



OFFSHORE HYDROCARBON RELEASES STATISTICS AND ANALYSIS, 2002

HID STATISTICS REPORT HSR 2002 002

Date of Issue: February 2003

Health & Safety Executive

Preface

This is the seventh report on statistics obtained from the HCR database, and is the fifth since the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR 95) came into force offshore on 1st April 1996. The report presents data on hydrocarbon releases that have been reported for the period 1st October 1992 to 31st March 2002 inclusive.

The report continues to be part of the HID Statistics Report (HSR) series to replace the OTO series, which has been discontinued.

Copies of this report can be obtained free of charge from:

Health and Safety Executive
Hazardous Installations Directorate
Central Division
CD4C Data Management
2nd Floor St Annes House
University Road
Bootle
Merseyside L20 3RA

Tel: 0151 951 3099
Fax: 0151 951 4980
e-mail : HCR.Admin@hse.gsi.gov.uk

Copies of this report can also be downloaded free of charge from HSE's website at <http://www.hse.gov.uk/hid/osd/hsr2002/index.htm>

OFFSHORE HYDROCARBON RELEASES
STATISTICS AND ANALYSIS, 2002
(FOR THE PERIOD 1-10-92 TO 31-3-02 INCLUSIVE)

CONTENTS

	Page
EXECUTIVE SUMMARY	4
1.0 INTRODUCTION	6
2.0 DATA CATEGORIES	7
3.0 STATISTICS	8
3.1 Hydrocarbon type	8
3.2 Reporting frequency	9
3.3 Severity analysis	9
3.4 Systems	11
3.5 Equipment	11
3.6 Installation type and location	12
3.7 Ignitions	14
3.8 Means of Detection	15
3.9 Emergency actions	16
3.10 Causation & Operating Mode	16
4.0 ANALYSIS	18
5.0 TABLES (See separate section index)	26
6.0 FIGURES (See separate section index)	60
Appendix 1 - 'OSD PROCESS INTEGRITY INITIATIVE'	69
Appendix 2 - 'SEVERITY CLASSIFICATION'	70
FEEDBACK QUESTIONNAIRE	74

EXECUTIVE SUMMARY

A target sought by the UK Offshore Oil and Gas industry and HSE is to reduce the number of reported major and significant releases by 50% over the three years to March 2004, with 1999/2000 figures (139) as baseline data. The total number of major releases in 2001/2002 continues to show a decrease, down from 8 to 4 (50%) on last year's figure, and the total number of significant releases has also decreased from 117 to 109 (7%) over the same period. The combined total for major and significant releases has therefore shown a reduction of 19% on the baseline target (i.e. 139 to 113).

Last year, 2000/01, saw a 50% increase in the number of reported minor releases, up from 95 to 145. This year's figure of 128, however, represents a 12% decrease on 2000/01. There is some evidence that the increase level of minor releases since 2000/01 (though seeming to decline this year) is due to improved reporting performance by offshore personnel.

There were 12 reported ignitions in 2001/2002 none of which were major releases. Although there have been no ignited major releases since the launch of the HCR database, of the total 143 reported ignitions over the period 1 October 1992 to 31 March 2002, 41 of these (28.7%) have been significant releases (17 gas and 24 liquids).

This latest report also includes an update on last year's analysis of investigated releases (OTO 2001 055) which supplements the information in this report (see Section 4.0).

1. INTRODUCTION

The purpose of this report is to provide the offshore industry with data from the Hydrocarbon Releases (HCR) Database for their use in connection with the preparation and revision of offshore safety cases, particularly in quantified risk assessment (QRA), as recommended by Lord Cullen in his report on the Piper Alpha disaster (Cullen Recommendation 39).

The HCR Database contains data on offshore hydrocarbon release incidents, supplementary details of which are reported voluntarily to the Health and Safety Executive, Hazardous Industries Directorate, on form OIR/12. These data have been technically checked against the "parent" RIDDOR (OIR/9B) details, and then entered into the database by OSD since database start-up on 1 October 1992.

This report, HSR 2002 002, covers the period 1 October 1992 to 31 March 2002. It is the seventh report on statistics obtained from the HCR Database, and is the fifth since the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR 95) came into force offshore on 1 April 1996.

Criteria for severity classification (i.e. major, significant, minor), first introduced in 1997, were refined in 1999 to include release rates (see Appendix 2). The limited accuracy of the systems and equipment population data estimates, and the voluntary nature of the information supplied on form OIR/12, should all be taken into consideration when drawing conclusions from the statistics contained in this report.

The main thrust of this report is to advise industry of the bare statistics. Nevertheless, some discussion has been added where appropriate. This report also contains statistics on detection modes, emergency actions, and causation, but offers no root cause analysis at this stage. However, Section 4.0 does contain some analysis on a limited number of investigated incidents from the 2001/02 period.

