downwards, and in the final year of the study no incidents had been attributed to this category.

The types of lifting equipment within this category are:

- Overhead gantry crane 6 of 17 incidents
- Pneumatic winch 6 of 17 incidents
- ROV handling crane 2 of 17 incidents
- Lifting davit 1 of 17 incidents
- Telescopic mast 1 of 17 incidents
- Helicopter lift 1 of 17 incidents

The most common cause identified was operator error (8 incidents). Half of these incidents were as a result of the lifting equipment being either operated prematurely or by accident. This was particularly concerning as it put the rest of the deck crew at risk as they were either attaching the load or had not retreated to a safe position. The remaining half of these incidents were due to the careless actions of the operator, where the lifting equipment was operated erratically, causing the load to swing uncontrollably.

The incidents identified as being caused by poor positioning of the deck crew were as a result of a lack of awareness of how the load was expected to move or how the equipment was to be operated.

MHE-HF6 – Other Lifting Equipment – Manual

Although the incident frequency trend has been downwards this is still second largest category within the mechanical handling-human factor group with 52 incidents reported.

The types of lifting equipment noted were:

- Chain hoist / block 24 of 52 incidents
- Lever hoist 7 of 52 incidents
- Wire rope hoist ('Tirfor') 3 of 52 incidents
- Beam trolley 2 of 52 incidents
- Other 16 of 52 incidents

26 of the 52 incidents (50%) resulted in personal injury, this was usually caused when the injured party attempted to manoeuvre the load whilst it was suspended on the lifting equipment trapping part of their body as the load shifted.

There were 23 incidents attributed to operator error, which included improper use of equipment, including the use of damaged or uncertified equipment (13), allowing the load to snag during hoisting (5) and the use of inadequate rigging (5).

MHE-HF7 – Pedestal Crane Maintenance

The smallest category within the mechanical handling, human factor group with 15 reported incidents during the study period, this is the only category that has shown a noteworthy increase in incident frequency, mainly due to a peak in the final year of the study.

The results of incidents attributed to maintenance of pedestal cranes were:

- Dropped object 10 of 15 incidents (67%)
- Injured personnel 2 of 15 incidents (12%)
- Dropped load 1 of 15 incidents (7%)
- Dropped boom 1 of 15 incidents (7%)
- Equipment damage 1 of 15 incidents (7%)

On 8 occasions the incident occurred during the maintenance activity as a result of careless action of the members of the maintenance team. The majority of these (5 incidents) resulted in a dropped object, usually due to the item of equipment being inspected / replace not being secured properly during its removal.

There were 3 incidents that occurred as a result of incorrect or inadequate maintenance activities where any item of equipment was either modified incorrectly or replaced with an incompatible item.

4. DISCUSSION

In this section of the report, each of the four main groups of incidents, drilling and mechanical handling, equipment failure and human factors, will be considered in more detail.

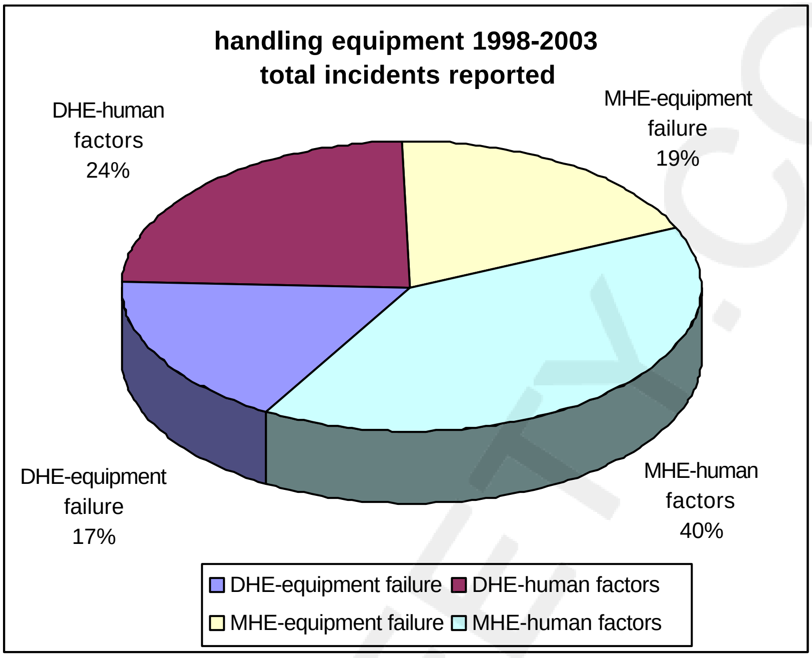

Figure 4.1
The 4 main incident groups – 1998 to 2003

Figure 4.1 clearly shows that mechanical handling operation account for the largest proportion (3 in every 5 incidents, 59%) of lifting incidents reported, with those attributed to human factors contributing the largest proportion. In addition the percentage split for equipment failure incidents is practically the same for both groups.

4.1 DRILLING HANDLING EQUIPMENT – EQUIPMENT FAILURE

Equipment failure for drilling handling equipment is the smallest of the four groups with only 17% of all lifting incidents reported. However this group has shown an increasing trend over the study period and by the end of the study it has almost passed mechanical handling equipment failures in terms of incident frequency. Although the final year of the study has shown a reduction in the number of incidents reported.

The category reporting the most incidents within this group was that attributed to wireline operations, this accounted for approximately one quarter of all incidents within the drilling handling equipment failure group, which is 1 in every 4 equipment failure incidents reported within the drilling floor. It has also shown the most dramatic rise in incident frequency trend over this study. However as mentioned earlier, the details provided for many of these incidents were not sufficient to determine any root cause for the failure of the wire. If these incidents were further investigated (depending on information available) it is possible that some incidents could have a degree of human factor contributing to the failure.

The second largest category within this group was the pipe handling system. This category has seen a steady increase in incident frequency, which could be attributed to the increasing mechanisation of this process, although this does suggest that greater control measures are needed to try and reverse this trend. A large proportion of incidents involved parts of the mechanical pipe racking system breaking and falling from the derrick. It is uncertain whether these can be attributed to the design of the equipment or to the levels of maintenance currently practiced by the drill crew.

The hoisting system was only the third largest category, and it is worth noting the extensive amount of equipment covered by this category and the fact that during drilling operations these are probably the most used pieces of equipment, however the trend is for a rise in incidents over the study period.

4.2 DRILLING HANDLING EQUIPMENT – HUMAN FACTOR

The largest category within this group is that attributed to the use of winches, accounts for 28% of incidents. However the incident trend is downwards during the study. The most common cause of the winch related incidents was deemed to be due to operator error, most notable allowing the load, empty hook or winch wire to foul on various pieces of equipment on either the drill floor or up in the derrick. This usually resulted in a dropped object, which given the confined space of the drill floor heightens the risk of members of the drill crew being injured by falling objects. More alarming though are the incidents occurring during manriding operation, where on several occasion there appears to be a lack of communication between the winch operator and the derrickhand undertaking the manriding task. The operator, for whatever reason does not verify that the derrickhand is ready to be hoisted and that it is safe to proceed before operating the winch. Most commonly the derrickhand is pulled into various parts of the derrick, i.e. monkey board, sustaining an injury in the process. Due to the height above the drill floor of some of these operations and the noisy atmosphere verbal communication between the two parties is difficult, however since the person in the riding belt has very little control over the winch, if any, their safety is entirely in the hands of the winch operator.

The second largest category within this group was pipe handling, and as mentioned earlier in Section 3.2 the increasing trend in incidents in this category has made it the most likely drilling related incident to occur by the end of the study. This increasing trend is alarming given the increasing mechanisation of this process due to the introduction of mechanical pipe racking systems, which should reduce some of the physical operations previously required by members of the drill crew. Removing some of the human factors involved in handling the drill pipe / collar within the drill floor, and hence exposure to risk, has not led to a decrease in the number of incidents attributed to this category, as now the second largest cause of incidents is due to operator error when working the various pipe handling equipment. Even with the introduction of these mechanical aids, there are still a high proportion of incidents attributed to the careless action of members of the drill crew, where they have positioned themselves or part of their body in a dangerous situation and become trapped as the pipe /collar is manoeuvred into position. The incident text shows there to be a lack of awareness by the derrickhands of the momentum of the pipe / collar when being handled.

Table 4.1
Root cause of drilling handling - human factor incidents

Root cause	*98/99*	*99/00*	*00/01*	*01/02*	*02/03*	*Total*
Operator error	16	22	24	17	15	94
Positioning	21	5	5	8	9	48
Procedures	5	5	7	3	5	25
Rigging	1	2	3	3	3	12
Banking	3	0	0	1	2	6
Maintenance	1	3	0	0	0	4
TOTAL	47	37	39	32	34	189

The root causes of the incidents within this group are shown in Table 4.1, and as can clearly been seen operator error is by far the most common cause with twice as many incidents as any other.

A year-on-year graph for the root causes for all drilling handling equipment – human factors can be found in Appendix 7.

4.3 MECHANICAL HANDLING EQUIPMENT – EQUIPMENT FAILURE

The mechanical handling equipment – equipment failure is the second smallest group with 19% of all lifting incidents reported. The largest category was the failure of manual lifting equipment (31 incidents), such as chain and lever hoists, although this was one of only 4 categories (this having the maximum) that showed a decreasing incident trend over the study period. As mentioned earlier the fact that this is the largest equipment failure category within this group is rather alarming given the rigorous periodic examinations carried out on portable lifting gear. Also, it is common practice to colour code the portable lifting gear making it easy to identify whether the equipment is still in current certification. Therefore, given all these control measures there could be a certain degree of negligence or equipment abuse, during operation or maintenance, contributing to some these failures. This could also be true for the lifting accessories (i.e. shackles, slings, etc) as this was the second largest category but it is also subject to the same control measures the portable lifting equipment (colour coding and periodic examination).

The primary item of lifting equipment used offshore is the pedestal crane, and 6 of the 9 categories within this group are dedicated to failure of various items of equipment / systems on the pedestal crane. Combining all the pedestal crane equipment failure incidents it was found that they account for 49% of all incidents within this group.

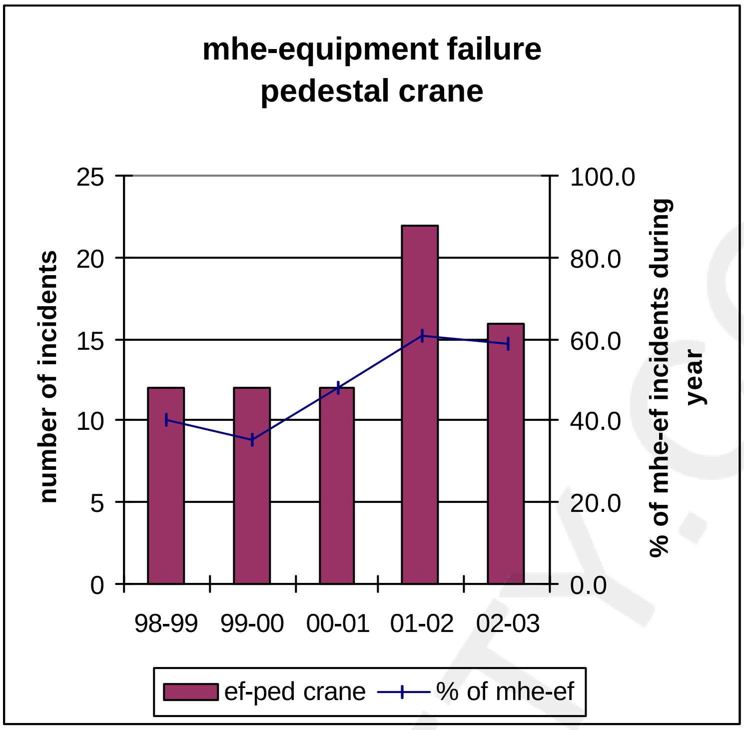

Figure 4.2
Mechanical handling incidents – equipment failure
Pedestal crane incidents – 1998 to 2003

Overall the trend has been increasing for pedestal crane equipment failure incidents, with only the power pack and accessory categories showing a decreasing trend.

4.4 MECHANICAL HANDLING EQUIPMENT – HUMAN FACTORS

The mechanical handling equipment – human factors is the largest group within the study accounting for 317 incidents (40% of all lifting incidents), which is more than all the equipment failure incidents and nearly twice as many incidents as the drilling handling human factor group. However this is the only group that has shown a decreasing trend over the study period.

By far and away the largest category within this group is that attributed to installation lifts - pedestal crane operations where the root cause was attributed to the deck crew, accounting for 41% of incidents. Over half of the incidents (77 of 128) resulted in some form of personal injury, most commonly due to the poor positioning of the injured party during the lifting operation. Combining this category with that where the deck crew of the associated sea going vessel where deemed to be the root cause, we find that these two categories alone account for 50% of incident within this group.

Overall, 248 of the 317 incidents (78%) within this group involved the operation of pedestal cranes, and as mentioned earlier they are the primary item of lifting equipment used offshore. Of these incidents only 76 where attributed to the crane operator, the majority, 157 incidents were attributed to third-parties (i.e. the deck crew) and the remaining 15 incidents attributed to maintenance activities. Figure 4.3 shows the incident frequency trends for these three root causes, as a percentage of all pedestal crane incidents attributed to human factors:

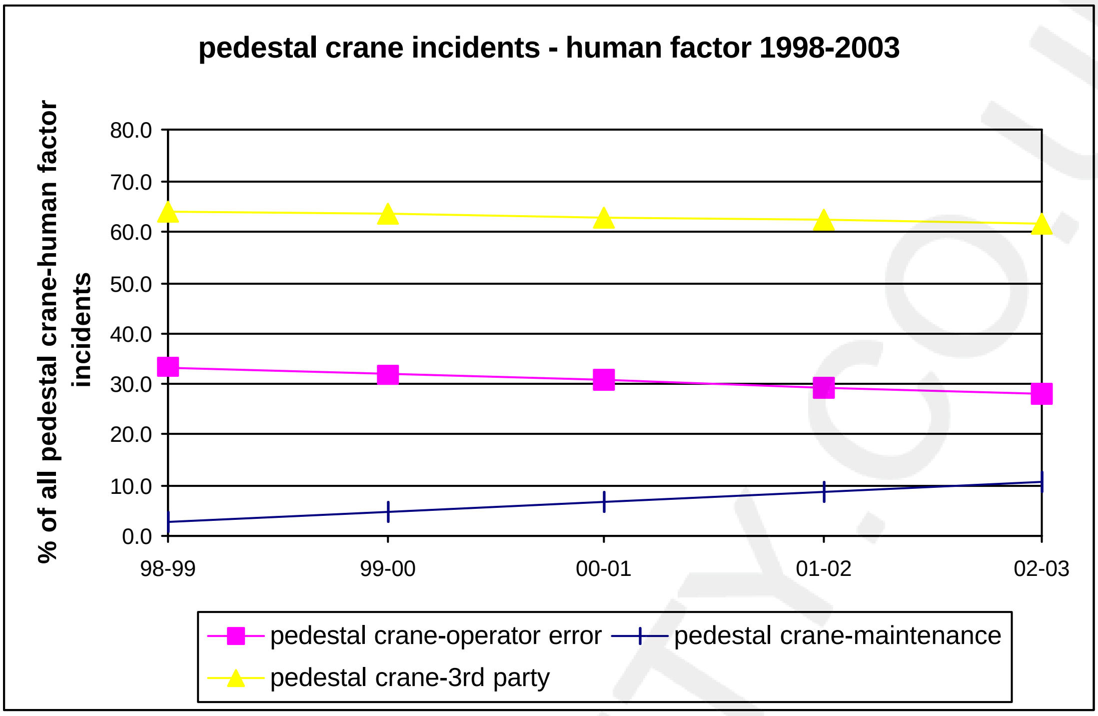

Figure 4.3
Mechanical handling equipment
Pedestal crane incidents – human factors (best fit lines) – 1998 – 2003

As figure 4.3 shows, incidents attributed to poor or lack of maintenance is the only root cause demonstrating a rising trend over the study. This rising trend is primarily due to the increase in incidents occurring in the final year of the study.

The incidents attributed to operator error and 3rd party personnel account for 94% of the pedestal crane human factor incidents, since generally the cranes are undertaking substantially more lifting operations compared to the number of maintenance activities carried out (half of all maintenance incidents occur during maintenance activities). The trends for operator error and 3rd party incidents have shown a reduction over the study period, however despite the level of training that these groups of personnel are exposed to, i.e. crane operator training (basic principals through to full offshore lifting operations), slinging and banking, rigging and lifting and handling courses, there is still a considerable amount of incident occurring due to careless action or lack of forward thinking. This is particularly evident within the incidents caused by 3rd party personnel where the largest single cause of incidents was deemed to be due to the poor positioning of a member of the deck crew or the position of part of their body (i.e. hand, arm, foot, etc), and always resulting in personal injury. Most commonly this involved the injured party trying to guide the load into position as it was landed on the deck or guiding it out of a tight space. During this operation, the injured party would inadvertently place a part of their body in a poor position, resulting in them becoming trapped as the load shifted. It is understandable for the deck crew to try and manually guide a small load into position with their hands but this is also occurring when lifting loads of several tonnes, where no amount of physical effort could control the swinging motion.

These actions by the deck crew are not just limited to pedestal crane operations, as it was also found to be a common occurrence in both the powered and manually lifting appliance categories. The identifiable root causes of the mechanical handling human factor incidents (311 of 317) are shown in Table 4.2.

Table 4.2

Root cause of mechanical handling - human factor incidents

Root cause	*98/99*	*99/00*	*00/01*	*01/02*	*02/03*	*Total*
Operator error	31	21	25	19	13	109
Positioning	31	22	13	21	7	94
Banking	7	4	5	5	4	25
Slinging	4	6	6	5	3	24
Packing	4	3	3	6	7	23
Procedures	4	3	3	7	4	21
Maintenance	3	3	1	2	6	15
TOTAL	84	62	56	65	44	311

As can be seen from Table 4.2, the poor positioning of members of the deck crew is a major factor in the number of incidents occurring each year. It is not until the final year of the study that the incidents attributed to poor positioning has reduced down to a level similar to the rest of the root causes. Whilst operator error was identified as the largest root cause of incidents within this group it is worth noting that all the incidents in categories MHE-HF1 and MHE-HF2 were classified as caused by operator error, with the 6 remaining causes split between the other 5 incident categories.

Year-on-year graphs for the root causes for pedestal crane incidents attributed to 3rd party error and all mechanical handling equipment – human factor incidents can be found in Appendix 8.

5. JOINT INDUSTRY AND HSE SAFETY INITIATIVES

Having undertaken a review of all HSE OSD lifting incidents the second element of the Scope of Work was to identify the key industry safety initiatives that have been introduced since the end of phase 1 of this study and to determine if these initiative have had an effect on the number of lifting incidents occurring in the North Sea Oil and Gas industry.

The main safety initiatives that have been introduced across the entire UKCS Oil and Gas industry are **Step Change in Safety, Lifting Operations and Lifting Equipment Regulations LOLER (L113), Provision and Use of Work Equipment Regulations PUWER (L22)**, **Technical Guidance on the Safe Use of Lifting Equipment Offshore (HSG221)**, and **Code of Practice for the Safe Use of Lifting Equipment (LEEA)**. In conjunction with these, the HSE OSD also release various safety notices relating to specific equipment or operations and the numerous operators and drilling contractors run their own safety initiatives, such as STOP and TOFS (Time Out For Safety) on their different installations.

5.1 SAFETY INITIATIVE BACKGROUND

Step Change in Safety

Step Change was launched in September 1997 to improve the safety performance, awareness and behaviours throughout the UKCS Oil and Gas industry. Step Change in Safety was set-up as a non-profit organisation with the support of several Trade Associations across the industry with the aim to unite all the various sectors (i.e. employees, service companies, operators, trade unions, regulators and representative bodies) and work together to improve safety through the sharing of information, good practices and common safety goals. This was undertaken by the creation of cross-industry task groups set-up to address priority issues.

Lifting Operations and Lifting Equipment Regulations, LOLER (L113)

The Lifting Operations and Lifting Equipment Regulations, LOLER (L113) was issued by the HSE and came into force in December 1998. The regulations are a single statutory instrument to cover all lifting or lowering operations undertaken in the workplace and are set out in conjunction with approved code of practice and guidance material. LOLER applies to all area covered by the Health and Safety at Work Act and covers all lifting operations and lifting equipment (existing and new).

Provision and Use of Work Equipment Regulations, PUWER (L22)

The Provision and Use of Work Equipment Regulations, PUWER (L22) was issued by the HSE and came in to force in December 1998, superseding the first edition '*Work Equipment. Provision and Use of Work Equipment Regulation 1992*'. Similar to LOLER, the regulations are a single statutory instrument to cover the work equipment and machinery used everyday in workplaces and are set out in conjunction with approved code of practice and guidance material. PUWER applies to all areas covered by the Health and Safety at Work Act.

Technical Guidance on the Safe Use of Lifting Equipment Offshore (HSG221)

The Technical Guidance on the Safe Use of Lifting Equipment Offshore (HSG221) document was issued by the HSE in January 2002. The guidance document sets out to provide technical information for those involved in the supply, operation and control of lifting equipment offshore and also shows how to apply the regulations in LOLER and Provision and Use of Work Equipment Regulations 1998 (PUWER) offshore.