A target sought by the UK Offshore Oil and Gas industry and HSC/E is to reduce the number of reported major and significant releases by 50% over the three years to

March 2004, with 1999/2000 figures (139) as baseline data. . This report includes comment on progress made to date against that target.

Detailed failure rate tables are published in alternate years, and the latest versions of (a) *System Failure Rates & Severity / Hole Size Distribution*; and (b) *Equipment Failure Rates & Severity / Hole Size Distribution* can be found in the 2001 Hydrocarbon Statistics Report, HSR 2001 002.

A project jointly funded by HSE and UKOOA, is underway to develop a web-based version of the HCR System which will be launched in 2003. It will be accessible via the HSE Home Page on the internet, and will allow dutyholders and other authorised users access to the system to submit incident reports direct to HSE as well as to extract hydrocarbon release data/statistics on line.

Statistical information will be made available in the form of standard reports which generate graphs and/or tables as required, and the facility to download data will also be provided.

Dutyholders will be able to register free of charge as users of the HCR web-based system prior to launch by contacting the HCR System Administration Team at HCR.Admin@hse.gsi.gov.uk , and giving details of the prospective users in their organisation.

Other prospective users of offshore hydrocarbon release data, such as consultants and academia, may also be accepted as registered users on a “read only” basis i.e. with access to standard reports and Data Download only. However, this may be subject to an annual registration fee which has yet to be decided.

2. DATA CATEGORIES

This section describes the categories of data available from the HCR Database, statistics from which are contained in section 3.0.

Section 5.0 contains the data tables referred to in the report, all of which are listed in a separate section 5.0 index.

Section 6.0 contains the figures referred to in the report, all of which are listed in a separate section 6.0 index.

The statistics, tables, and figures show the breakdown of data using the following sort categories:

- Type of hydrocarbon, viz. liquids (oil/condensate/non-process¹), gas, or 2-phase
- Severity of release, i.e. major, significant, or minor (Appendix 2)
- Type of installation, viz. fixed (including Floating Production Systems [FPS]), mobile or subsea
- Location of installation on the UK Continental Shelf (UKCS) viz. Northern (above 59⁰ Latitude), Central (56⁰ to 59⁰ Latitude) or Southern area (below 56⁰ Latitude, including Irish Sea and English Channel)
- Year of occurrence (12 month periods from 1 April to 31 March unless noted otherwise)

Each release has a single system type allocated to it and an individual equipment type within that system (well type and/or well operation for drilling activities). Most tables show the number of releases occurring, sorted by one or more of the above categories.

Statistics for other reported features such as ignitions, mode of detection, emergency actions taken, causation factors etc., are also given in Section 3.0.

NB: Additional data categories used in Analysis (Section 4.0) were derived from investigation reports and OTO 2001/055, and the taxonomy is included in this report.

¹Non-process hydrocarbon liquids include diesel, helifuel, lubricants, methanol, etc.

3. STATISTICS

A total of **2312** hydrocarbon release incident reports have been received, checked and input during the 9½ year period since the start-up of the Hydrocarbon Releases (HCR) Database on 1 October 1992, up to 31 March 2002 inclusive.

The following subsections comprise detailed discussion of the statistics, which are illustrated in the tables and figures in sections 5.0 and 6.0 respectively.

Caution should be exercised when interpreting these statistics, in view of the limited accuracy of population data, the voluntary nature of the information supplied on form OIR/12, and the small number of releases involved in some cases.

3.1 Hydrocarbon type

Figure 1, in section 5.0, shows the breakdown of reported releases by hydrocarbon type. It can be seen from this pie-chart that gas releases constituted, by far, the largest proportion of releases reported, i.e. 1267 out of 2312 (54.8%). The other types, ranked in decreasing order, were oil 403 (17.4%), non-process 269 (11.6%), 2-phase 205 (8.9%) and condensate 168 (7.3%).

The higher proportion of gas releases may have arisen from the fact that almost all offshore installations handle gas, but only 37% of installations handle hydrocarbon production liquids (see also section 3.6 - "Installations"). Other contributing factors to the higher incidence of gas releases could be that gas is usually subjected to higher pressures and temperatures than other forms of hydrocarbon, hence there are greater challenges associated with gas containment.

3.2 Reporting frequency

Figure 2, in section 6.0, shows the monthly reporting frequencies since October 1992 up to the end of March 2002. Major milestones which occurred during the reporting period are also listed.

Reporting reached a peak of 325 in 1994/1995, probably attributable to more detailed reporting following the issue of the OIR/12 form in August, 1992, and to comprehensive guidance² in August, 1993. There then followed a substantial drop down to 212 in 1995/96, ostensibly due to the safety case regime and improved safety management systems taking effect. Thereafter, the number of incidents seemed to have reached a plateau with the annual totals for the following years being 226 (1996/1997), 218 (1997/1998), 234 (1998/1999) and 234 (1999/2000). The monthly reporting rate fluctuated between 18 to 20 in the same period.