Code of Practice for the Safe Use of Lifting Equipment (LEEA)

The Lifting Equipment Engineers Association (LEEA) code of practice for the safe use of lifting equipment document was first issued to the industry in 1981 to provide guidance on the safe use of lifting equipment. In 2003 LEEA issued a further code of practice that provides guidance on the safe use of hand chain blocks and lever hoists in offshore environments. This new code of practice was introduced in response to research by the HSE OSD following a series of incidents involving hand chain blocks and lever hoists in the offshore oil and gas industry, however its introduction was at the end of the study period and therefore will have had no effect on the incidents analysed.

Company Specific Initiatives

As well as the industry wide initiatives, each company / service provider have their own specific safety initiatives to further enhance the change in attitudes and behaviours of their employees and as a result improve their safety performance. These initiatives include but are not limited to STOP (Safety Training Observation Program), TOFS (Time Out For Safety) and pre task Toolbox Talks. There aims are to raise the awareness of their employees and contractors that every person is not only responsible for their own safety but also the safety of others, and that safety should always be the number one priority when undertaking any task. In adopting this change of thinking it is hoped that employees should no longer feel pressured into pushing ahead with a task when they have any safety fears relating to the operation.

5.2 SAFETY INITIATIVE INTRODUCTION

Combining the incident data from both phase 1 and 2 of this study, the number of incidents attributed to lifting equipment or operations were plotted on a year-by-year basis. The introduction of Step Change, LOLER and HSG221 were then superimposed onto the chart to provide an overall picture of how the incident trend has reacted since their introduction, see figure 5.1.

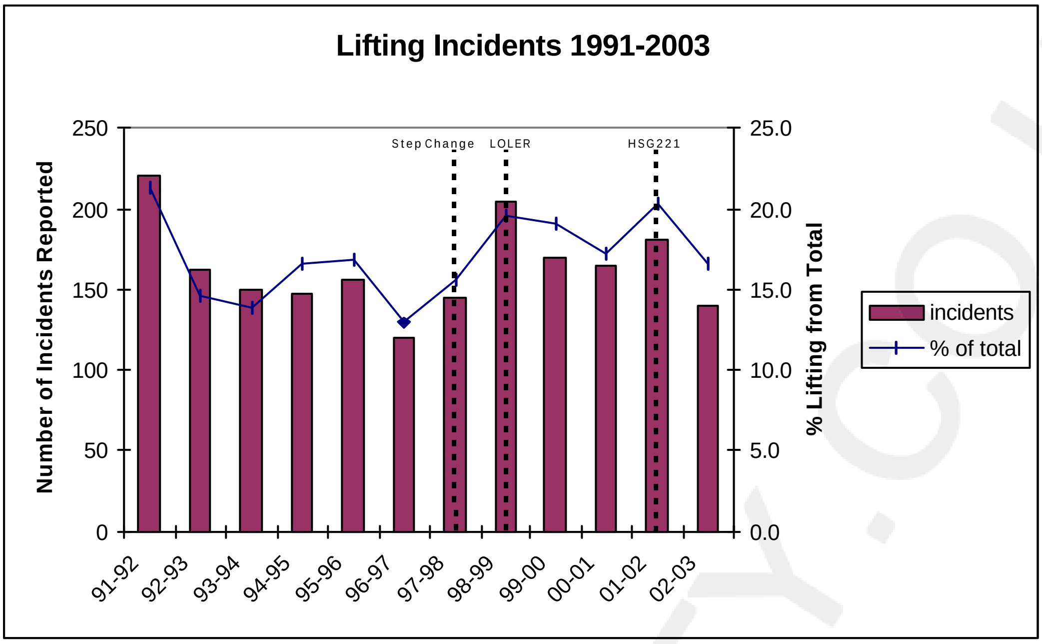

Figure 5.1
Lifting incidents reported – 1991-2003

As can be seen from Figure 5.1 above, the lifting incident trend during phase 1 was showing a steady reduction up to the final year of the of that phase, at which point the incidents have taken a sharp rise until 1999 where upon the trend has once again decreased. This rise, in the middle of the two phases of the study coincides with the introduction of Step Change in Safety, whilst this might at first seem quite alarming, it is worth taking time to remember what this safety initiative sets out to do. As well as the overall aim of improving the safety levels and as a result reducing the number of incident occurring, this initiative also encourages a change in attitude and behaviour towards safety and positively encourages the highlighting of potentially dangerous activities and the reporting of all incident and near misses even when there was no risk of personnel injury, damage to plant or equipment or harmful to the environment. Therefore even though the number of reported incidents started to rise it does not necessarily mean that the industry suddenly became more unsafe. Splitting the lifting incidents between those resulting in personal injury and those that did not produces the trends as shown in Figure 5.2.

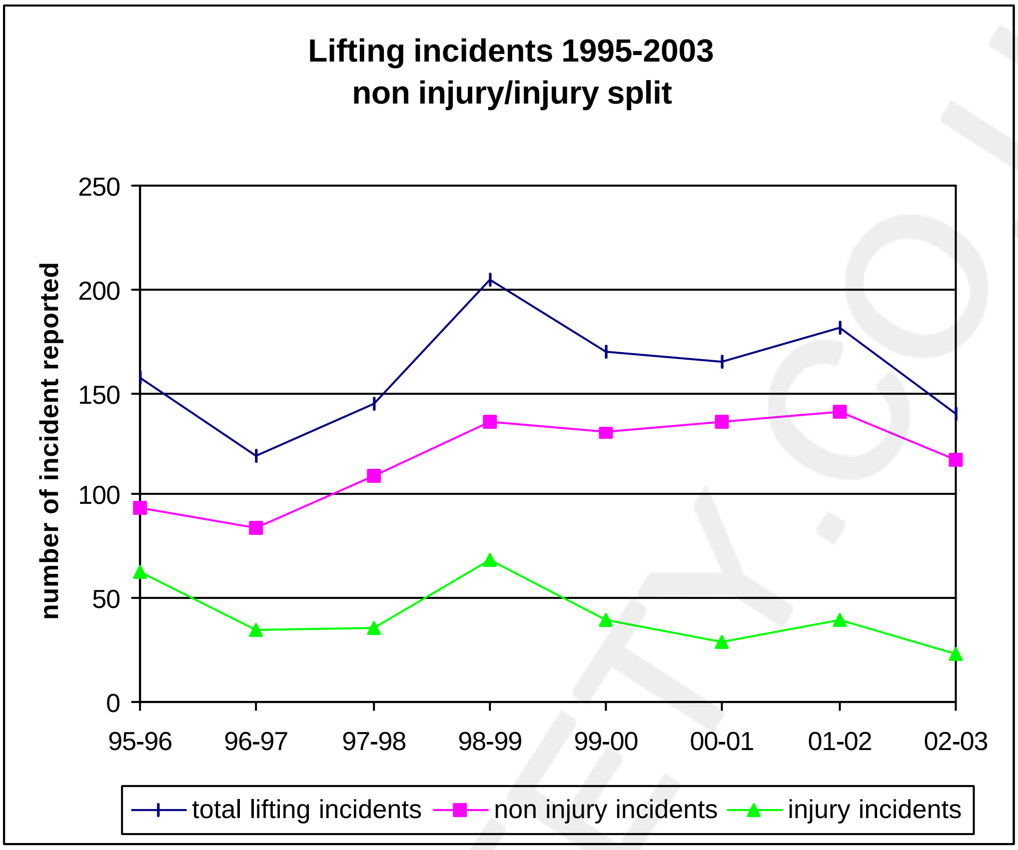

Figure 5.2

Lifting incidents reported – non injury / injury split – 1995-2003

Figure 5.2 also contains incidents from 1995 to 1997 so as to show the trends before and after the introduction of LOLER at the end of 1998. This information has been taken from the incidents reviewed by OTO 2000 024. As Figure 5.2 shows, incidents resulting in both injury and non-injury had started to rise around 1996/1997, however since LOLER has come into effect the number of incidents resulting in personal injury has started to drop and has continued to do so, apart from a slight blip in 2001 / 2002, down to a low of 23 incidents per year by the end of the study. This reduction has not been followed by non-injury incidents, as these have continued to increase up until the final year of the study where they have actually started to decrease. The start of this decline coincides with the introduction of HSG221, Technical guidance on the safe use of lifting equipment offshore.

Since the introduction of LOLER in December 1998 the number of lifting incidents occurring has started to drop again and by the end of the study they had almost returned to the low seen in 1996 / 1997.

Also with the introduction of these safety initiatives, as with any new initiative / working practice, the industry would require a bit of time to adjust to the new working practices. This can be seen in Figure 5.1 where the rising lifting incidents trend was reversed by 1999 / 2000 and has continued to do so up to the end of the study.

6. CONCLUSIONS

Having completed the analysis of the HSE OSD incident data and having reviewed the key industry safety initiatives and their effect on reducing the level of incidents occurring the following conclusions have been reached:

6.1 DATA ANALYSIS

- Of the 4,624 reported incidents provided by the HSE OSD covering the period 1st April 1998 to 31st March 2003 (phase two) for all oil and gas production and drilling operation locations on the UKCS, 861 incidents were identified as occurring during operations where lifting equipment was being used.

- The annual distribution of incidents is as shown in Figure 6.1 below:

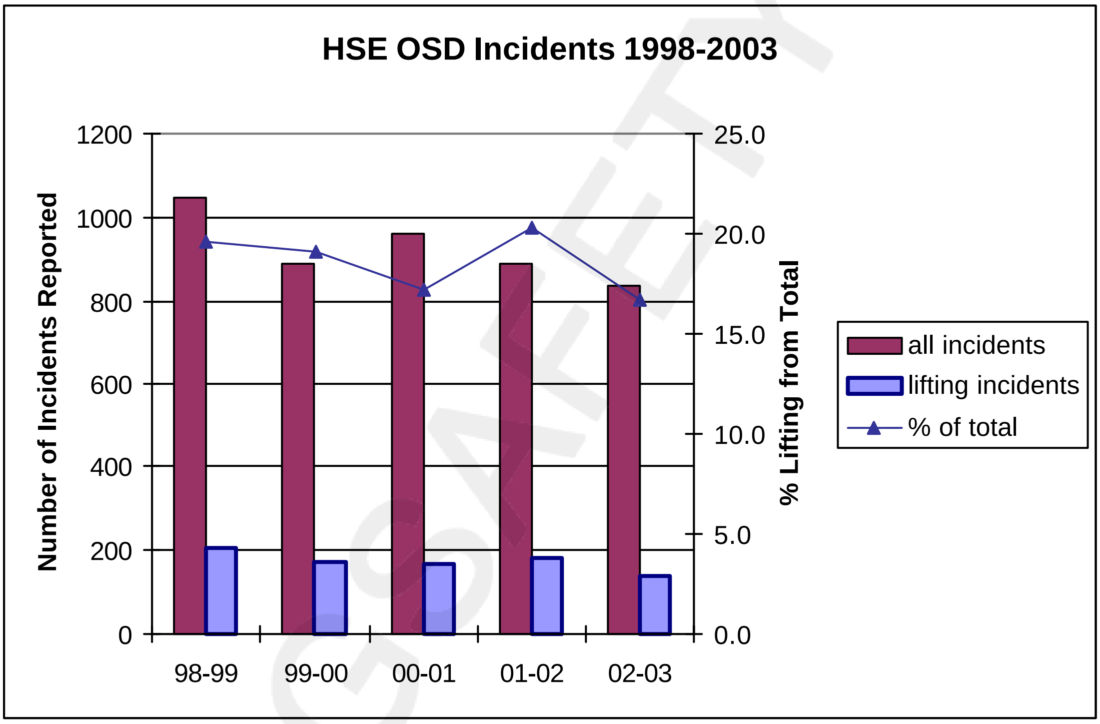

Figure 6.1
HSE OSD incidents reported – 1998 - 2003

- The proportion of incidents associated with lifting equipment rages from 16.7% to 20.3% of all lifting incidents reported and averages 18.6% over the study period.

- The average number of lifting incidents reported was 172 per year, with a maximum of 205 in 1998/99 and steadily reducing to a minimum in 2002/03 of 140, apart from a slight rise in 2001/02.

- 58.5% of lifting incidents took place during mechanical handling lifting operations.

- 41.5% of lifting incidents took place during drilling handling lifting operations.

- 59% of all lifting incidents had human factors as their root cause.
- 33.3% of all lifting incidents had equipment failure as their root cause.
- 7.7% of all lifting incidents could not be classified as having been caused by equipment failure or human factors.
- Incidents that took place during drilling handling operations show a sustained **increasing** trend over the study period, rising from 40.2% of all lifting incidents during 1998/99 to 43.1% in 2002/03.
- Incidents that took place during mechanical handling operations show a sustained **decreasing** trend over the study period, falling from 59.8% of all lifting incidents in 1998/99 to 56.9% in 2002/03.

6.2 DRILLING HANDLING EQUIPMENT

- The main drilling handling equipment areas in which incidents occurred (60% of all drilling incidents) were the use of winches (77 of 357 incidents, 21.6%), pipe handling (72 of 357, 20.2%) and the hoisting system (66 of 357, 18.5%).
- Rising trends in incident frequency were most apparent in wireline and pipe handling categories, both equipment failure and human factors. A rising trend was also apparent for incidents attributed to equipment failure of the hoisting system and the elevators.
- The largest cause of drilling handling incidents attributed to human factors was due to operator error, accounting for 49.7% of all drilling handling human factor incidents and 26.3% of all drilling handling incidents.

6.3 MECHANICAL HANDLING EQUIPMENT

- The main mechanical handling equipment category in which incidents occurred (128 of 503 incidents, 25.4%) was that attributed to being caused by the deck crew during lifting operations with pedestal cranes.
- The largest cause of mechanical handling incidents attributed to human factors was due to operator error, accounting for 34.3% of all mechanical handling human factor incidents and 21.6% of all mechanical handling incidents. However the majority of these incidents were attributed to the crane operator (69.7%).
- Excluding incidents attributed to the crane operator the largest cause of human factor incidents within the mechanical handling equipment group was due to the poor positioning of members of the deck crew (both installation and sea going vessels), accounting for 29.6% of all mechanical handling human factor incidents.
- Failure of the pedestal crane hoist function showed the most dramatic in incident frequency within the mechanical handling equipment group, however this category still only accounts for 2.6% of all lifting incidents.

6.4 PEDESTAL CRANES

- Incidents involving the use of pedestal cranes accounted for 37.4% of all lifting incidents.

- The trend for pedestal crane incidents has reduced over the study period, however as a percentage of lifting incidents the trend has actually increased, meaning that the use of pedestal cranes account for a greater proportion of lifting incidents. This shows that the decreasing trend has not been as great as the other incident categories.

- Incidents involving the use of pedestal cranes, where the crane operator was deemed to be at fault, have shown a steady decline over the study period and these account for 8.8% of all lifting incidents.

- Pedestal crane incidents where a person other than the crane operator was responsible have shown a steady decline over the study period and these account for 18.2% of all lifting incidents.

6.5 SAFETY INITIATIVES

- Since the introduction of LOLER in December 1998, lifting incidents have shown a reduction from 205 to 140 incidents per year (31.7%) by the end of the study.

7. RECOMMENDATIONS

The following recommendations can be drawn from the review of the lifting incidents occurring in the UKCS Oil and Gas industry for the period 1st April 1998 to 31st March 2003:

7.1 TRAINING AND AWARENESS

- Improve the awareness of members of both the deck and drill crew into the inertia and momentum of suspended loads, no matter how light and small they may appear. These personnel should be made aware of the likely consequences of being struck or trapped by swinging loads and urged to show forward thinking toward the position that they should occupy during a lifting operation.

- Both deck and drill crew should be advised and trained into the proper and safest way of stopping a swinging load and made aware of the consequences of trying to restrain a load.

7.2 LIFTING OPERATIONS

- A culture of risk assessment and pre task toolbox talks when undertaking lifting operations is well established in the UKCS Oil and Gas industry, however it is recommended that these pre task safety measures also make the personnel involved in the lifting operation aware of the procedures to be used and the lifting plan, as during the review it was noted that on several occasions personnel were caught unaware when the load was lifted or as it was being landed, in particular the anticipated location of where that the load was to be placed.

- It is recommended that communication between all parties involved in undertaking a lifting operation be improved as there was evidence of members of the lifting team being unaware of another's actions or position and as a result one or more of the personnel sustained an injury. This should also include the level of communication possible between the pedestal crane operator and both the deck crew of the installation and any supply vessels. This could be improved by the introduction of a direct radio link between the crane operator and the individual controlling the lift on the deck or the vessel. Also fitting the crane with a warning horn and / or a PA system would allow the crane operator to attract the attention of personnel on the deck.

- The introduction of tighter control measures and improved training of personnel involved in man riding operations within the drilling package. This should particularly cover the responsibility of the winch operator as they are directly responsible for the safety of the personnel in the riding belt. Communication between the two parties needs to be improved so that the winch operator is working at the command of the person in the riding belt and not at their own discretion.

7.3 REPORTING OF INCIDENTS

- There should be better reporting of lifting incidents at time of occurrence. It is recommended that this includes greater details of the incident, including a brief summary of operation, personnel involved and the result of the incident. These details would greatly help any further investigation into a specific incident and as a result identify the required actions to prevent a reoccurrence.

7.4 FURTHER INVESTIGATION

- During the study there has been a significant rise in the number of wireline equipment failure incidents particularly attributed to the parting of the wire. The information available was not sufficient to determine the root cause of these failures and due to the fact that this has now become the most common drilling handling equipment failure incident category it is recommended that further investigation in to future incidents is undertaken.

- Investigation in the increasing trend of pipe handling incidents attributed to human factors given the increase mechanisation of this operation due to the introduction of mechanical pipe racking systems.

8. RECOMMENDED FUTURE WORK

The following recommended future work topics have been identified from the review of the lifting incidents occurring in the UKCS Oil and Gas industry for the period 1st April 1998 to 31st March 2003:

- Conduct a review of the current training programmes associated with lifting operations, including those conducted on the drill floor, in the UKCS, including both specialist training organisations and company specific training schemes. The review should highlight any improvements that could be made to either existing training programmes or areas where new material could be introduced. The review should also examine the level of continuous training offered throughout an individual's development.

- Investigate the existing control measures and procedures being used during lifting operations on offshore installations. This investigation should particularly examine the lifting operations involving either a blind lift or man riding operations as these are two areas that have been identified as containing a high proportion of incidents.

- Amend the HSE OIR 9 incident reporting form so that a greater level of detail can be contained on each form. In particular the OIR 9 form should include a section to note the details of the lifting equipment being used, for example:
    - type of equipment
    - manufacturer
    - serial number of equipment
    - date of last inspection / test

  These details would allow further investigation into specific categories of incidents, particularly those resulting from equipment failure. It would also provide scope to identify any trends that may develop regarding a specific type or a manufactured batch of equipment.

- Carry out an assessment on the introduction of crane simulator training, assessing the impact, if any on the incident trends. The assessment should also review the content and frequency of the training provided, and highlight any improvements that could be made to enhance the skills of the crane operators.

REFERENCES

1. *Safe use lifting equipment 'Lifting Operations and Lifting Equipment Regulations 1998' (LOLER) Approved Code of Practice and Guidance* L113 HSE Books 1998

2. *Safe use of work equipment 'Provision and Use of Work Equipment Regulation 1998 (PUWER) Approved Code of Practice and Guidance* L22 HSE Books 1998

3. *Technical guidance on the safe use of lifting equipment offshore* HSG221 HSE Books 2002

4. *Code of practice for the safe use of lifting equipment*, 1981 Lifting Equipment Engineers Association (LEEA)

5. *Code of practice for the safe use of hand chain blocks and lever hoists in offshore environments*, 2003 Lifting Equipment Engineers Association (LEEA)

6. *Lifting equipment project – phase 1* 2000 HSE OTO 2000 024

7. *'Heath & Safety Executive*, web site – 'http://www.hse.gov.uk'

8. *'A Step Change in Safety'* web site – 'http://step.steel-sci.org'

9. *'International Association of Drilling Contractors (IADC)'* web site – 'http://www.iadc.org

APPENDICES

APPENDIX 1 HSE OSD DATA FORMAT

Notification Id	Incident Id	Date Of Incident	Incident Title	Number Of Accidents	Number Of Dos	Summary (Incident) Note Text	Broad Incident Type Text	Incident Operation Text
8725	8444	01-Apr-98	LIFTING LINE OF ROV PARTED WHILST RECOVERING ROV	0	1	ROV WAS BEING RECOVERED FROM THE WATER. WEATHER CONDITIONS WERE GOOD. A WIRE LINE WAS RUN DOWN TO THE ROV FROM THE RECOVERY CRANE AND LATCHED ON. THE ROV WAS HOISTED FROM THE WATER AND LIFTED ABOVE THE HAND RAIL. AS IT WAS SWUNG INBOARD THE RECOVERY WIRE PARTED. THE ROV LANDED ON THE HAND RAIL AND TOPPLED INBOARD AND LANDED ON ITS SIDE. NO ONE WAS ANYWHERE NEAR THE ROV AT THE TIME. HOWEVER AT TIMES A CREW MEMBER IS REQUIRED TO GUIDE THE ROV TO ITS LANDING POINT USING A BOAT HOOK. ACTIONS TAKEN/PLANNED TO PREVENT RECURRENCE OF INCIDENT	LIFTING/CRANE OPERATIONS	other
8691	8410	03-Apr-98	END DOOR FELL OFF OPEN BASKET DURING LIFTING OPS	0	1	DISCHARGING LAST LIFT OF DECK CARGO - AN OPEN BASKET CONTAINING DRILLING EQUIPMENT - THE CRANE LIFTED THE BASKET AND SWUNG IT AGAINST THE CARGO BARRIER TO CHECK THE SWING. THIS ACTION CAUSED THE (UNSECURED) CONTENTS TO HAVE A BATTERING RAM EFFECT ON THE END OF THE BASKET CAUSING THE HINGES OF THE END DOOR TO GIVE WAY AND THE END TO FALL OFF DECK CREW WERE WELL CLEAR & NO CARGO FELL OUT OF THE BASKET. ACTIONS TAKEN/PLANNED TO PREVENT RECURRENCE OF INCIDENT	FALLING OBJECT	deck operations
8715	8434	05-Apr-98	IP RECEIVED CRUSH INJURY TO FINGER	1	0	OPERAATOR RECEIVED CRUSH INJURY TO FINGER WHEN FINGER WAS CAUGHT BETWEEN WIRELINE TRACTOR TOOL WAS BEING WINCHED ONTO DRILLFLOOR. ACTIONS TAKEN/PLANNED TO PREVENT RECURRENCE OF INCIDENT	HANDLING GOODS/MATERIALS	drilling/workover
8688	8407	06-Apr-98	IP TRAPPED RIGHT HAND BETWEEN ELEVATORS AND PUP JO	1	0	WHILST PICKING UP THE DRILL COLLAR THE I.P. PUT JOINT ABOVE IT IN ORDED TO LATCH THE ELEVATORS. HE PULLED BACK THE DRILL COLLAR AND THE LINK-TILT WAS FUCTIONED THE ELEVATORS CAME INTO CONTACT WITH HIS RIGHT HAND, TRAPPING IT BETWEEN THE ELEVATORS AND THE PUP JOINT. ACTIONS TAKEN/PLANNED TO PREVENT RECURRENCE OF INCIDENT	LIFTING/CRANE OPERATIONS	drilling/workover
8706	8425	08-Apr-98	IP WAS LANDING HEAVY WEIGHT BUNDLES WHEN ONE LOWER	1	0	IP WAS LANDING HEAVY WEIGHT DRILL PIPES BUNDLES ON THE PIPE DECK IN FAIR WEATHER. IP WAS STANDING ON ONE BUNDLE WHEN THE SECOND BUNDLE WAS LOWERED BY CRANE INTO POSITION. THE BUNDLE WAS LOWERED TRAPPING HIS RIGHT FOOT. THE LOAD WAS REMOVED AND IP TAKEN TO THE MEDIC. ACTIONS TAKEN/PLANNED TO PREVENT RECURRENCE OF INCIDENT	LIFTING/CRANE OPERATIONS	deck operations

APPENDIX 2 HIGH LEVEL DATA ANALYSIS – DETAIL CHARTS

The following charts are in support of Section 3.1 High Level Analysis.