However, 2000/2001 saw a rise in the overall number of releases reported to 270 with a rise in the monthly reporting rate to 23. This increase coincided with the introduction for that year of the Progress Integrity Initiative. The figures for the latest year, 2001/2002, show a fall in the total number of releases to 241, a decrease of 11% on the previous year. There was also a fall in the monthly average back to 20. There is quite convincing evidence that the increase in 2000/01 was due to improved reporting performance and improved awareness of the reporting requirements by offshore personnel, and increased emphasis on reporting by oil company senior managers. The fall in 2001/02 may be confirmation that there is now more or less full reporting of hydrocarbon releases and the work done to reduce the incidence of major and significant releases is giving a benefit across the range. However further observation of the data over the next 4 quarters will be needed to confirm whether this is an overoptimistic interpretation of the situation.

3.3 Severity analysis

²Revised in Nov 96 to encompass RIDDOR 95 "Revised Guidance on Reporting Offshore Hydrocarbon Releases" OTO 96 956, is available free on request from HSE on tel :0151-951-3099 or fax: 0151-951-4980 or e-mail: HCR.Admin@hse.gsi.gov.uk or downloaded free from the HSE website: <http://www.hse.gov.uk/research/noframes/oto/1996/index.htm>

3.3.1 **All releases**

All releases have been classified according to agreed severity criteria (see Appendix 2). Table 1 in Section 5.0 shows that, of the 2312 reported releases to 31 March 2002, 147 were classified major (6.4% of all leaks), 1284 were significant releases (55.5%) and the remaining 881 were minor (38.1%).

Figure 3 in section 6.0 shows the reporting patterns by year for major, significant and minor releases in both tabular and line graph form. The overall number of major releases in 2001/2002 continued the decrease shown in last year's figures (down from 8 to 4), and the number of significant releases also decreased (from 117 to 109) over the same period. This means that the reduction in the number of major and significant releases has now reached 19% (139 to 113) against an overall target of 50% (i.e. down to 70) by end March 2004. The overall number of minor³ releases reported in 2001/2002 has reversed the increase – quite possibly due to improved reporting performance by offshore personnel - experienced last year, down from 145 to 128.

3.3.2 **Gas releases**

Figure 4 in section 6.0 shows the reporting patterns by year for major, significant and minor gas releases in both tabular and line graph form. The upward trend in the annual number of reported gas releases ceased in 2001/2002, with a decrease of 17% over the previous year (down to 117 from 141). The number of major gas releases also went down, decreasing to 4 in 2001/2002 from 8 in 2000/2001. Similarly, significant gas releases dropped from 74 to 69 in the same period. The combined number of major and significant gas releases has decreased to 73 in 2001/2002 from 81 in 2000/2001. This is the lowest full-year figure for combined major and significant gas releases since the start-up of the HCR database. The number of minor gas releases has also shown a decrease for this year, to 44 from 60 in the previous year.

³It is important to note that reports of minor releases only cover those reportable under RIDDOR definitions which are based on the potential for fire/explosion. It should also be noted that all ignitions offshore are reportable, no matter how minor.

3.3.3 *Liquid releases*

Figure 5 in section 6.0 shows the reporting patterns by year for major, significant and minor liquid releases in both tabular and line graph form. It can be seen from these that the annual numbers of reported liquid releases (i.e. oil, condensate and non-process combined) have fluctuated over the years since database start-up, with no discernible trend. Although 4 less incidents than last year, the number of minor releases at 75 is still higher than all other earlier years, apart from 2000/01. As reported earlier, time will tell if the increase was due to improved reporting performance and therefore the current fall is symptomatic of an improvement in hydrocarbon containment across the board.

3.3.4 *2-phase releases*

Figure 6 in section 6.0 shows the reporting patterns by year for major, significant and minor 2-phase releases in both tabular and line graph form. From these, it can be seen that the numbers of reported 2-phase releases have also fluctuated over the years since database start-up. As with liquid releases, there is no discernible trend.

3.4 **Systems**

3.4.1 *Systems : highest 15 failure rates*

The barchart in figure 7, section 6.0, shows the failure rates in leaks per system year for the highest ranked 15 release rates out of a total of 52 system types.

The system with the highest failure rate is gas compression with a failure rate of 2.90×10^{-1} leaks per system year. High operating temperatures and pressures, vibration, and the consequent effects of these on vulnerable equipment items such as seals, instruments, and small bore pipework items etc. are considered to be major contributors to the frequency of hydrocarbon releases from this system type, and these factors have been taken into account in the current Process Integrity initiative (Appendix 1).

Next highest ranking system failure rates were oil export (1.56×10^{-1} leaks per system year), and fuel gas (1.38×10^{-1} leaks per system year).

3.5 Equipment

3.5.1 Equipment : highest 15 failure rates

The barchart in figure 8, section 6.0, shows the failure rates in leaks per equipment year for the highest ranked 15 release rates out of a total of 119 equipment types.

The major equipment items with the highest failure rates are dual fuel turbines at 7.24×10^{-2} leaks per equipment year, and reciprocating compressors at 6.52×10^{-2} leaks per equipment year, both of which indicate strong links with the high gas compression system leak rates shown above.

It should be noted that the equipment items having the highest numbers of reported leaks were instruments (370 total), and pipework items such as valves, flanges and piping. Their respective population numbers are also very large and thus their respective failure rates in the rankings are reduced. However, the problems (with small bore fittings in particular) have been recognised and guidelines have been produced for addressing loss of containment, etc.

3.6 Installation type/location versus release type and severity

Table 2 in section 5.0 summarises the breakdown of all reported releases by hydrocarbon type versus installation type, i.e. Fixed which includes floating production systems (FPS), Mobile including both drilling and accommodation units, and Subsea.

Each installation also has an associated location in either the Northern (above 59° Latitude North), Central (56° to 59° Latitude North), or Southern (below 56° Latitude North, including Irish Sea and English Channel) areas of UKCS. The total current population and the estimated number of installation years (as at 31 March 2002) is also given for each installation type on the UKCS by area.

3.6.1 Installation type

The breakdown by installation type showed that fixed installations were responsible for 2229 (96.4%) of releases reported. In contrast, only 83 releases (3.6%) were

reported by mobile drilling and accommodation installations. These proportions are not considered unusual, because there is constant exposure to hydrocarbons on fixed installations whereas the exposure on mobile installations is intermittent.

3.6.2 *Fixed installation failure rates*

Failure rates have been calculated in terms of leaks per installation year, for each type of installation, by dividing the total number of leaks for that type by the total number of installation years.

Floating Production Systems (including FPSO and FSU) had the highest overall leak rate of 2.57 leaks per installation year, with 5.3% major releases. Fixed attended installations in the Northern North Sea had the next highest leak rate of 2.57 leaks per installation year, with 4.5% of these being major releases. Central fixed attended installations were next, with 2.26 leaks per installation year, with 4.9% major releases. Southern fixed attended installations had a leak rate of 0.37 leaks per installation year, with 8.1% major, and Southern normally unattended installations (NUI) leak rate was 0.15 leaks per installation year, but with 20.8% major releases.

The production equipment on the larger attended oil production platforms in the Northern and Central areas is more complex and subject to much greater fluctuation of operating parameters than on the simpler and smaller gas production platforms in the Southern area. It is reasonably foreseeable, therefore, that there may be a greater propensity for hydrocarbon releases of all types on the larger installations.

3.6.3 *Mobile installation failure rates*

Using the population data held in the HCR database, leak rates have been calculated in terms of leaks per installation year, for each type of mobile installation. However, in the absence of accurate rig years data, it was necessary to assume that each unit was present on the UKCS for the entire period since their arrival, and so these leak rates must be considered very approximate (and tending toward best case) as a result.

Combining Southern and Central release figures gave an overall leak rate for jack-up mobile drilling and accommodation units of 0.34 leaks per installation year, with 7.0%

HSR 2002 002

major releases. Northern and Central release figures combined gave an overall leak rate for semi-submersible mobile drilling and accommodation units of 0.25 leaks per installation year, but with 17.5% major releases.

3.7 Ignitions

3.7.1 Ignition summary

Table 3, section 5.0, summarises the numbers of ignitions for each year versus the number of releases for each type of hydrocarbon. It is important to note that the percentages shown are ignition rates (i.e. percentage of releases ignited) and NOT ignition probabilities (i.e. the likelihood of a particular release igniting).

There was a grand total of 143 reported ignitions (i.e. 6.2% of all releases) over the 9½ year period, none of which were major.

There were 42 gas ignitions (29.4% of all ignitions), of which 17 were classed as significant releases (ignition rate 2.1%), and 25 as minor (ignition rate 7.0%). There were no major ignited gas releases.

There were 101 liquid ignitions (69.5% of all ignitions) of which 24 were classed as significant releases (ignition rate 7.3%), and 77 as minor (ignition rate 15.5%). There were no major ignited liquids releases.

There have been no reported 2-phase ignitions to date.

The higher ignition rates in the case of minor releases, and liquids releases in particular, is considered to be due to the fact that reports of unignited minor releases cover only those reportable under RIDDOR definitions based on the potential for fire/explosion, whereas ALL ignitions are reportable no matter how minor.

3.7.2 Ignition details

Table 4, section 5.0, comprises three parts, which contain full details of every ignition reported in the 9½ years to 31 March 2002.

The three parts cover the following details :

- (a) Release parameters
- (b) Mode of operation/ignition sources/ignition sequences, and
- (c) Detection mode/emergency actions taken.