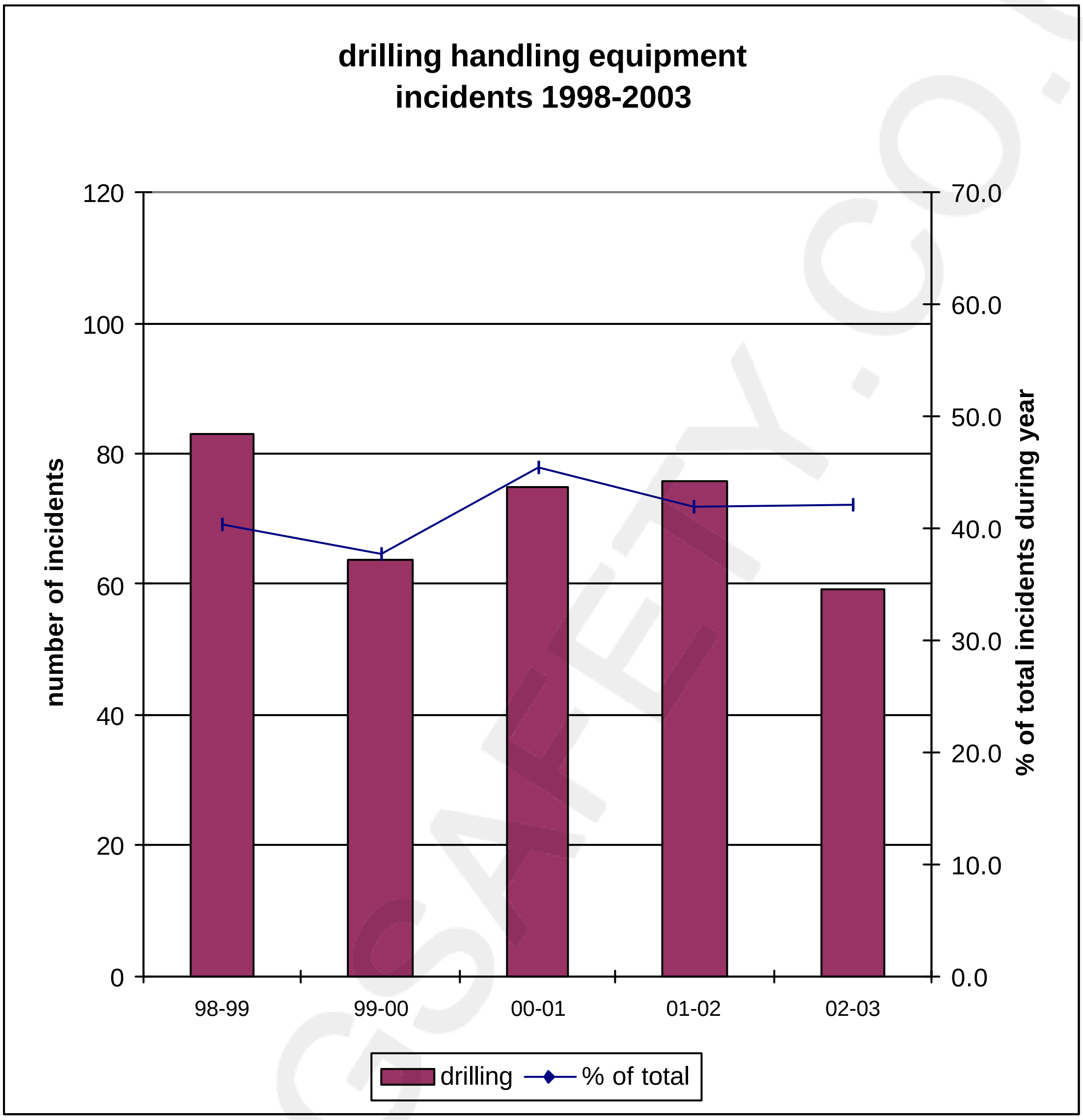

Figure A2.1
Lifting incidents reported – drilling handling equipment – 1998 to 2003

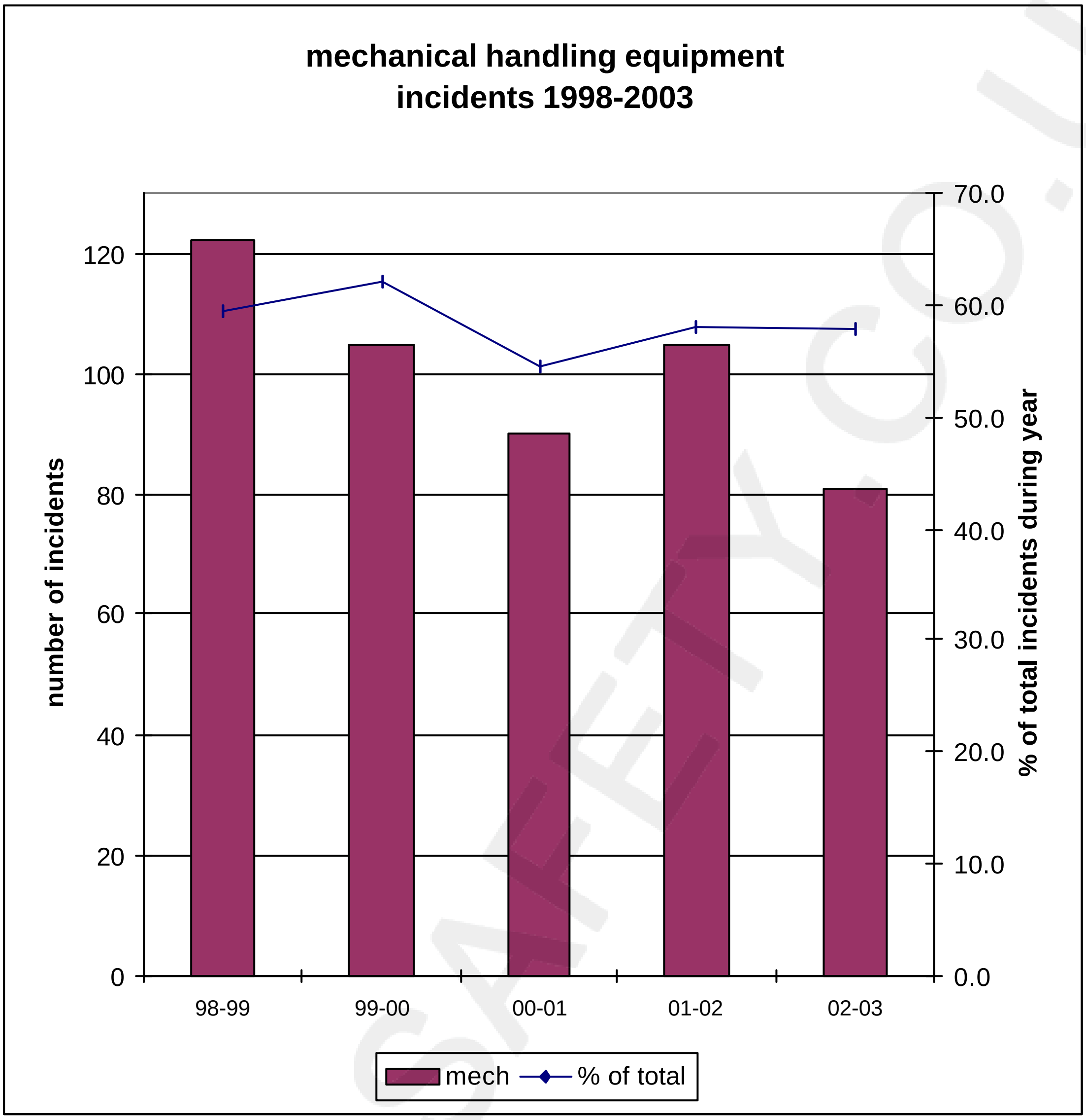

Figure A2.2
Lifting incidents reported – mechanical handling equipment – 1998 to 2003