Each individual record has a unique number and so it is possible to read all three parts for one ignition incident to obtain the full picture. The purpose of this report is to provide statistics only, so any analysis of ignitions has been excluded here.

3.8 Means of detection

3.8.1 Summary

Table 5 in section 5.0, summarises the modes of detection employed during an incident versus the type of hydrocarbon and severity of release. The modes comprise heat, smoke, flame, gas and 'other'. It should be noted that more than one means of detection may be reported for any one release, and so the totals for each column may be more than the total number of releases reported.

There were 2471 detection modes connected with the total 2312 reported releases, more than one mode being effective on some releases. Gas detectors detected 41.6% of all releases (75.9% of gas releases), and the remaining releases were mainly detected by means other than equipment designed for the purpose (see 3.8.2 below).

3.8.2 Other detection modes

A breakdown of the 'other' category which includes detection by visual means, by sound, by smell etc., is shown in table 6, section 5.0. It is considered important to have a separate table for these, since they have made a substantial contribution to the overall detection of offshore releases.

Of the total 2471 modes, 1411 (57.1% of modes) involved means of detection other than by dedicated detection systems. Of these 1411 'other' means of detection, 1089 (77.2%) were visually detected, of which 51 (4.7% of visual detection) involved major releases, 569 (52.2% of visual detection) involved significant releases, and 747 (43.3%) minor releases.

Specific detection details for all reported ignitions are included in table 4 (c).

3.9 Emergency actions versus release type & severity

Table 7, section 5.0, shows a breakdown of the various types of emergency actions taken against the types and severity of releases involved. These actions include either automatic or manual initiation of shutdown, blowdown, deluge, and/or CO₂/Halon systems, plus whether any musters and/or any other emergency actions were carried out.

Two-thirds of releases (1523) required shutdown action (461 automatic, 1062 manual), of which 107 (7% of shutdowns) were for major releases. Blowdown operated on 724 (295 auto, 429 manual = 31.3% of all releases) of which 66 (2.9% of blowdowns) were for major releases.

There were 625 musters (582 at stations, 43 at lifeboats = 27.0% of all releases), 60 of which (2.6% of musters) were for major releases.

In contrast, deluge only operated on 50 releases (2.2% of all releases), of which 13 (26% of deluge) were for major releases, and only 59 (2.6% of all releases) involved the use of CO₂/Halon systems, of which only 1 was for a major release.

3.10 Causation & operating mode versus release type & severity

Table 8, section 5.0, summarises the breakdown of all types of release into the four main causation categories (i.e. design, equipment, operational and/or procedural faults) plus details of the mode of operation in the area at the time of the incident. It should be noted that more than one category may be involved in any one incident, and so caution should be exercised when interpreting the figures shown.

The most frequently reported factor was equipment fault at 1532 (66.3% of incidents). Operational faults were next with 1227 (53.1% of incidents), procedural faults 640 (27.7% of incidents), and design faults 348 (15.1% of incidents).

The proportion of releases occurring during normal production was 49.1% compared to that during intervention type activities such as start-up / reinstatement (17.9%), drilling / workover (9.5%), and maintenance / construction (9.5%). These proportions have generally been maintained throughout each year since database start-up in October 1992.

The causation factor involved in most incidents was 'mechanical failure' which occurred on 1034 occasions (44.7% of all incidents), followed by 'improper operation' that occurred on 549 occasions (23.7% of all incidents).

4. ANALYSIS OF INVESTIGATED OFFSHORE HYDROCARBON RELEASES

This section updates the report produced last year (OTO/2001/055) in which all releases reported in 2000/01 were investigated as part of the Process Integrity Initiative (See Appendix 1).

There were 241 reportable releases in 2001/02, of which 47 investigation reports were received for analysis, representing 21% of the total. These have been analysed according to the taxonomy presented in table 5 of last year's report. The following conclusions can be drawn from this sample.

4.1 Release site (see table 9)

4.1.1 Investigation Reports

Again pipework accounts for the majority of releases, 62%, this is comparable with last year's 61%. However, there are some differences within this grouping between this year's analysis and that of last year. A greater proportion of this year's release sites have been assigned to small bore pipework and associated connections, including instruments, 25% as opposed to 18% last year. Perhaps of more significance is the marked reduction in releases from pipe open ends, down from 16% to 4%. Valves were involved in 21% of releases, vessels 6% and pumps 6%.

Other findings:

- a) 70% of releases were cracks, splits or holes in the containment envelope. This is an increase compared to the 47% of the previous years.
- b) 23% of releases were from the body of the pipe, vessel or valve. This is in line with 21% for last year. Mostly these resulted from degradation of the containment envelope caused by degradation of material properties.
- c) 25% of releases were associated with small bore piping including instruments, the bulk of these were associated with connections.
- d) Flanges accounted for 15% of releases, which is exactly the same proportion as last year.
- e) 19% of releases were from seals or valve stems. This is an increase over last year's proportion of 14%.
- f) There were no hose releases in the sample investigated.