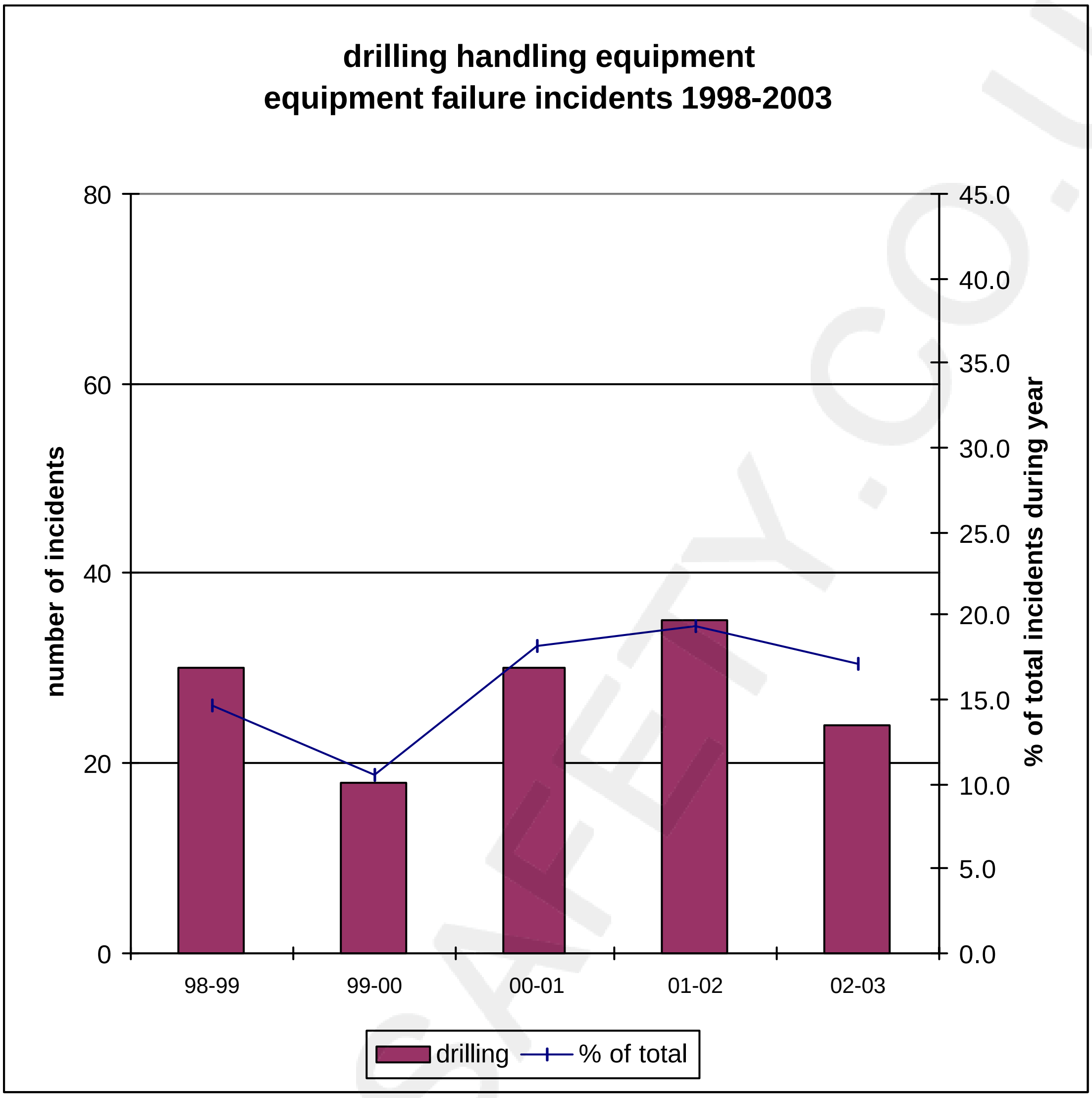

Figure A2.3
Drilling handling incidents –equipment failure – 1998 to 2003

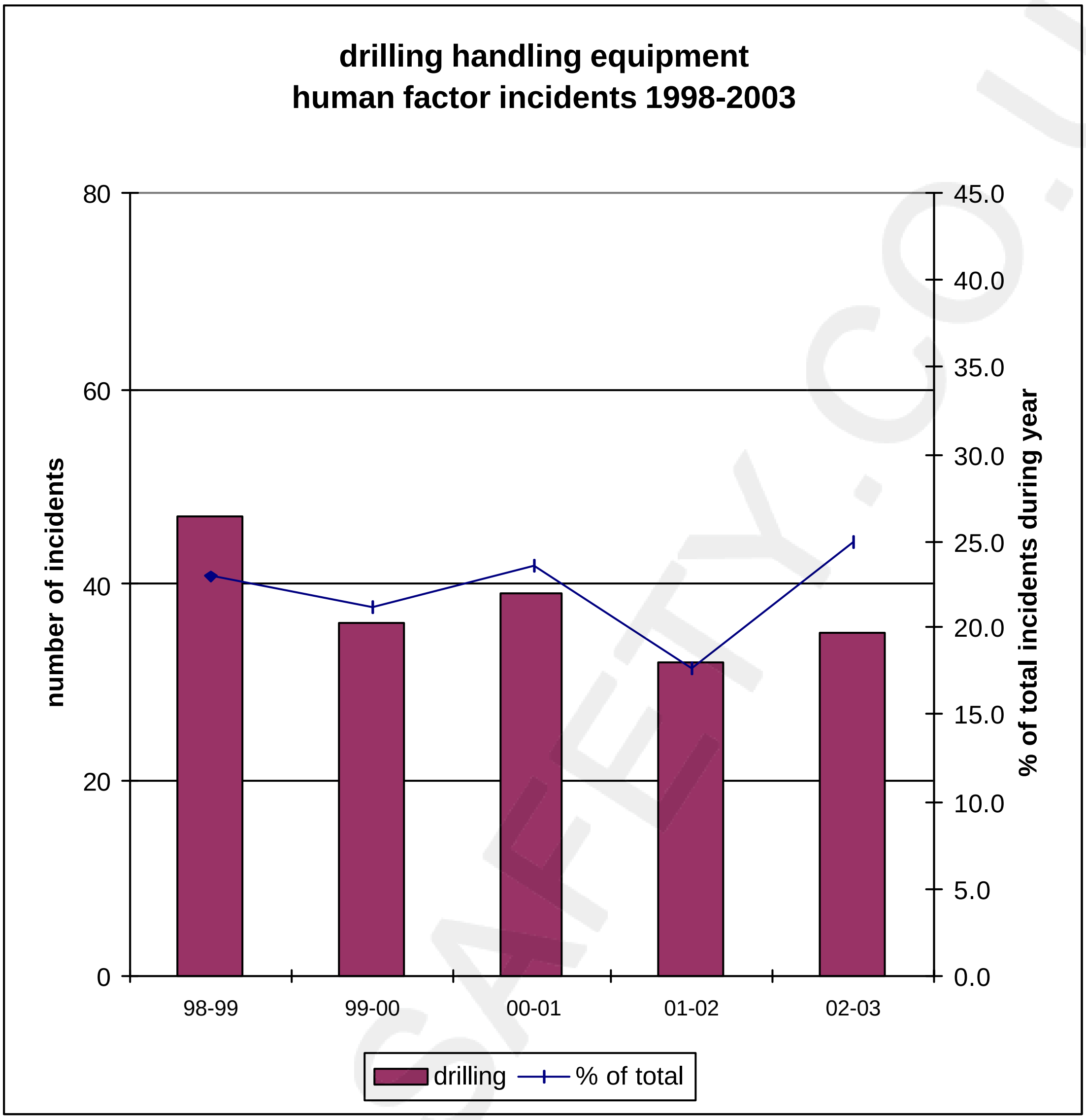

Figure A2.4
Drilling handling incidents –human factors – 1998 to 2003

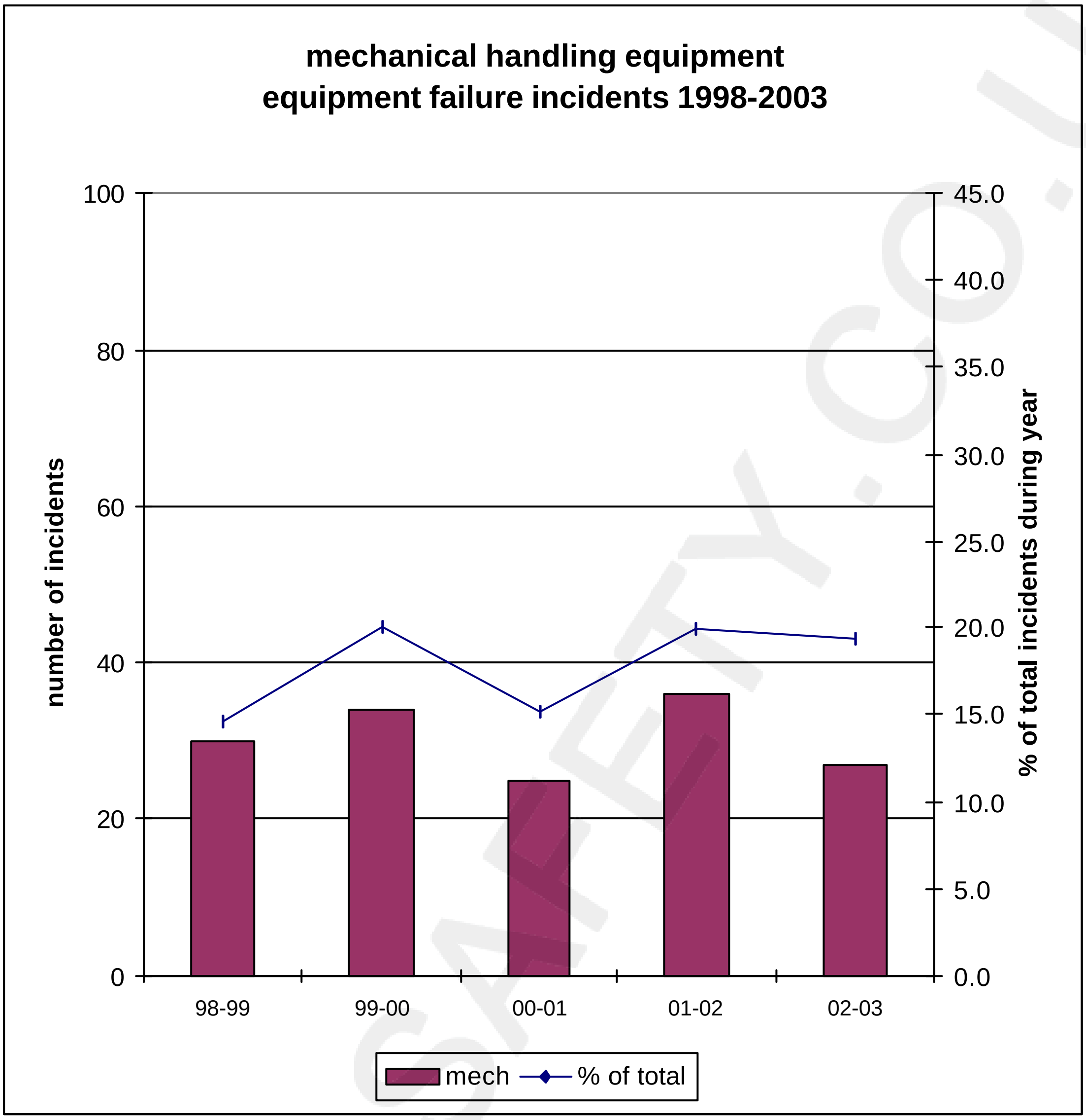

Figure A2.5
Mechanical handling incidents –equipment failure – 1998 to 2003

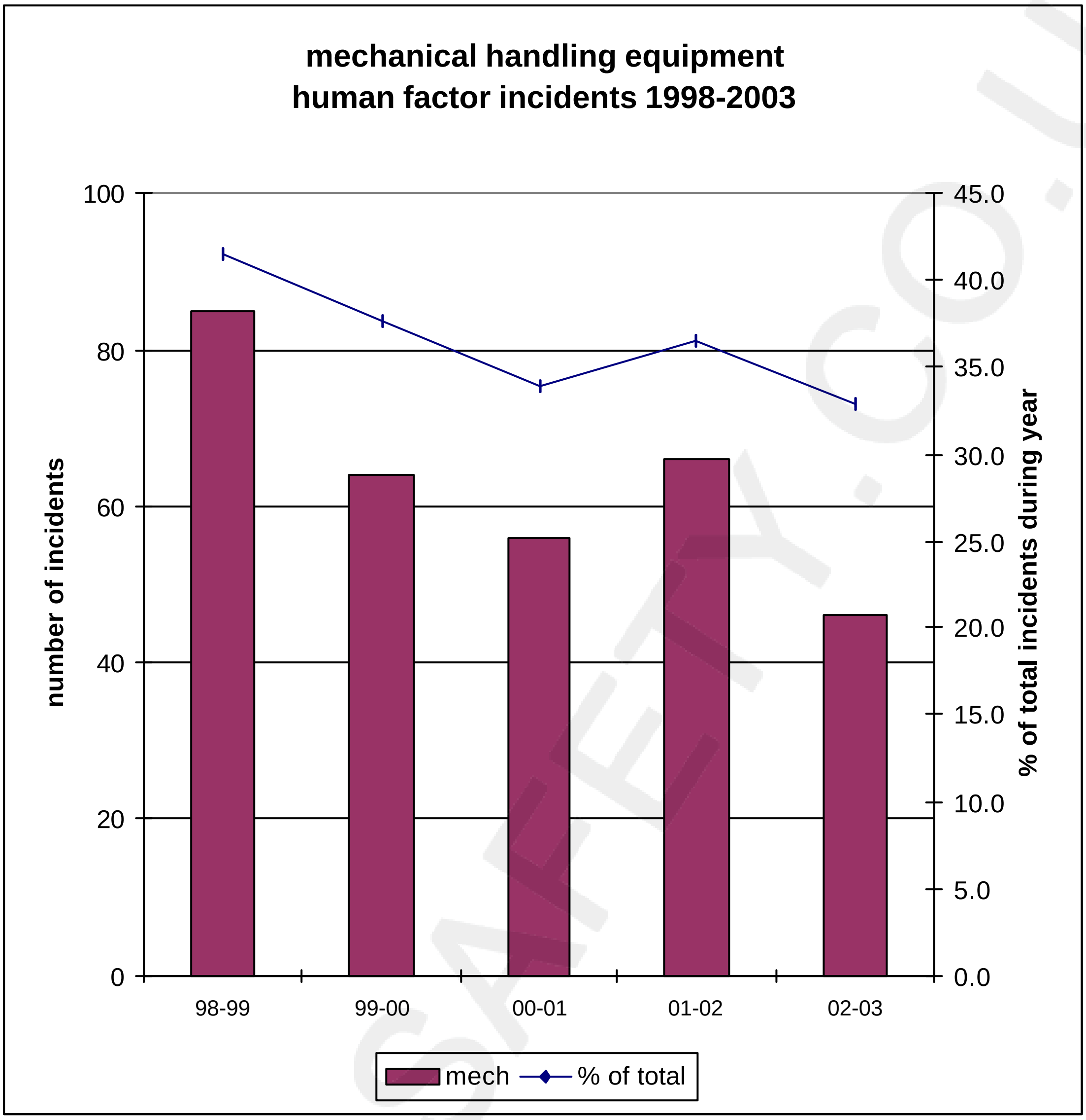

Figure A2.6
Mechanical handling incidents –human factors – 1998 to 2003

APPENDIX 3 DETAILED ANALYSIS – DRILLING EQUIPMENT FAILURES

The following charts are in support of Section 3.2 Detailed Analysis of Data – Drilling Equipment.

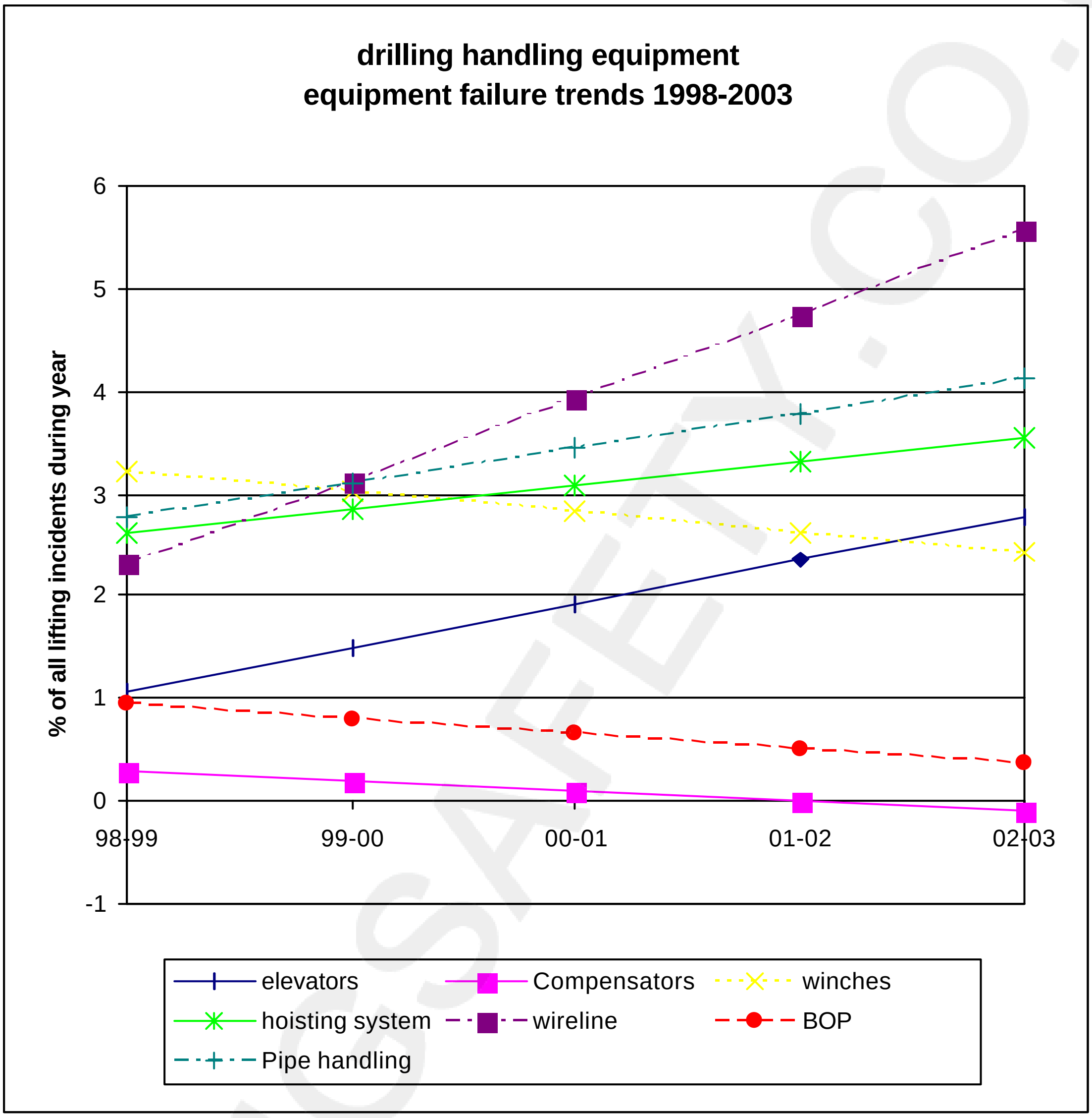

Figure A3.1
Drilling handling equipment – equipment failure trends – 1998 to 2003

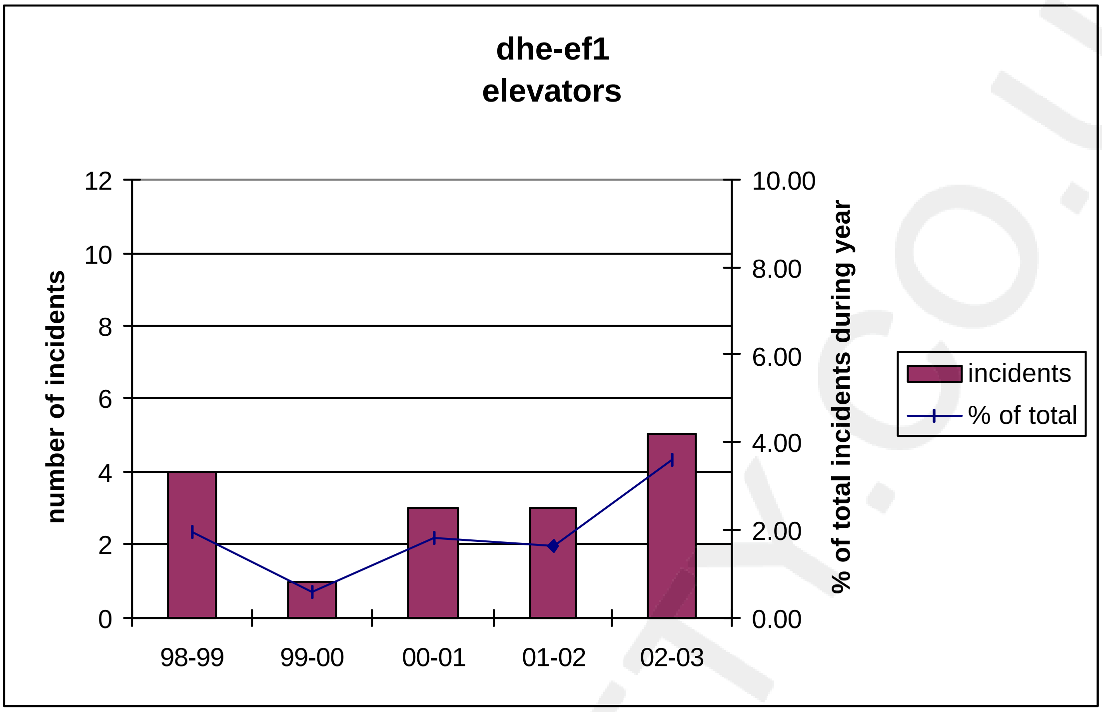

Figure A3.2
DHE-EF1 Elevator equipment failure incidents – 1998 to 2003

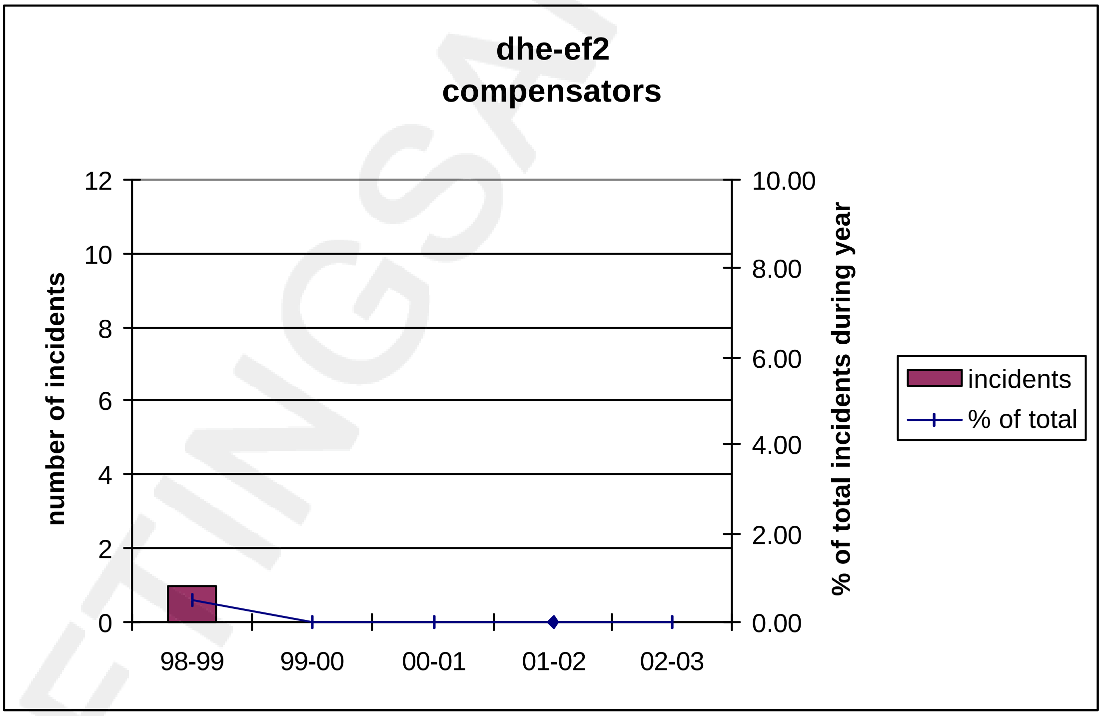

Figure A3.3
DHE-EF2 Compensator equipment failure incidents – 1998 to 2003

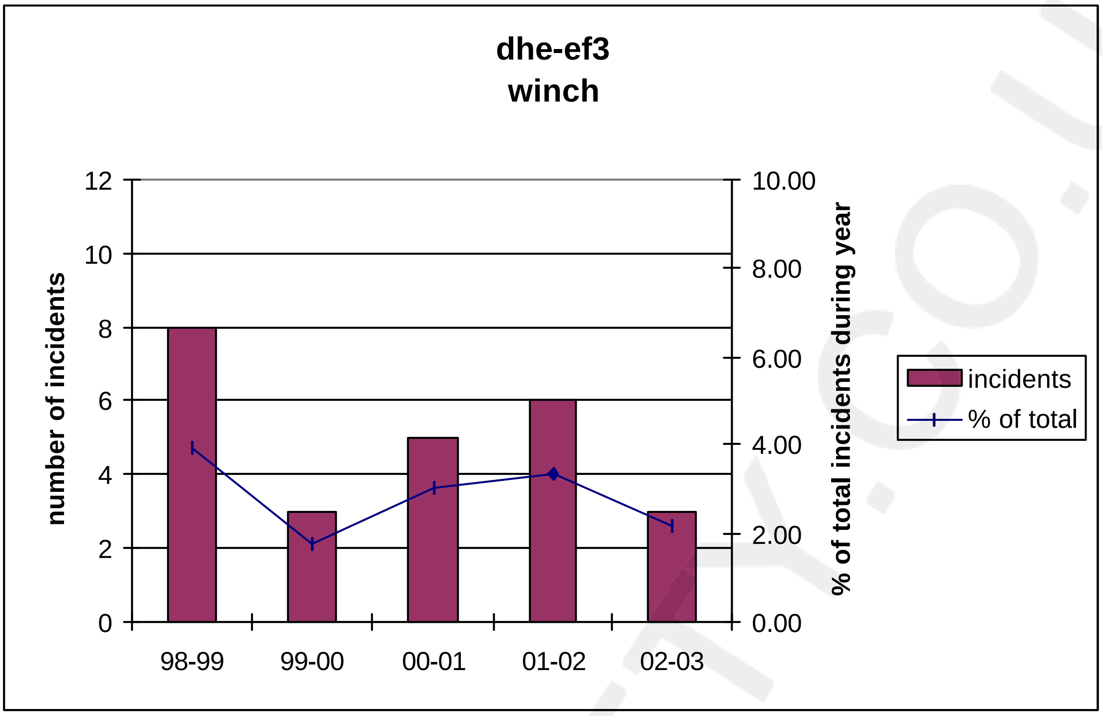

Figure A3.4
DHE-EF3 Winch equipment failure incidents – 1998 to 2003

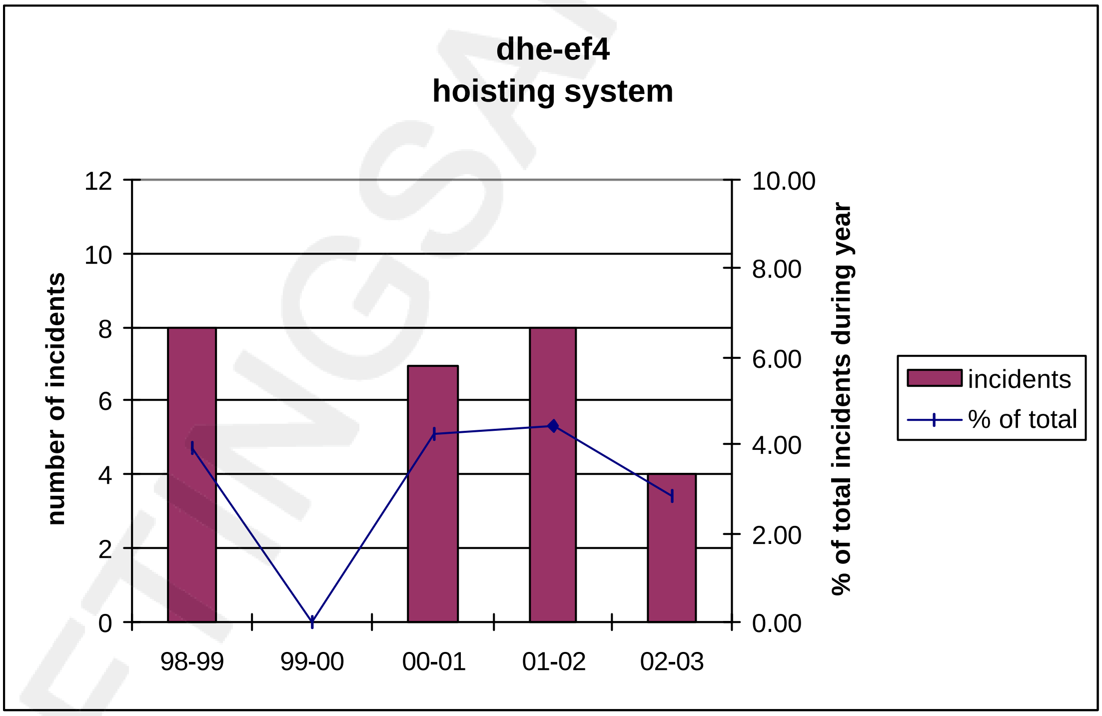

Figure A3.5
DHE-EF4 Hoisting system equipment failure incidents – 1998 to 2003

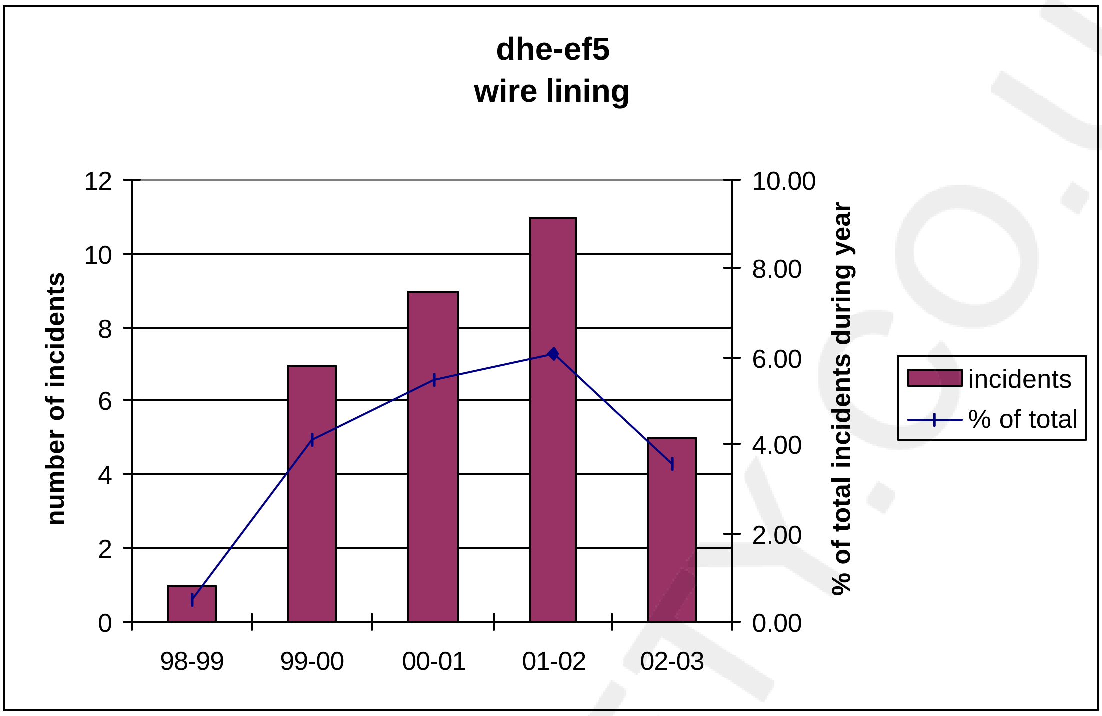

Figure A3.6
DHE-EF5 Wire lining equipment failure incidents – 1998 to 2003

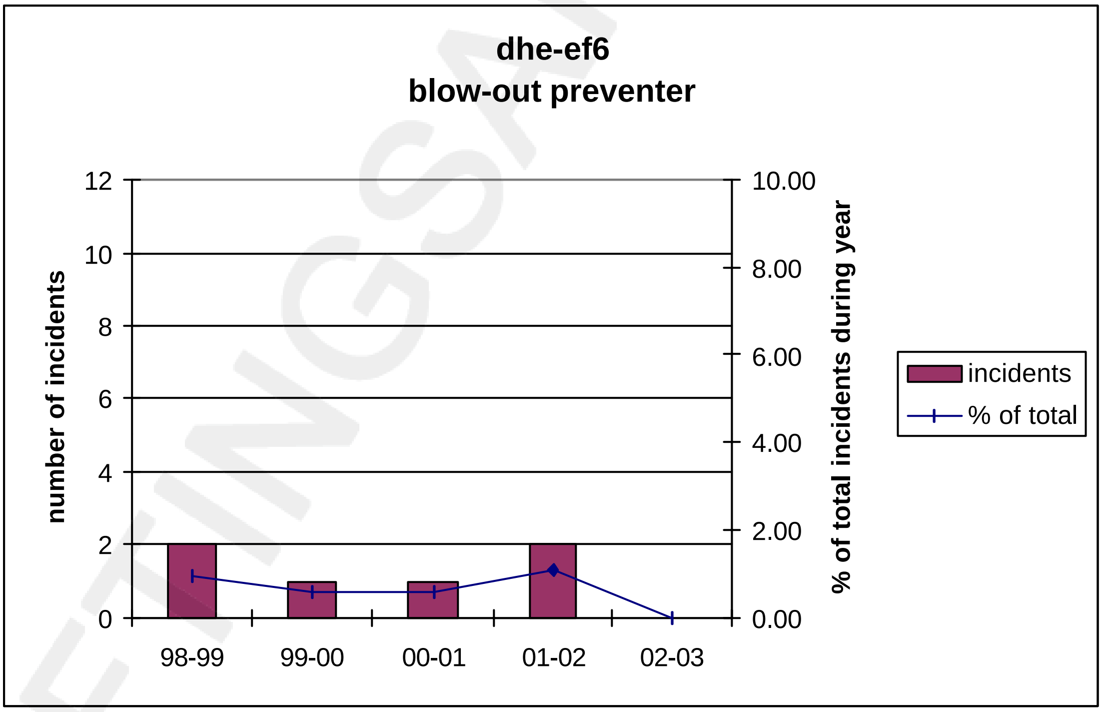

Figure A3.7
DHE-EF6 Blow-out preventer handling equipment failure incidents – 1998 to 2003

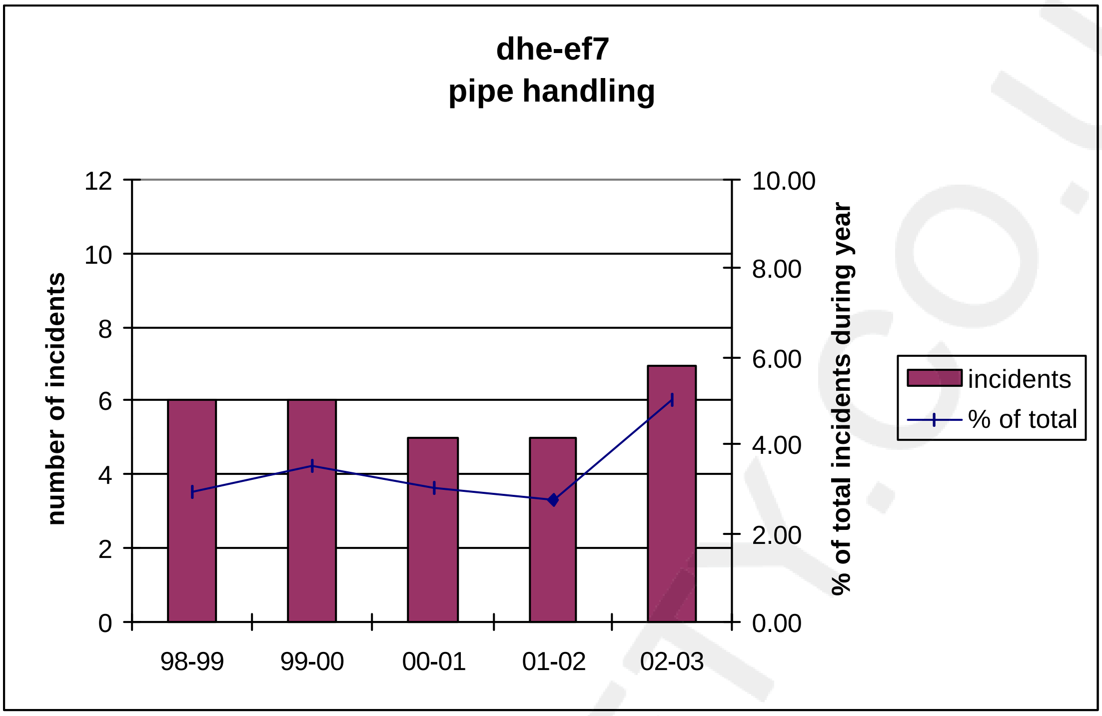

Figure A3.8
DHE-EF7 Pipe handling equipment failure incidents – 1998 to 2003

APPENDIX 4 DETAILED ANALYSIS – DRILLING HUMAN FACTORS

The following charts are in support of Section 3.2 Detailed Analysis of Data – Drilling Equipment.