4.1.2 Comparison with full set of HCR data.

The information provided in the hydrocarbons release database also records the location of release albeit using a different coding framework from that used in OTO 2001 055 (see table 14). This confirms that in most respects the sample of investigated reports is representative of the location of releases for the whole set of 241 releases. Releases from instrument (22%) and pipework (22%) dominate. These results reflect the indication from the sample that there is a slight change towards instrument releases and away from pipework compared to last year's data.

There were only 12% of releases from valves in the full data set which is in line with last year's results and indicates that the sample of investigated reports has a higher proportion of these types of release (21%).

The other main difference is in relation to releases from flanges. The sample includes 15% of these releases which is a greater proportion than the whole 241 releases which only had 7% flange releases.

There were no hose releases investigated this year. However, 3% of the total releases were from hoses, this was in line with 4% of releases last year.

4.2 **Immediate causes** (see table 10)

4.2.1 Investigation Reports

As last year, the largest single cause was degradation of material properties which accounted for 28% of the incidents, comparable with last year's 26%. Incorrect installation at 21% and fatigue/vibration also 21% were the second largest contributors. Both of these are almost double last year's figures of 12% and 11% respectively, and more significant than corrosion/erosion which accounted for 13%, this is a drop compared to 19% last year. Procedural type causes were all less than 10%.

4.2.2 Comparison with full set of HCR data

A check against the full set of 241 releases on the HCR database shows good agreement for erosion/corrosion causes. The full set of data shows an even greater contribution from mechanical failure and wearout which together account for 36% of the total, whereas fatigue accounted for 12% of the total. Incorrectly fitted at 7% of the total is the most frequent of the procedural failures. Although the percentages differ between the sample and the full set of data, the two sets of data give the same indication of the most prevalent immediate causes, despite using different causation frameworks. One interesting result from this comparison is to confirm the finding that in this year's releases, a much smaller proportion were due to releases from open end of pipes or valves compared to last year. This is confirmed by the causes "left open" or "opened with hydrocarbon present" which accounted for 7% of releases. This is in line with the 10% of "open end" releases in the sample which is a reduction compared to the 20% of such releases occurring last year.

Degradation of material properties is taken to mean loss of integrity by failure of equipment that was originally fit for purpose and has been operated correctly. This includes failure of flange gaskets and valve packings and might be termed general "wear and tear". It excludes the more specific causes of failure such as corrosion, erosion, fatigue and vibration. Unlike last year, three of the four major releases had immediate causes of degradation of material properties and only one was due to operator error. Although four is too small a number to draw any far-reaching conclusions.

4.2.3 Immediate Cause versus Release Site:

When it comes to analysis of the most important release sites, the most prominent cause for flange leaks (15% of all releases) was incorrect installation in 60% of cases, which is a significant increase compared to last year. Degradation of material properties was much less significant at 15%. For small bore tubing and associated connections (25% of releases) fatigue accounts for 33% of causes, incorrect installation a further 25% and degradation of material properties 17%. This is in line with last year's findings although incorrect installation plays a more prominent role. Open ends only account for 10% of releases in this analysis. The causes are evenly distributed although most are procedural rather than hardware related, which is not really surprising.

4.2.4 Hardware versus Software

The immediate causes can be divided into hardware or software related as follows:

Hardware:

Degradation of material properties

Fatigue/ vibration

Internal corrosion

Erosion

62% of releases had hardware related immediate causes, of these the underlying causes were mainly inadequate inspection/condition monitoring in 48% of these incidents. The next most significant underlying cause was inadequate design (34%).

Software:

Incorrect installation

Operator error

Procedural violation

Inadequate isolation

Inadequate procedures

The remaining 38% of releases had software related immediate causes, of these the causes were mainly inadequate procedures (40% of these incidents), the next most frequent cause was inadequate compliance (28%).

4.3 Underlying causes (table 11)

4.3.1 Investigation Reports:

The underlying causes of many incidents are complex and more than one cause can be identified in many cases. When these are analysed independently of immediate cause, the largest contribution was from inadequate inspection/condition monitoring in 32% of investigated incidents, closely followed by inadequate design 30%. These are very similar to last year's figures of 28% and 29%. The next four most significant underlying causes were inadequate procedures in 23% of incidents, incorrect installation 15%, incorrect material specification/usage 13% and inadequate risk assessment 13%. Other underlying causes were identified in less than 10% of investigated incidents.

4.3.2 Comparison with full set of HCR data

Comparison with last year's analysis reveals that the same two underlying causes dominate but that there is a slightly different contribution from the other causes. Excessive workload, inadequate communication, outdated information and inadequate task specification again made little or no contribution.