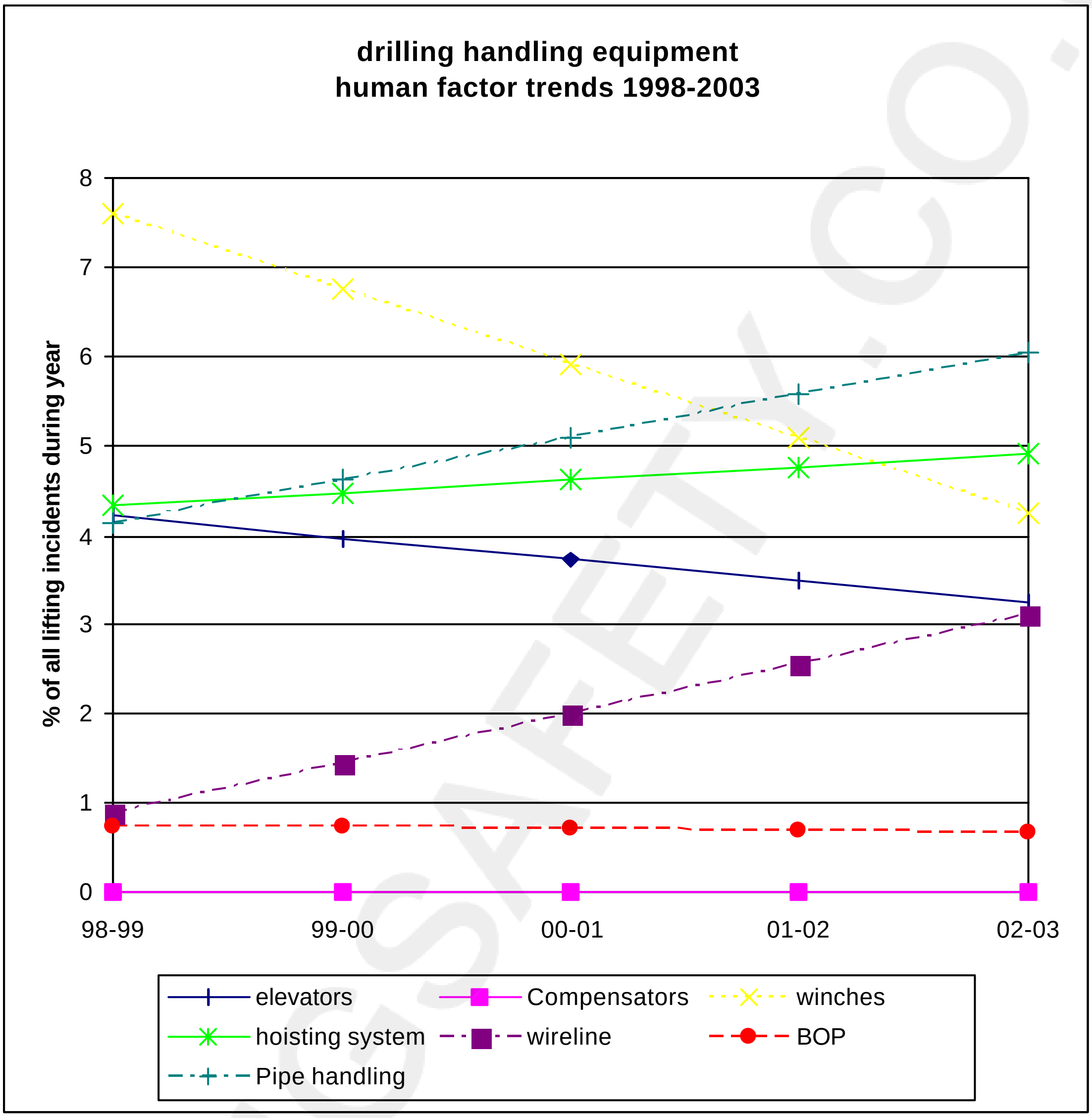

Figure A4.1
Drilling handling equipment – human factor trends – 1998 to 2003

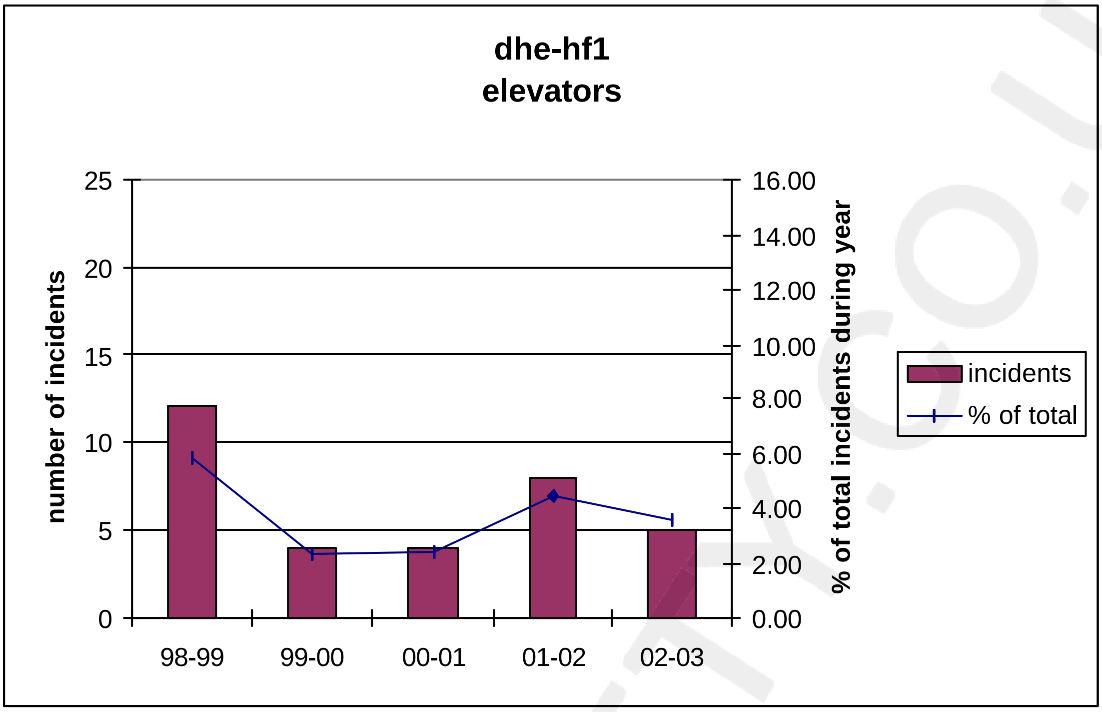

Figure A4.2
DHE-HF1 Elevator incidents – 1998 to 2003

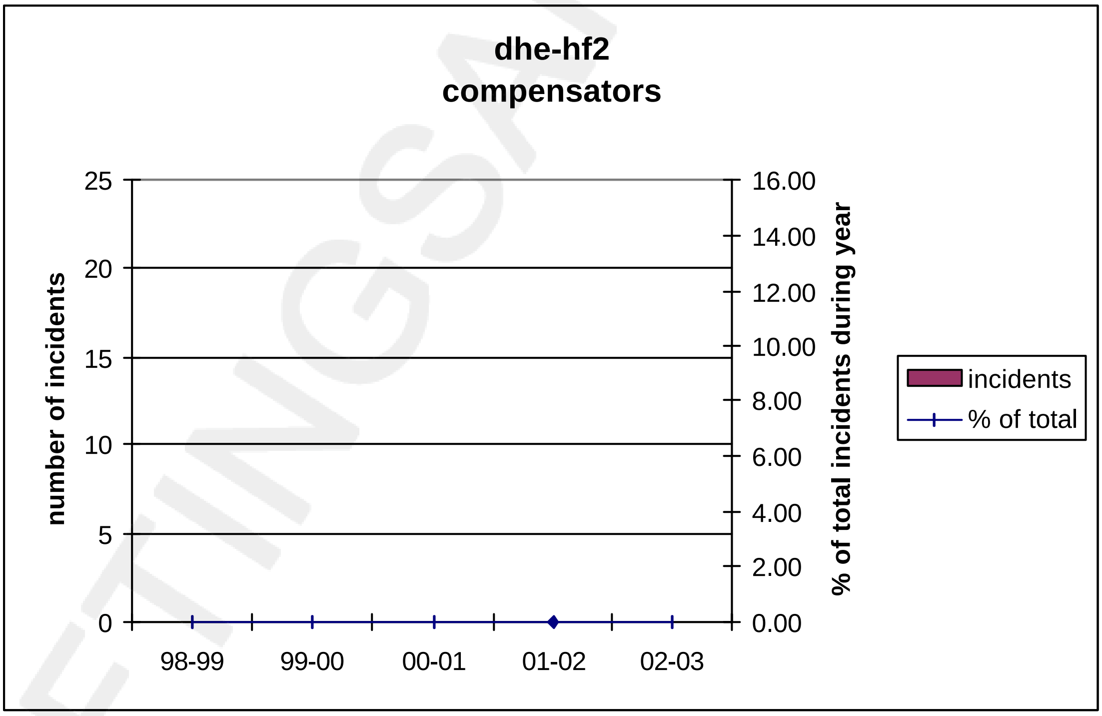

Figure A4.3
DHE-HF2 Compensator incidents – 1998 to 2003

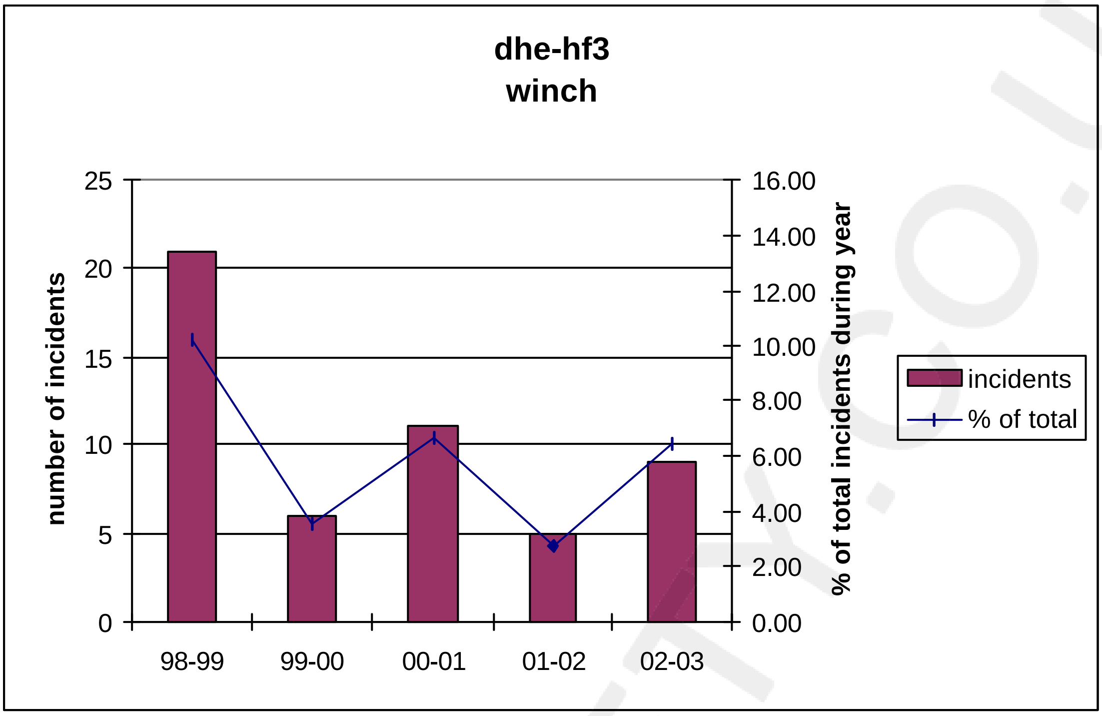

Figure A4.4
DHE-HF3 Winch incidents – 1998 to 2003

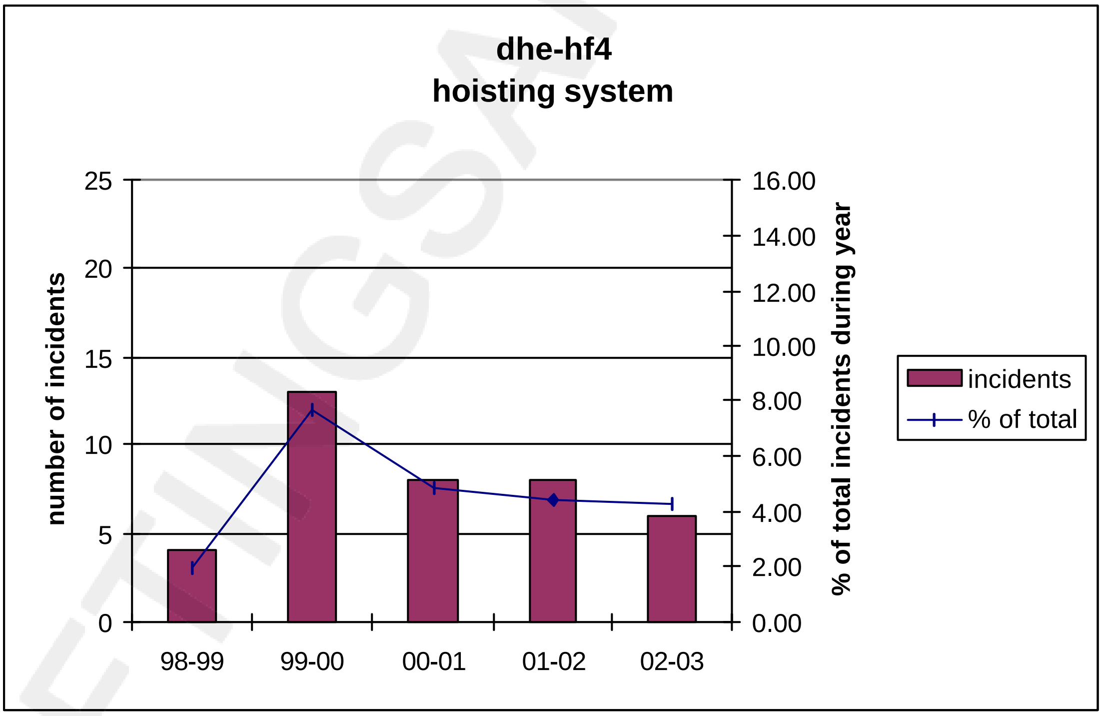

Figure A4.5
DHE-HF4 Hoisting system incidents – 1998 to 2003

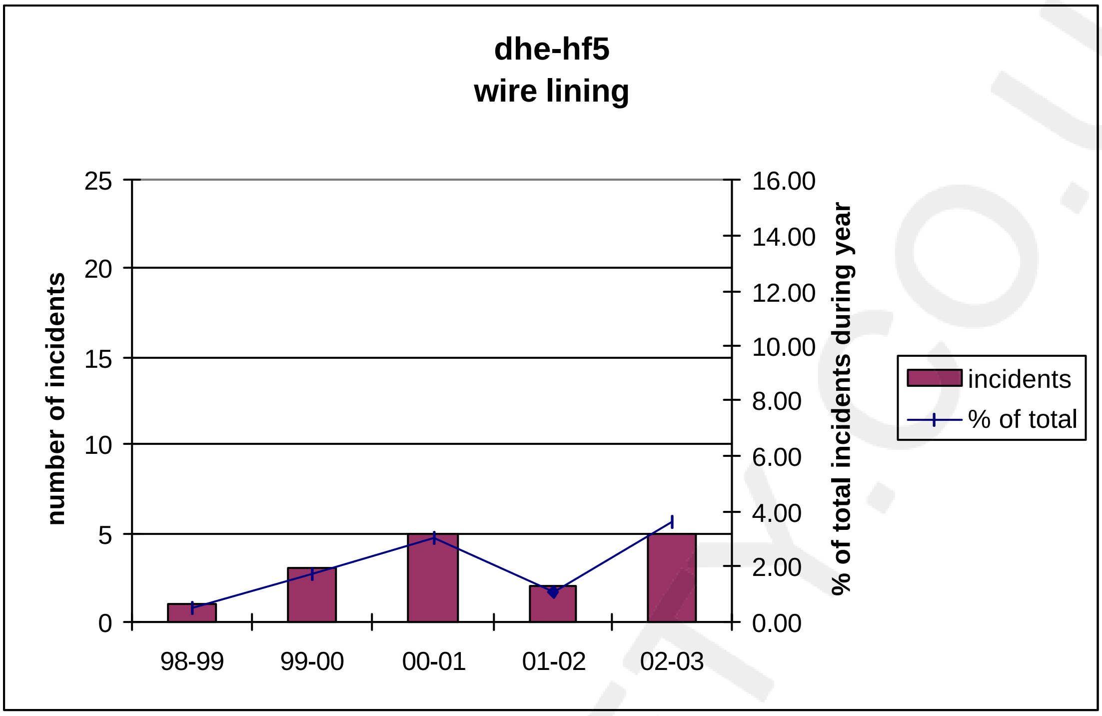

Figure A4.6
DHE-HF5 Wire lining incidents – 1998 to 2003

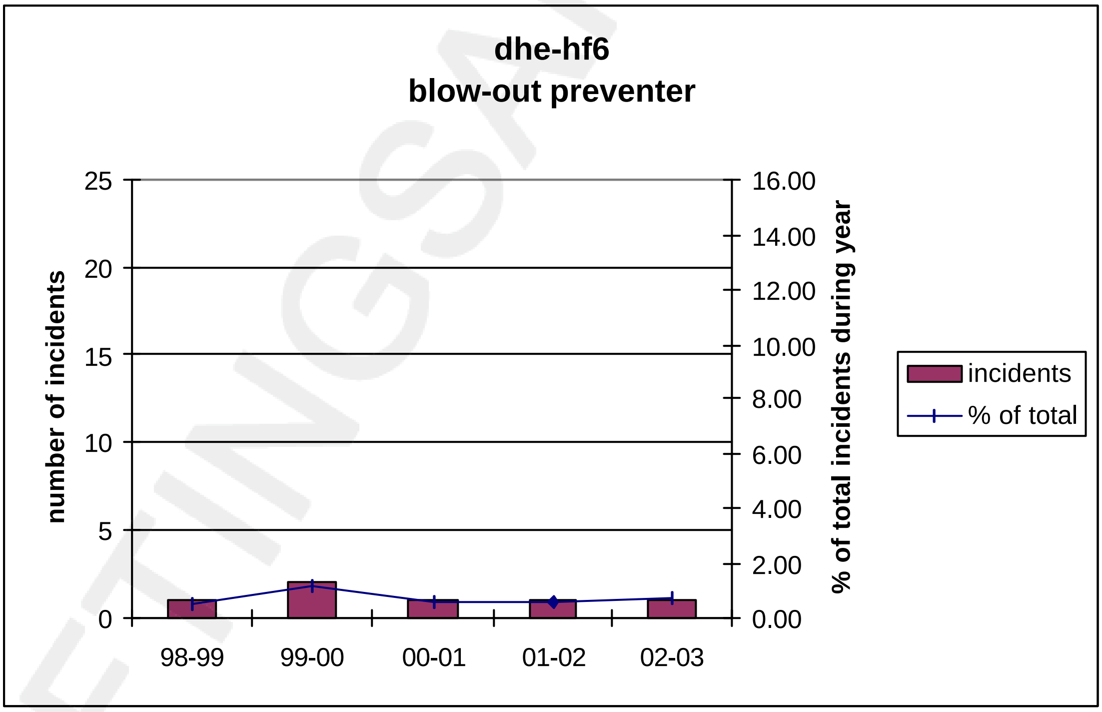

Figure A4.7
DHE-HF6 Blow-out preventer handling equipment incidents – 1998 to 2003

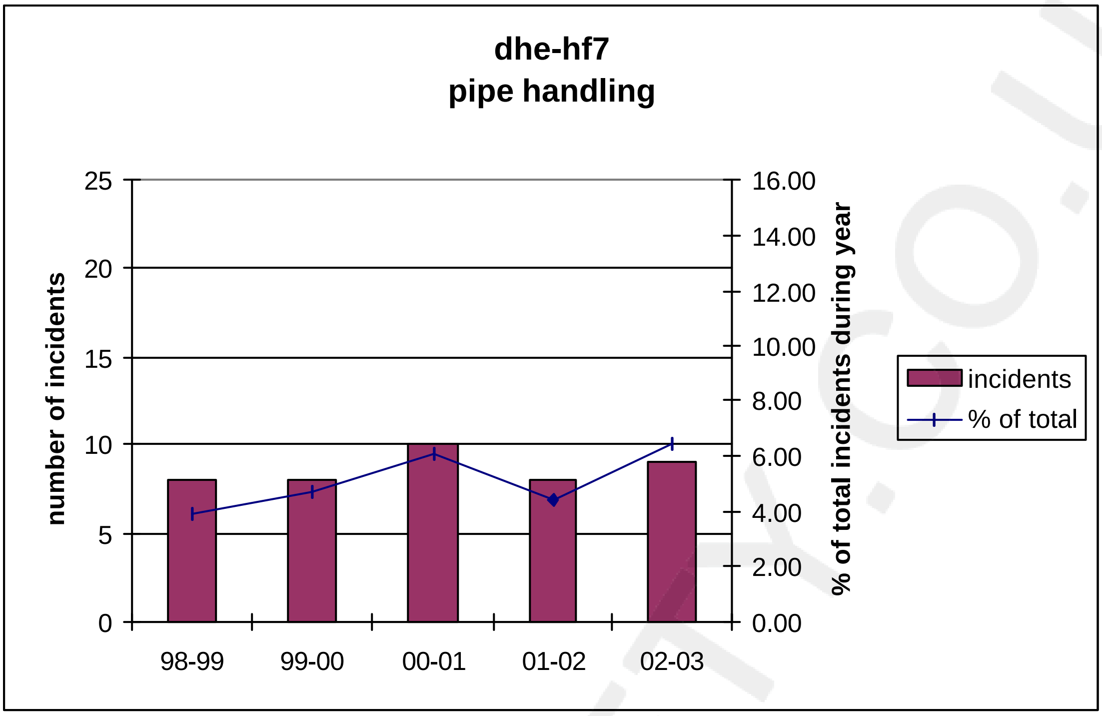

Figure A4.8
DHE-HF7 Pipe handling incidents – 1998 to 2003

APPENDIX 5 DETAILED ANALYSIS – MECHANICAL EQUIPMENT FAILURES

The following charts are in support of Section 3.3 Detailed Analysis of Data – Mechanical Handling Equipment.

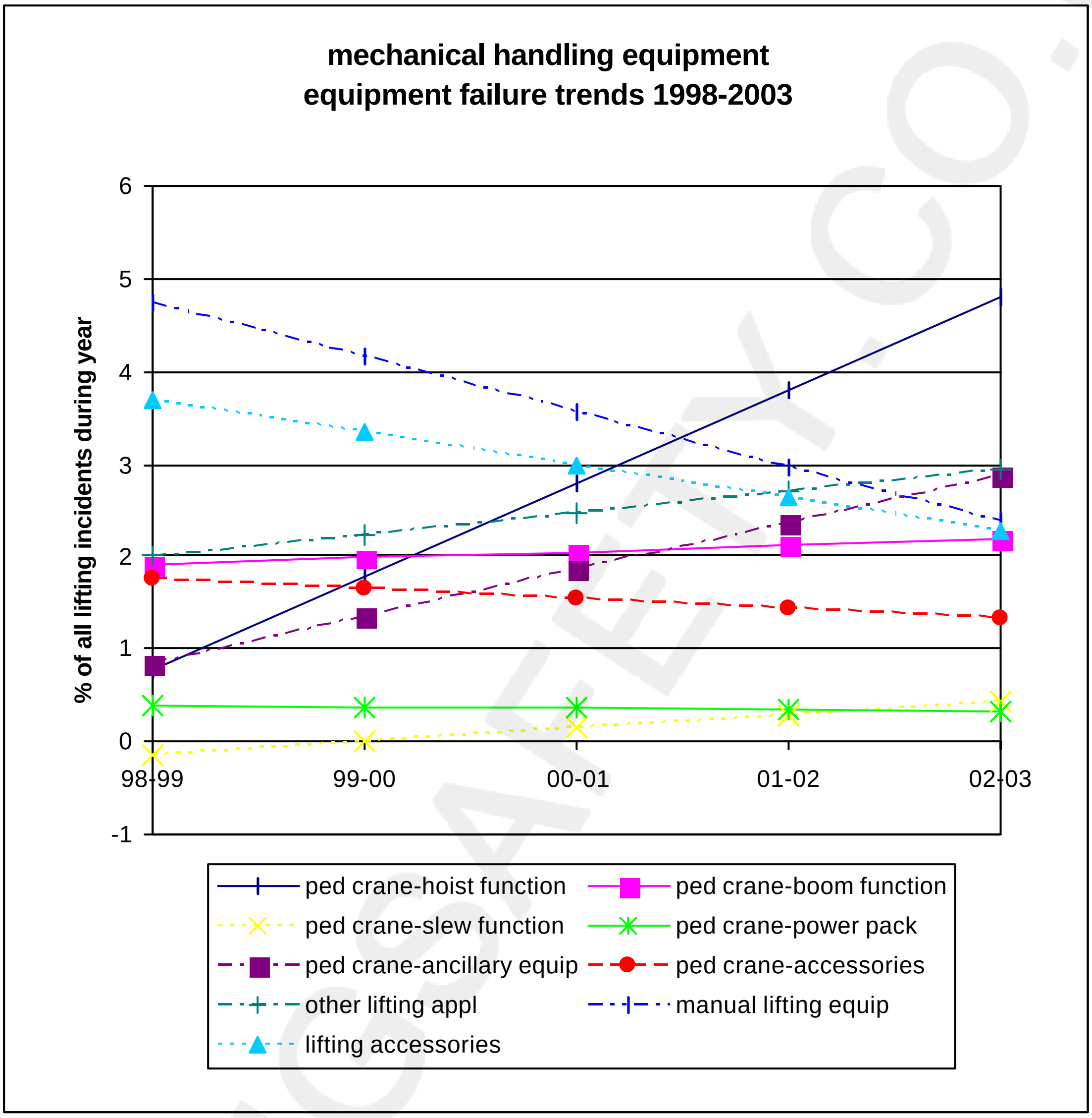

Figure A5.1
Mechanical handling equipment – equipment failure trends – 1998 to 2003

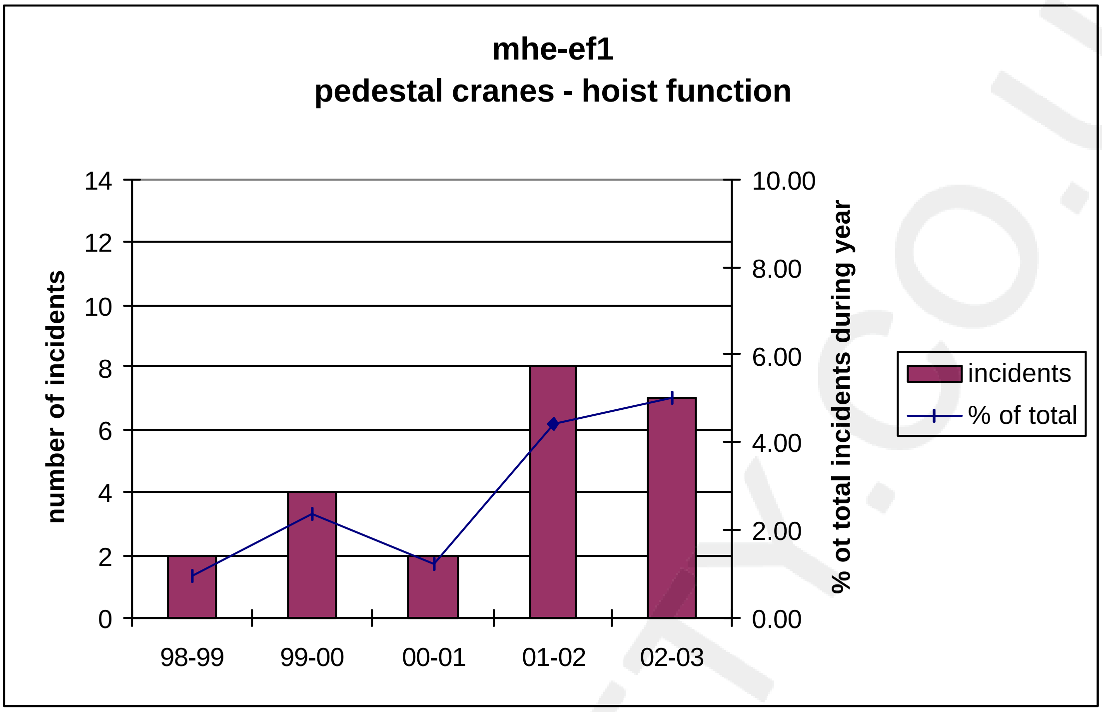

Figure A5.2
MHE-EF1 Pedestal cranes – hoist function incidents – 1998 to 2003

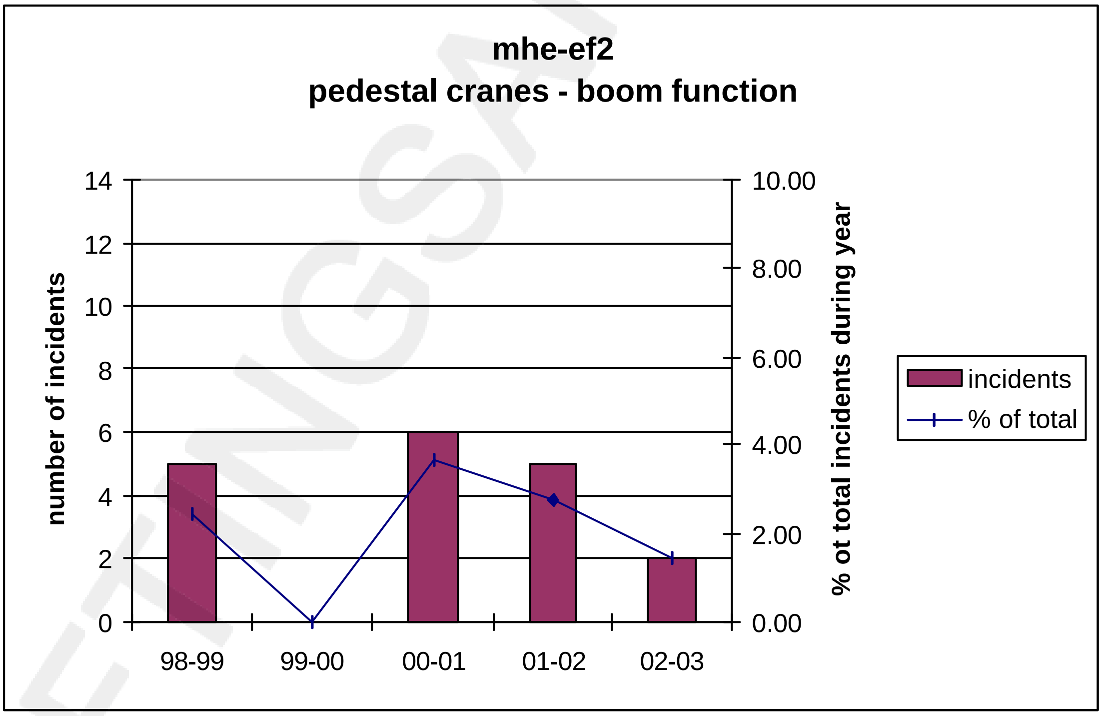

Figure A5.3
MHE-EF2 Pedestal cranes – boom function incidents – 1998 to 2003

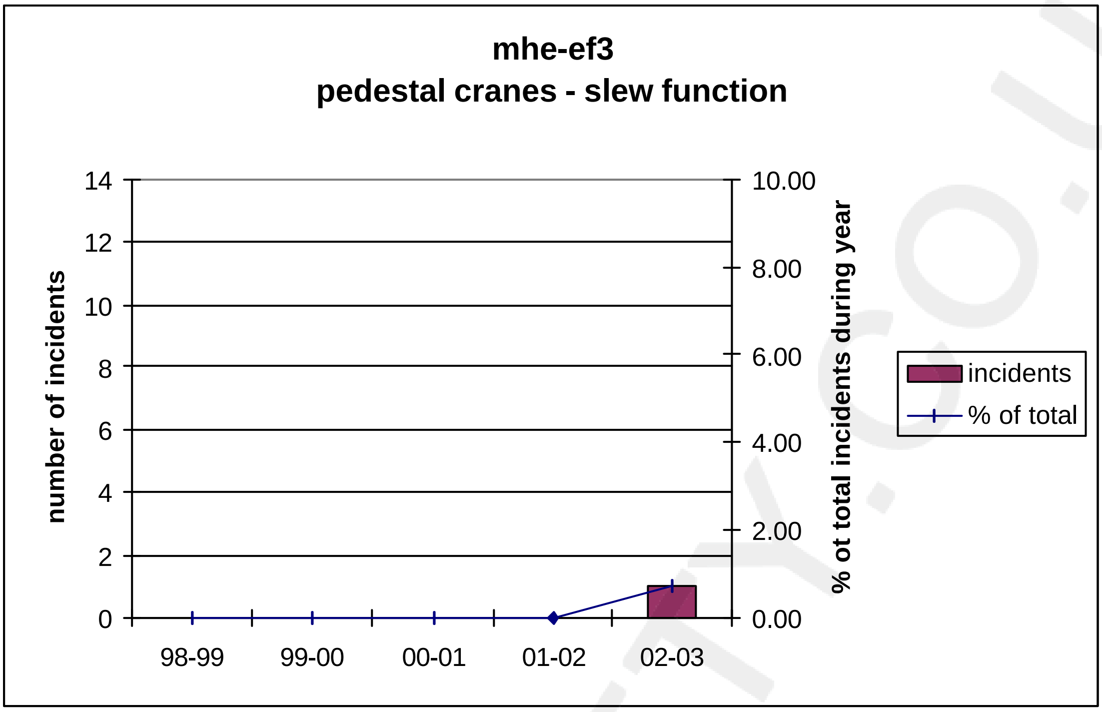

Figure A5.4
MHE-EF3 Pedestal cranes – slew function incidents – 1998 to 2003

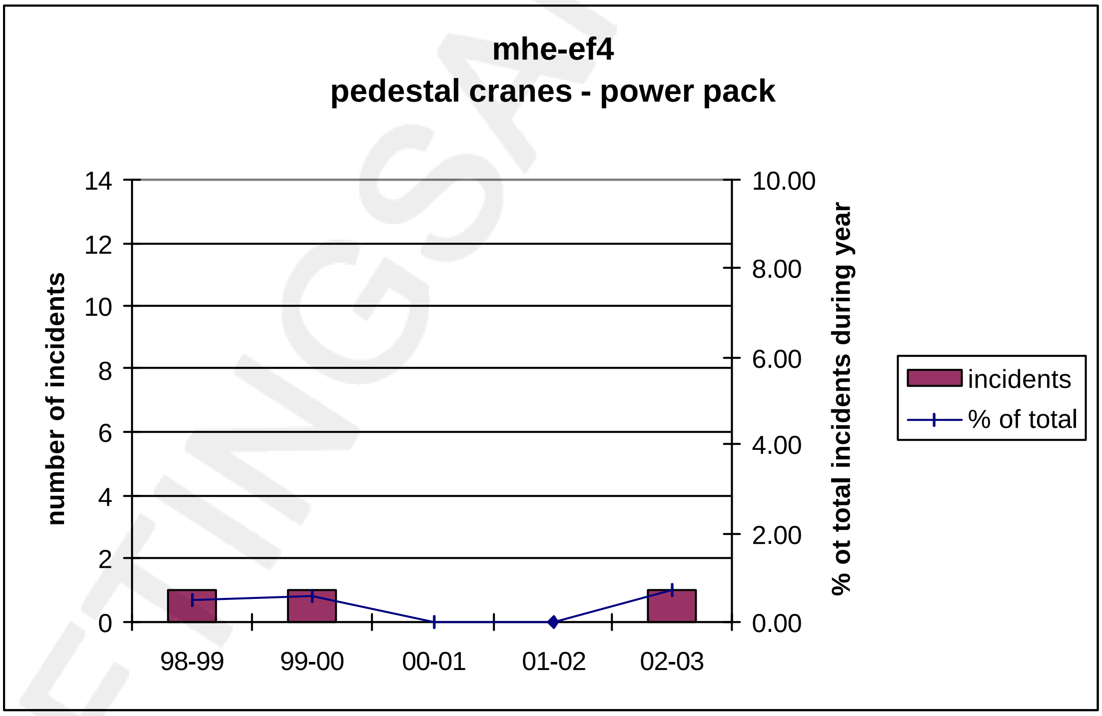

Figure A5.5
MHE-EF4 Pedestal cranes – power pack incidents – 1998 to 2003

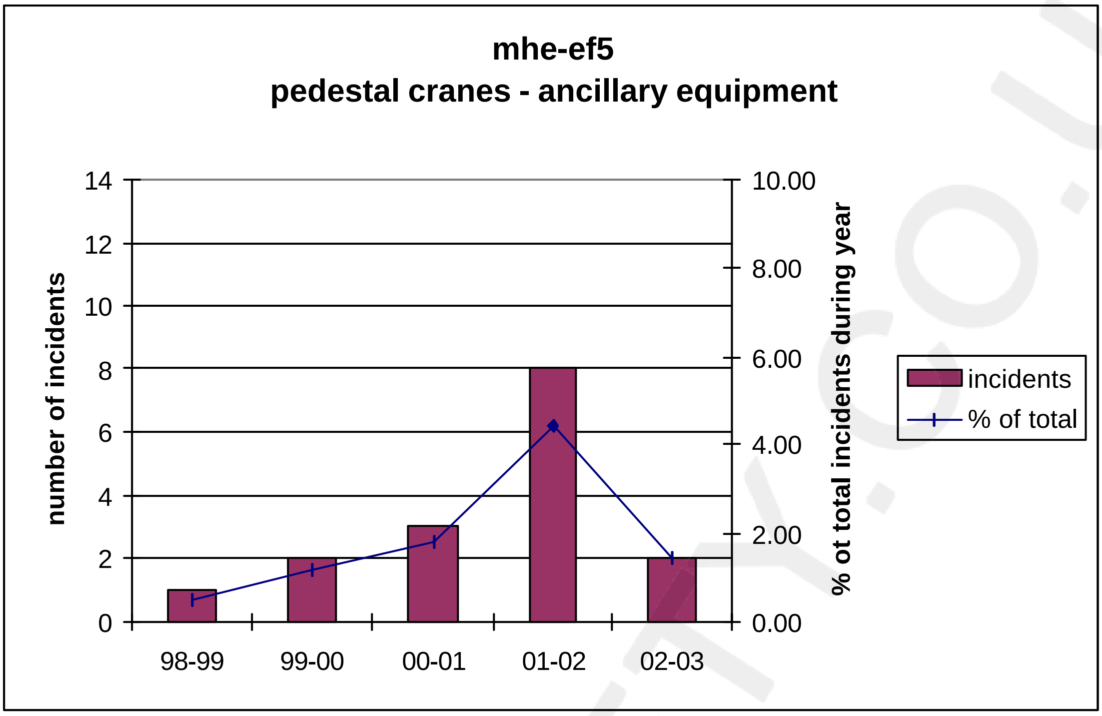

Figure A5.6
MHE-EF5 Pedestal cranes – ancillary equipment incidents – 1998 to 2003

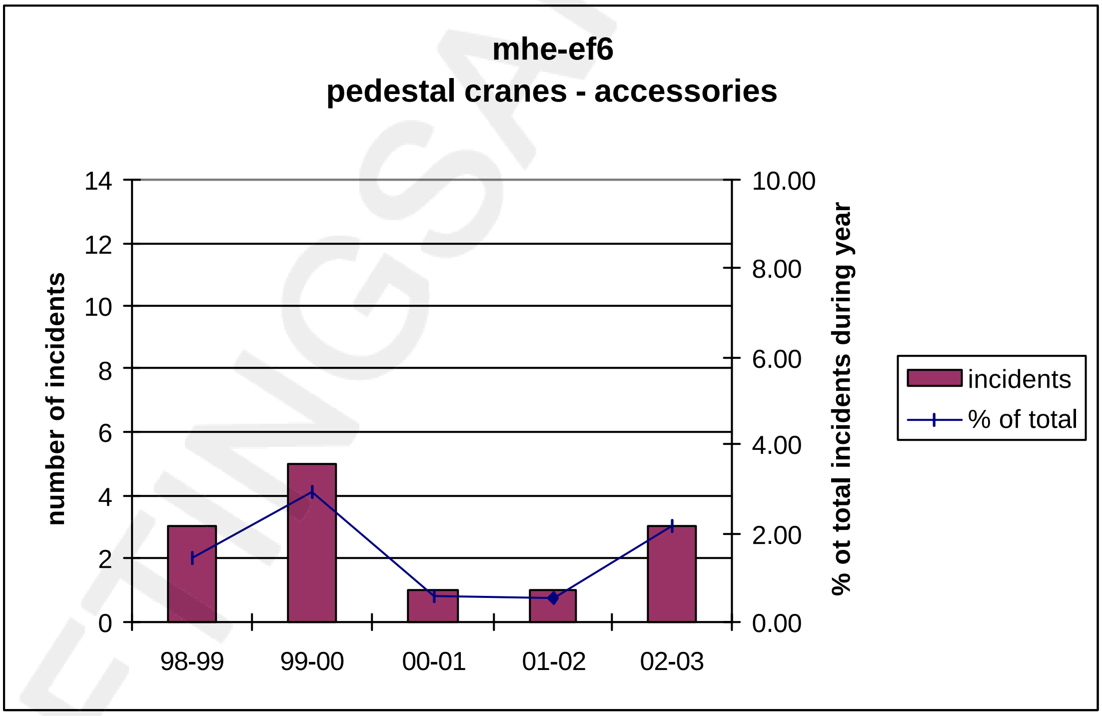

Figure A5.7
MHE-EF6 Pedestal cranes – accessories incidents – 1998 to 2003

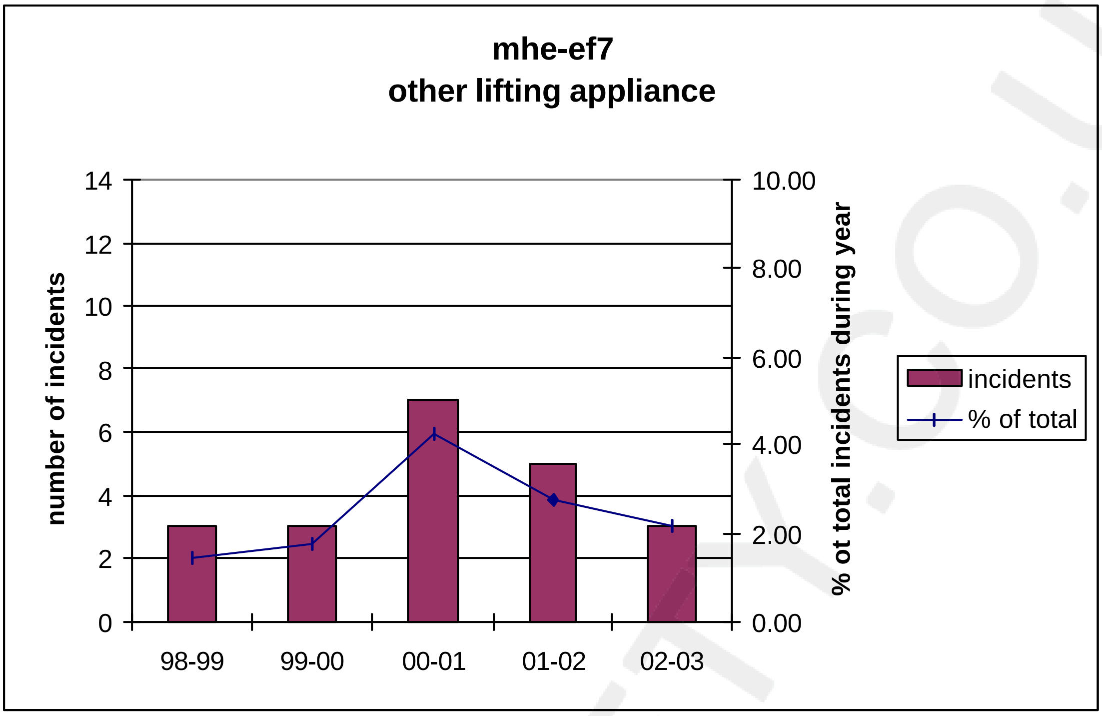

Figure A5.8
MHE-EF7 Other cranes incidents – 1998 to 2003

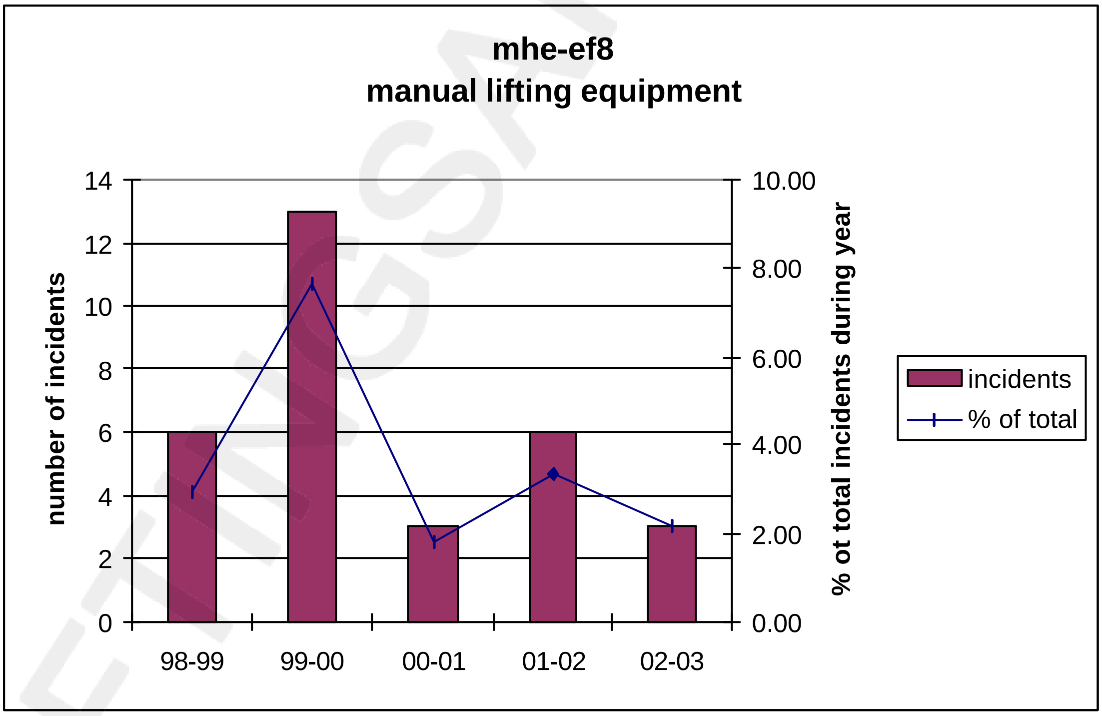

Figure A5.9
MHE-EF8 Manual lifting equipment incidents – 1998 to 2003

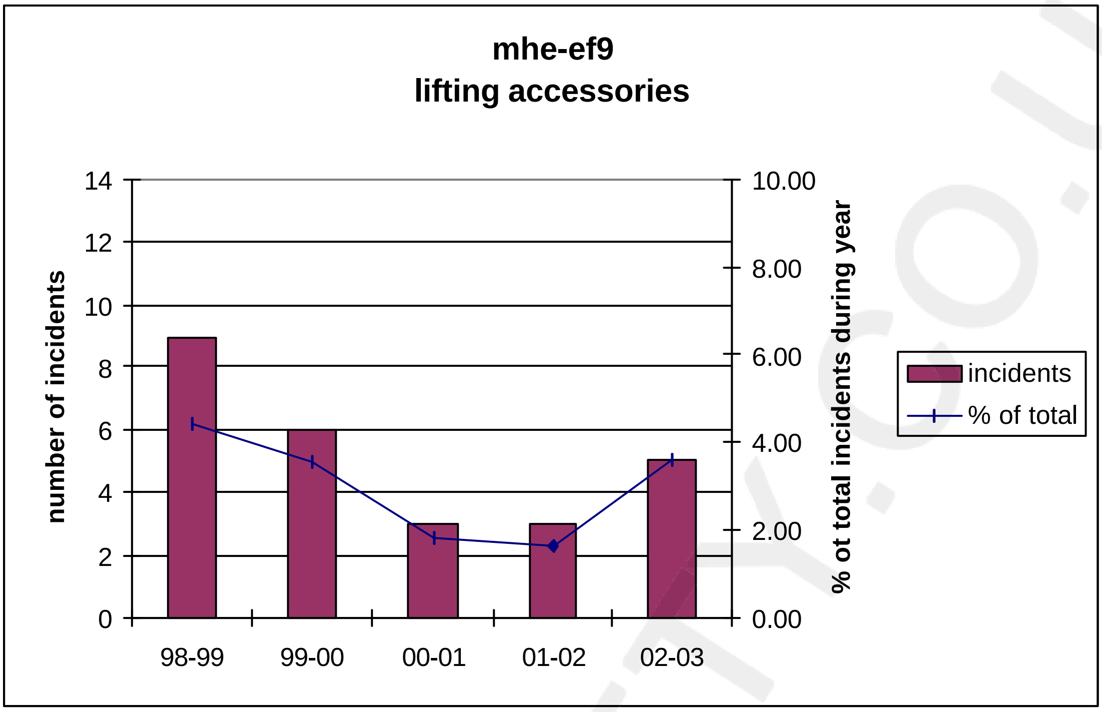

Figure A5.10
MHE-EF9 Lifting accessories incidents – 1998 to 2003

APPENDIX 6 DETAILED ANALYSIS – MECHANICAL HUMAN FACTORS

The following charts are in support of Section 3.3 Detailed Analysis of Data – Mechanical Handling Equipment.

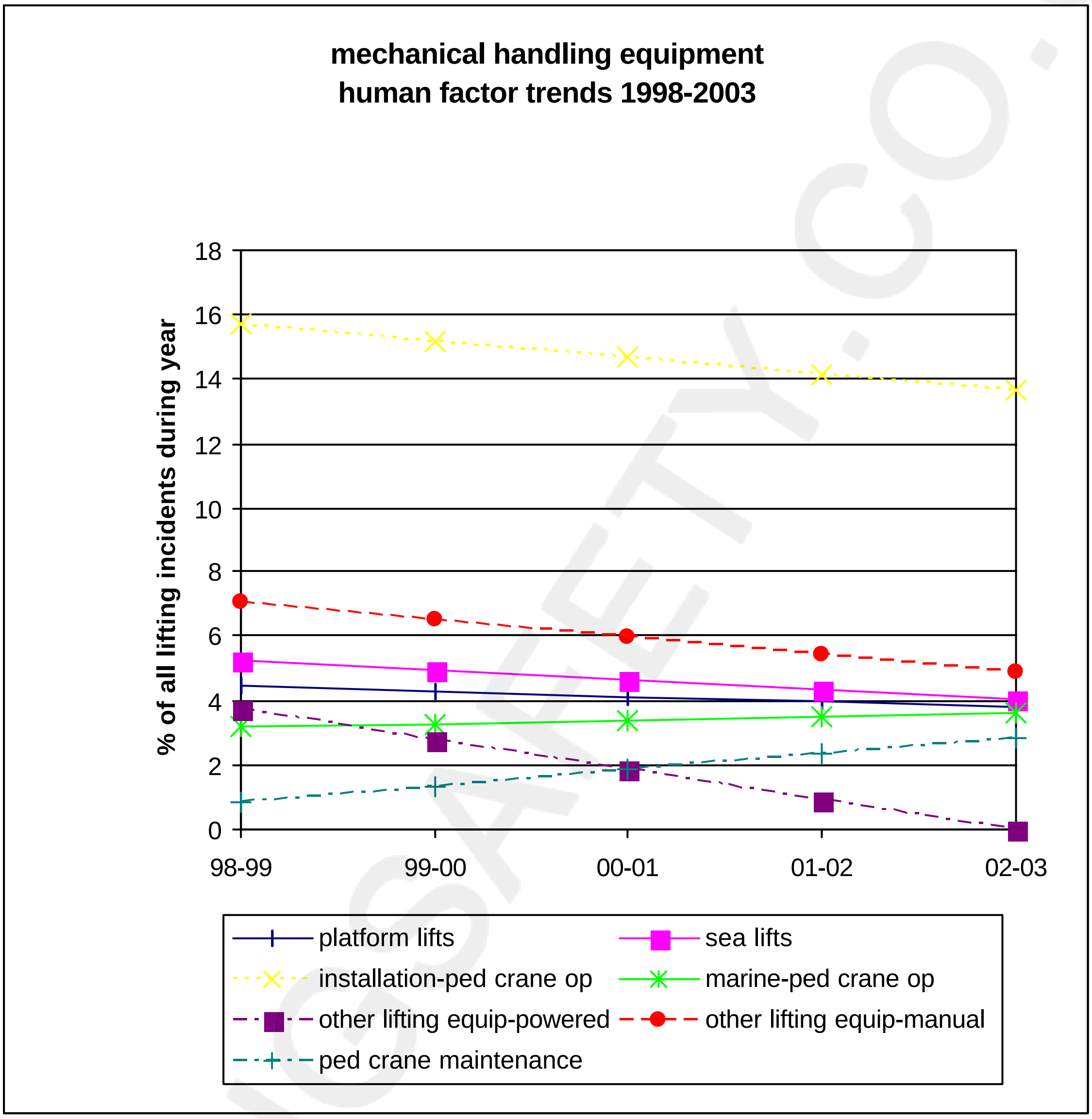

Figure A6.1
Mechanical handling equipment – human factor trends – 1998 to 2003

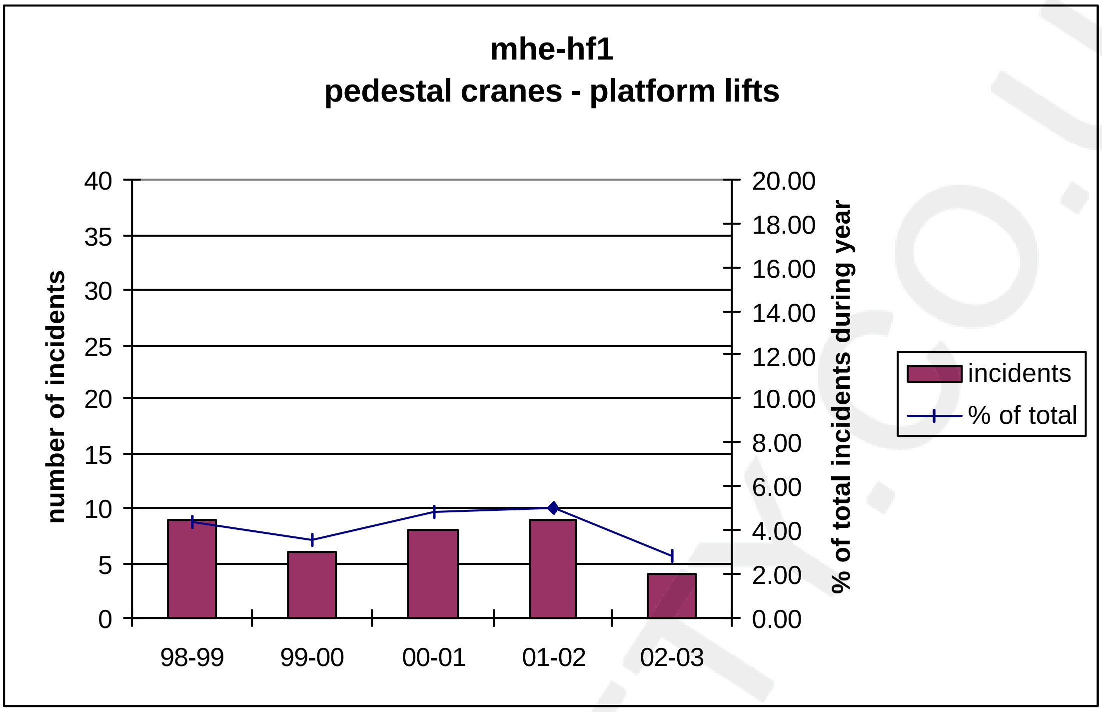

Figure A6.2
MHE-HF1 Pedestal cranes – platform lift incidents – 1998 to 2003

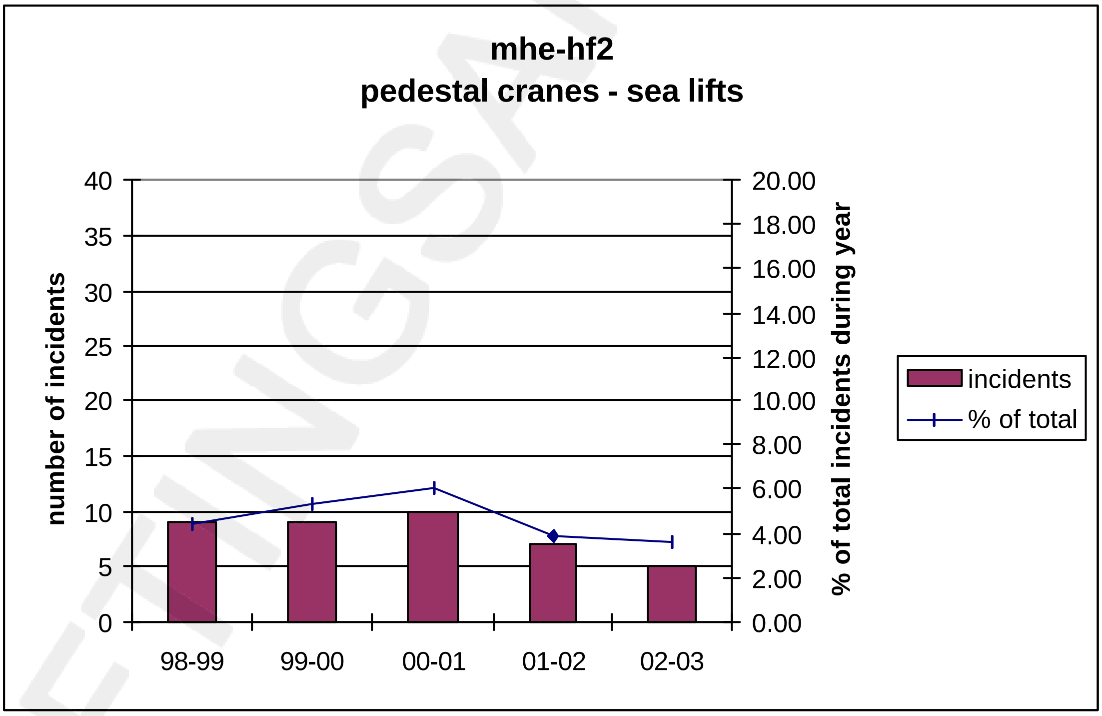

Figure A6.3
MHE-HF2 Pedestal cranes – sea lift incidents – 1998 to 2003

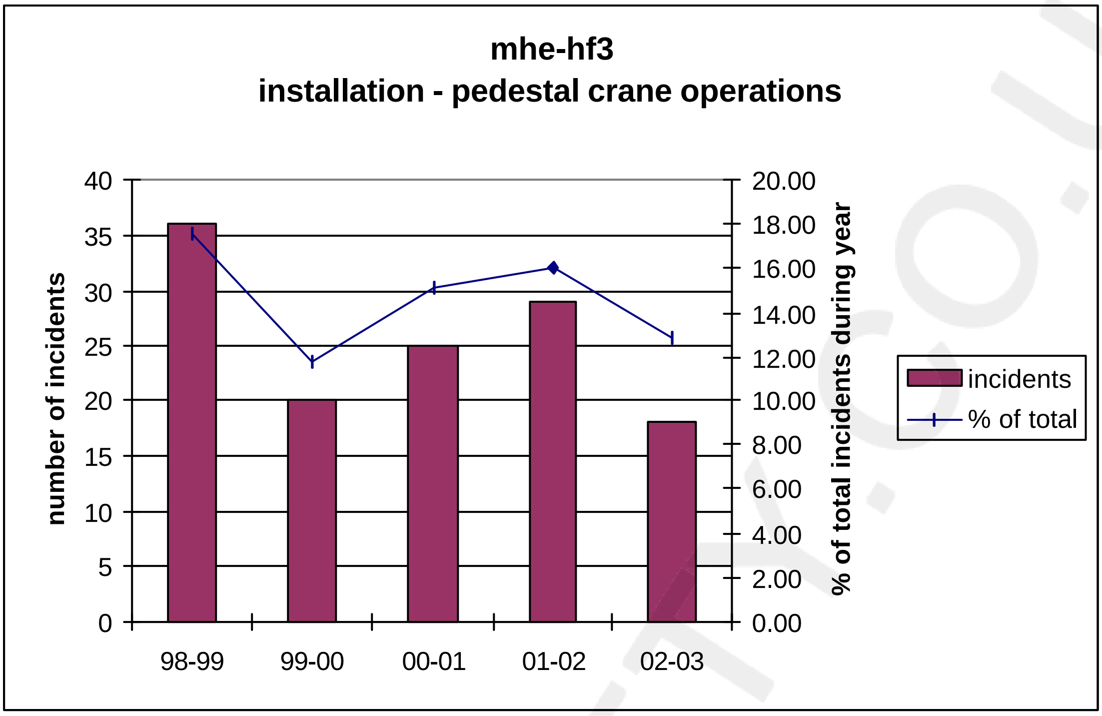

Figure A6.4
MHE-HF3 Installation - pedestal crane operation incidents – 1998 to 2003