4.4 Failed Safeguards (table 12)

As with last year's analysis, inspection/condition monitoring was the most prevalent failed safeguarding system that might have prevented the release of 30% of all incidents investigated. Of the remaining safeguarding systems, competency assurance was the next highest with corrosion/erosion monitoring and change control also featuring. Design review was less significant than in last year's analysis.

There was no identifiable pattern for major releases.

4.5 Additional Safeguards (table 13)

The UKOOA small bore piping guide continues to be relevant, in 23% of investigated incidents. But in this year's analysis, the flange verification scheme was less relevant, only in 4% of this sample.

4.6 Conclusions

The sample of investigated releases shows similar results to the analysis of a larger sample from last year. Where there are changes identified it is difficult to be certain that these are real differences or whether they arise from a different interpretation of some of the coding. However, this analysis indicates that important lessons can be learned from analysis of investigation reports, over and above the information that is available from the Hydrocarbons release database.

The results indicate that conclusions drawn from the previous analysis are still valid and therefore the focus of the process integrity intervention project should continue. In order to identify any real change in the causes of hydrocarbon releases, analysis

of a larger sample would be necessary which perhaps points to collection of more investigation reports during the remaining years of the project. This information would also be of use in demonstrating the impact of the intervention, not only in driving down the number of releases, but also in tackling some of the immediate and underlying causes.

4.7 HSE Process Integrity Initiatives.

Appendix 1 of this report outlines the framework for the OSD Process Integrity Initiative aimed at raising industry awareness of offshore hydrocarbon releases and the need for their reduction. The initiative is structured around 10 key elements that could contribute to the prevention of hydrocarbon releases. Not all elements are applicable to all installations and some elements are of lesser direct impact for releases for many installations. OSD have conducted process integrity inspections on manned production installations commencing in the year 2000.

To the end of 2002, inspection progress has been made on 87% of installations covered by the initiative. The greater activity has been on 7 of the 10 elements that have larger direct bearing on potential releases. These include issues such as process integrity management, documentation and change control, and design and operational issues including isolation & PTW, small bore pipework, plant protection systems and maintenance & verification of safety critical elements. Around half of all possible inspections across all installations in these 7 elements have been completed. Work has also progressed on the remaining elements.

HSE has kept the offshore industry informed of key findings emerging from inspections via joint HSE/industry workshops held at staged points throughout the project (Appendix 1). As information has been passed on, emphasis has moved towards the current position of development of remedial programmes by dutyholders to target their high risk areas and activities. During the coming year, HSE will be targeting efforts towards the poorest performing companies, as measured by the number of releases per manned production installation (see Table 15 in Section 5.0).

OSD will use the existing data on offshore hydrocarbon releases to target inspections on dutyholders and installations that appear to have, in recent years, the poorest performance. This is intended to focus inspection resources towards areas of highest risk, in line with HSE policy. The inspections will use analysis of incident investigations and other sources of information to identify topics for particular attention. Any findings of non-compliance with regulations that arise from the inspections will result in enforcement as set out in existing HSE and OSD policy.

5.0 TABLES

CONTENTS

(All single page tables unless noted otherwise)

- Table 1. Severity analysis**
- 2. Installation type/location versus release type & severity**
(2 pages incl.Notes)
 - 3. Ignitions: summary**
 - 4. Ignitions: details** (3 tables of 5, 6 and 5 pages, plus 1 page of notes)
 - 5. Means of detection: summary**
 - 6. Means of detection: other**
 - 7. Emergency actions versus release type & severity**
 - 8. Causation & operating mode versus release type & severity**
 - 9. Release site**
 - 10. Immediate causes**
 - 11. Underlying causes**
 - 12. Failed safeguarding system**
 - 13. Potential new/additional safeguards**
 - 14. Location from HCR database**
 - 15. Major/Significant release rates per manned Production Installation**

Table 1 : HYDROCARBON TYPE versus SEVERITY OF RELEASE

SEVERITY	HYD TYPE	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	TOTAL
MAJOR	LIQUID	1	4	1	2	3	1	2	0	0	0	14
	GAS	9	16	16	12	14	6	8	11	7	4	103
	2-PHASE	2	4	3	6	2	6	5	1	1	0	30
	TOTAL	12	24	20	20	19	13	15	12	8	4	147
SIGNIFICANT	LIQUID	12	32	53	30	40	40	31	36	28	28	330
	GAS	34	97	132	86	74	79	85	79	74	69	809
	2-PHASE	4	22	9	18	15	20	18	12	15	12	145
	TOTAL	50	151	194	134	129	139	134	127	117	109	1284
MINOR	LIQUID	9	53	56	34	54	37	53	46	79	75	496
	GAS	10	40	51	24	20	29	31	46	60	44	355
	2-PHASE	0	3	4	0	4	0	1	3	6	9	30
	TOTAL	19	96	111	58	78	66	85	95	145	128	881
ALL	LIQUID	22	89	110	66	97	78	86	82	107	103	840
	GAS	53	153	199	122	108	114	124	136	141	117	1267
	2-PHASE	6	29	16	24	21	26	24	16	22	21	205
	TOTAL	81	271	325	212	226	218	234	234	270	241	2312