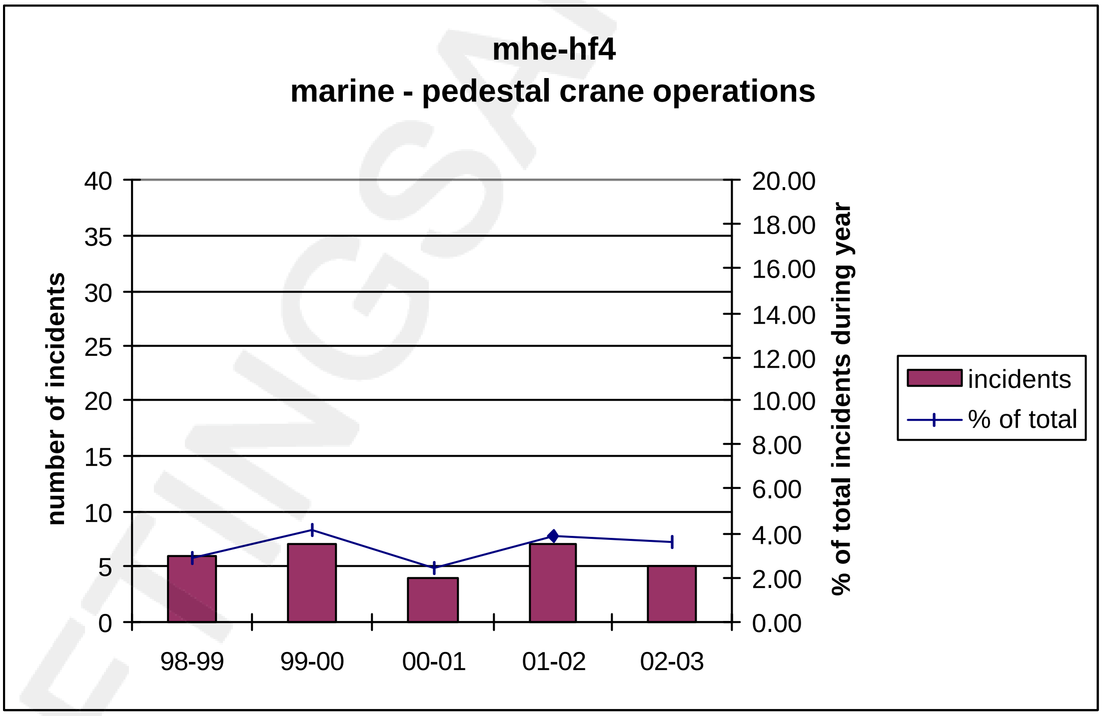

Figure A6.5
MHE-HF4 Marine - pedestal crane operation incidents – 1998 to 2003

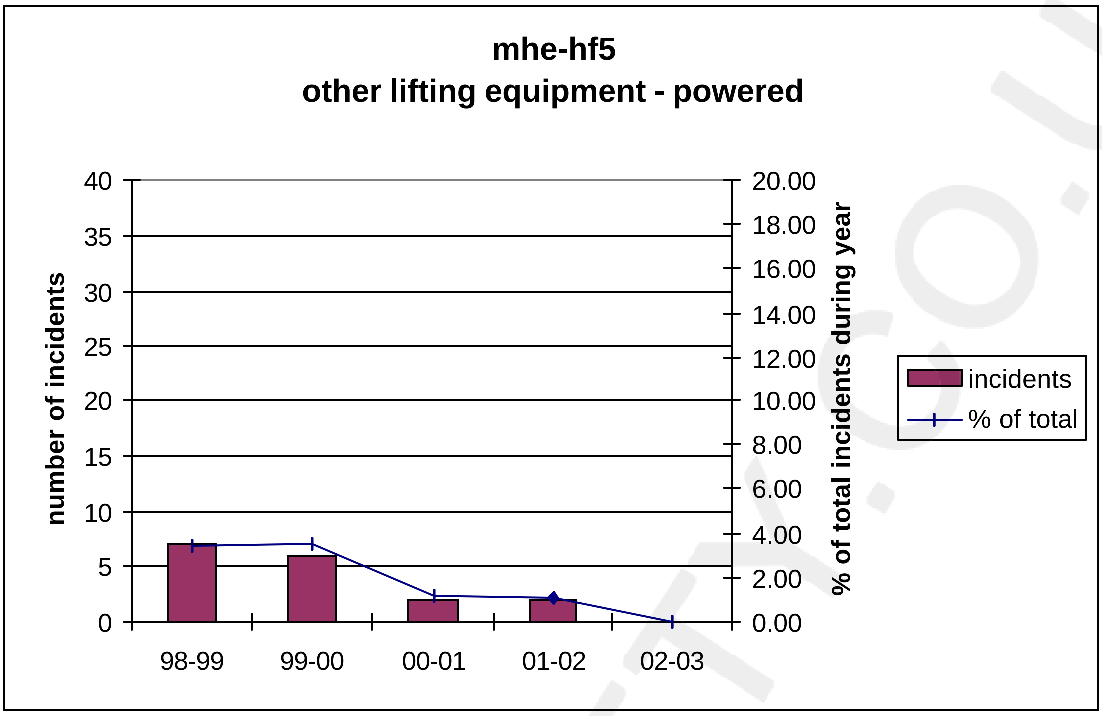

Figure A6.6
MHE-HF5 Other lifting appliances - powered incidents – 1998 to 2003

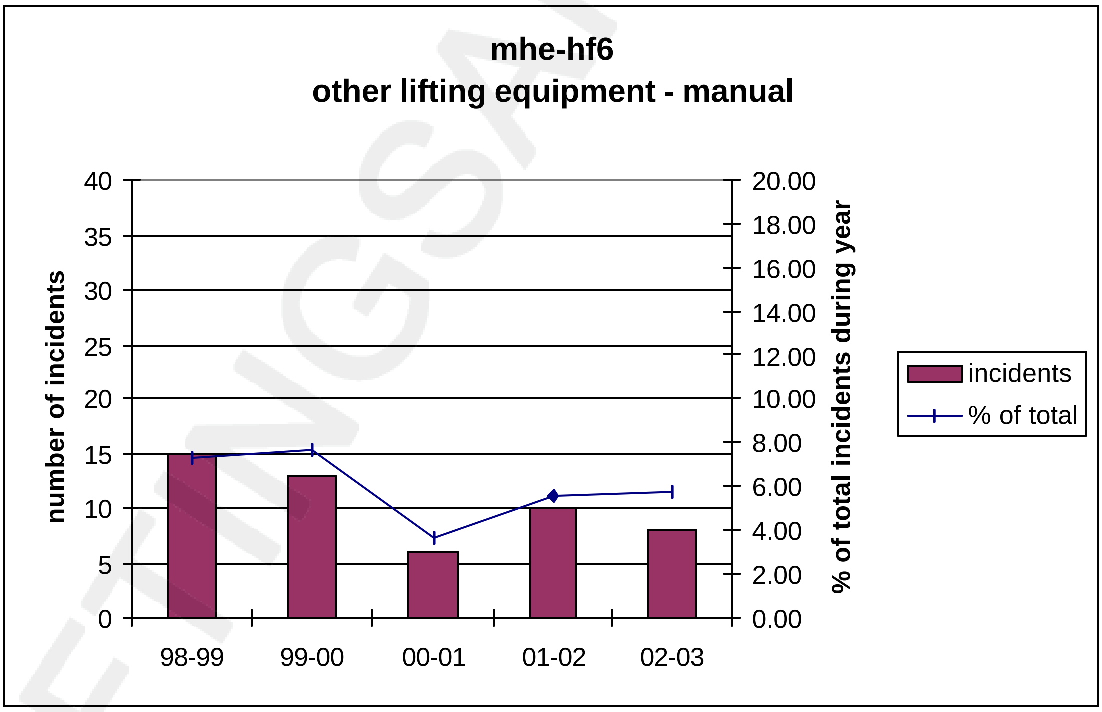

Figure A6.7
MHE-HF6 Other lifting appliances - manual incidents – 1998 to 2003

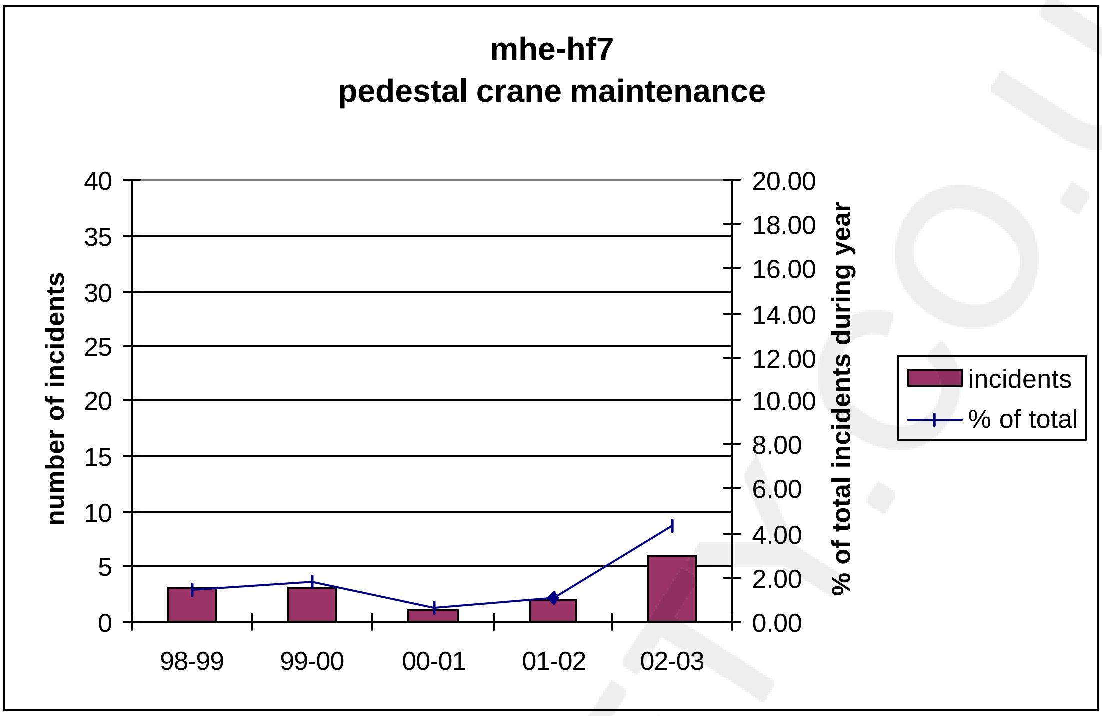

Figure A6.8
MHE-HF7 Pedestal crane maintenance incidents – 1998 to 2003

APPENDIX 7 DRILLING HANDLING EQUIPMENT - HUMAN FACTORS

The following chart is in support of Section 4.2 Drilling Handling Equipment – Human factors.

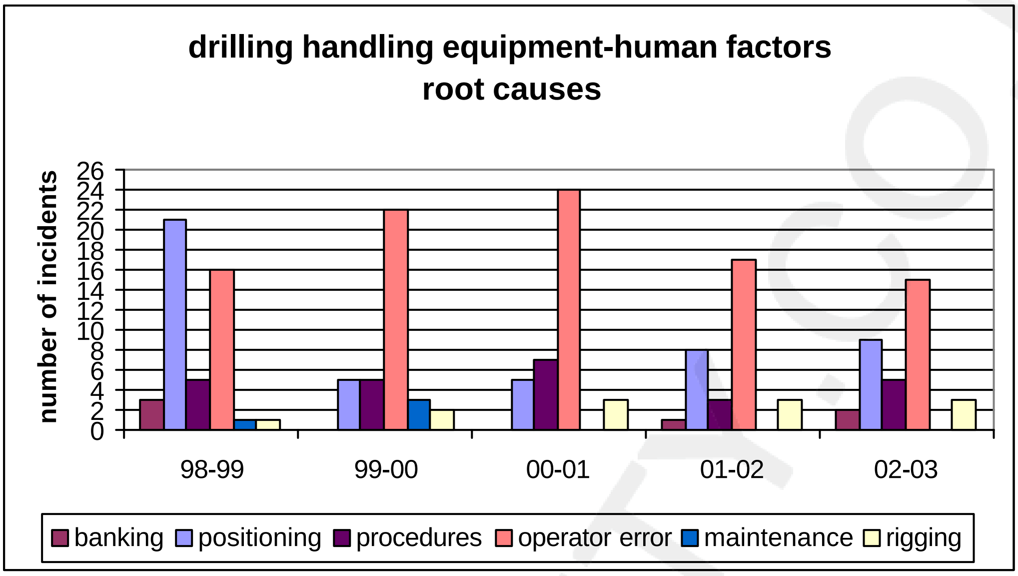

Figure A7.1
Drilling handling equipment – human factor root cause – 1998 to 2003

The following chart is in support of Section 4.4 Mechanical Handling Equipment – Human factors.

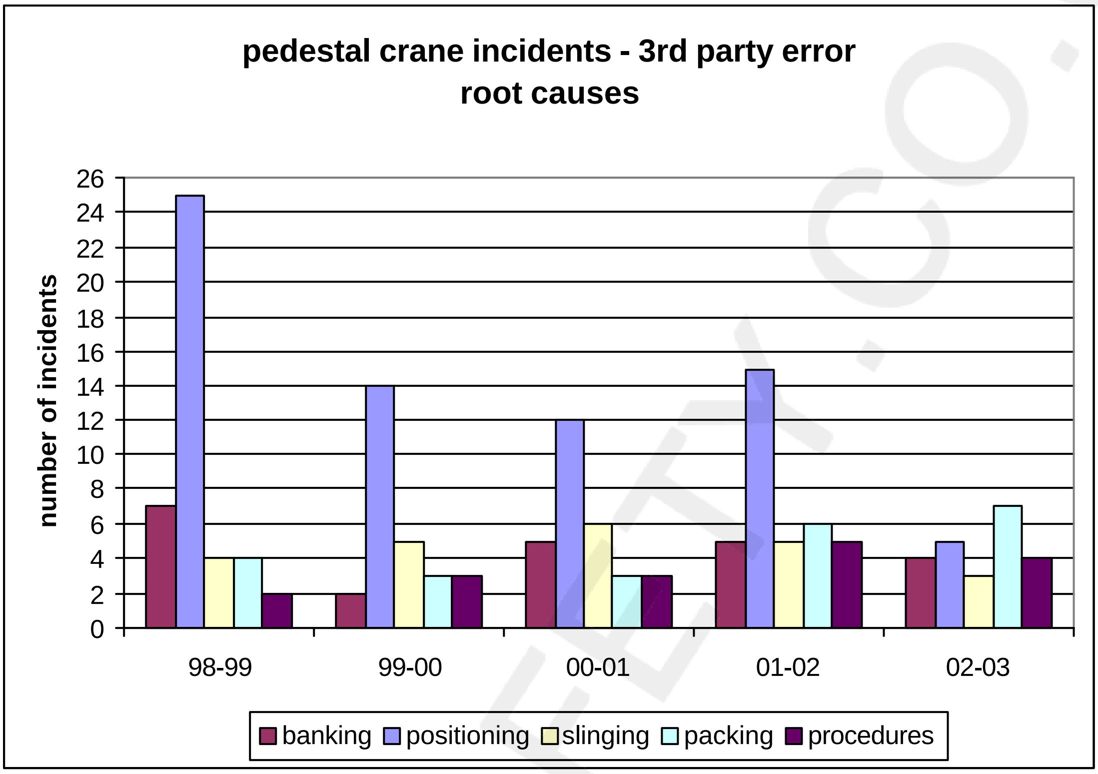

Figure A8.1
Mechanical handling equipment – human factors
Pedestal crane incidents – 3rd party error root cause

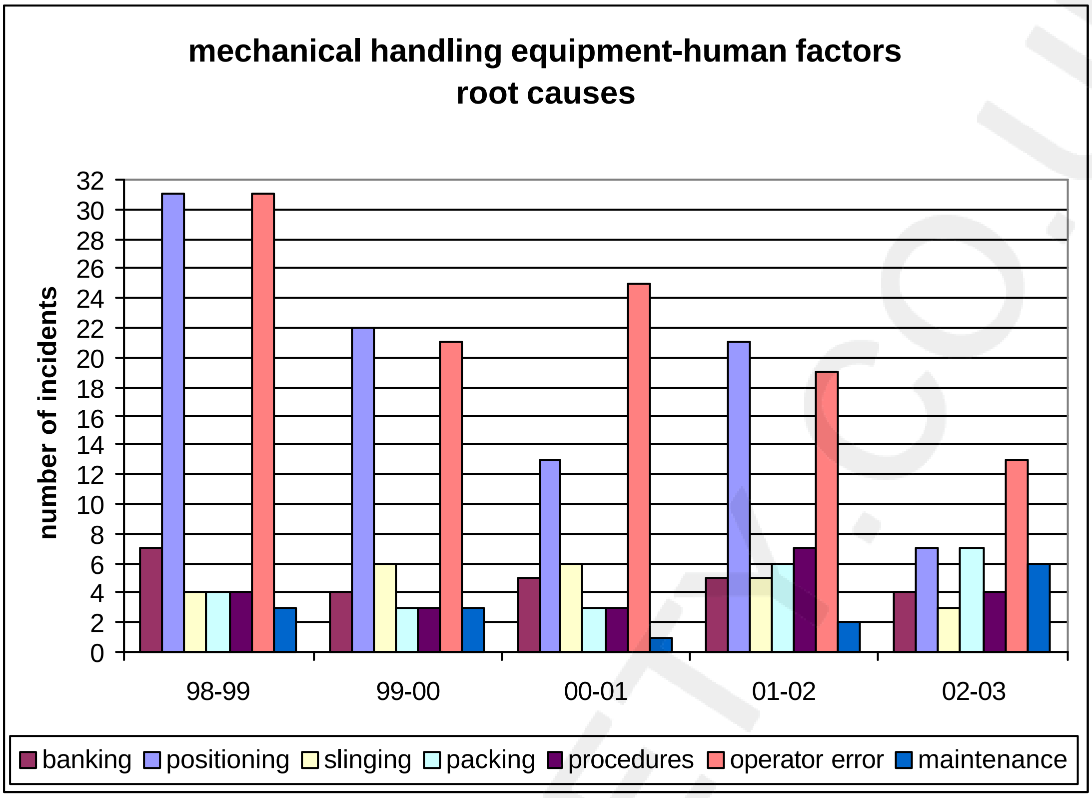

Figure A8.2
Mechanical handling equipment – human factor root causes

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