Table 2 : INSTALLATION TYPE/LOCATION versus RELEASE TYPE & SEVERITY**NOTES :**

1. Data covers the period from 1st October, 1992 to 31st March, 2002.
2. Northern Area (N) = 59° N Latitude and above.
Central Area (C) = between 56° N Latitude and 59° N Latitude.
Southern Area (S) = 56° N Latitude and below. (incl. Irish Sea and English Channel)
3. COUNT of fixed installation types comprises all installations of that type operating in that area of the UKCS as at 31st March 2002.
4. COUNT of mobile installations comprises known fleet operating in UK waters during 2001/2002.
5. COUNT of subsea installations comprises all known installations that have operated in the UKCS as at 31 March 2002, excluding single well satellite/tie-backs. Because of the small number of subsea releases, no calculation of subsea installation years has been undertaken.
6. YEARS = estimated number of installation years (as at 31st March 2002) including those for installations abandoned since 1st October 1992.
7. FPS includes FPSO and FSU.
8. Maj = Major release
Sig = Significant release
Min = Minor release
(Please refer to APPENDIX 2 for definitions of severity)
9. Installation Failure rates (see Section 3.6) are calculated by dividing Release Type TOTALS by Installation YEARS.

Table 2: INSTALLATION TYPE/LOCATION versus RELEASE TYPE AND SEVERITY

INSTALLATION TYPE		01/02 POPULATION			RELEASE TYPE												TOTALS
		COUNT	YEARS	of TOTAL RELEASES	LIQUIDS			GAS			2-PHASE						
					Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min	
(1) FIXED = 2229 or 96.4 % of TOTAL RELEASES																	
NORTHERN FIXED	MANNED	31	281.6		3	82	157	21	256	117	9	61	19				725
	NUI	3	28.5		0	0	0	0	0	0	0	0	0				0
CENTRAL FIXED	MANNED	43	339.8		1	106	195	30	258	114	7	52	6				769
	NUI	11	77.8		0	0	3	0	0	2	0	1	0				6
SOUTHERN FIXED	MANNED	76	661.2		2	30	47	18	107	40	0	3	0				247
	NUI	95	747.0		2	22	8	20	48	11	2	2	0				115
FPS		25	138.9		2	70	75	10	116	53	7	22	5				360
SUBSEA		40	-		0	0	0	1	3	1	2	0	0				7
TOTAL		324	-		10	310	485	100	788	338	27	141	30				2229
(2) MOBILES = 83 or 3.6 % of TOTAL RELEASES																	
SEMI-SUB	N				3	8	2	0	3	0	1	1	0				18
	C	21	159.3		0	6	3	1	5	2	2	3	0				22
	S				0	0	0	0	0	0	0	0	0				0
JACK-UP	N				0	0	0	0	0	0	0	0	0				0
	C	16	127.3		1	0	2	2	2	1	0	0	0				8
	S				0	5	5	0	10	15	0	0	0				35
TOTAL		37	-		4	19	12	3	20	18	3	4	0				83
GRAND TOTAL		361	-		14	329	497	103	808	356	30	145	30				2312

Table 3 : IGNITIONS SUMMARY ⁽¹⁾

YEAR	DETAILS	HYDROCARBON TYPE & SEVERITY									TOTAL
		LIQUIDS			GAS			2-PHASE			
		Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min	
1992/93 ⁽²⁾	IGNITIONS RELEASES % ⁽³⁾	0	1	2	0	1	0	0	0	0	4
		1	12	9	9	34	10	2	4	0	81
		0	8.3	22.2	0	2.9	0	0	0	0	4.9
1993/94	IGNITIONS RELEASES % ⁽³⁾	0	7	10	0	4	5	0	0	0	26
		4	32	53	16	97	40	4	22	3	271
		0	21.9	18.9	0	4.1	12.5	0	0	0	9.6
1994/95	IGNITIONS RELEASES % ⁽³⁾	0	5	15	0	1	3	0	0	0	24
		1	53	56	16	132	51	3	9	4	325
		0	9.4	26.8	0	0.8	5.9	0	0	0	7.4
1995/96	IGNITIONS RELEASES % ⁽³⁾	0	1	6	0	1	1	0	0	0	9
		2	30	34	12	86	24	6	18	0	212
		0	3.3	17.6	0	1.2	4.2	0	0	0	4.2
1996/97	IGNITIONS RELEASES % ⁽³⁾	0	4	10	0	2	2	0	0	0	18
		3	40	54	14	74	20	2	15	4	226
		0	10	18.5	0	2.7	10	0	0	0	8
1997/98	IGNITIONS RELEASES % ⁽³⁾	0	0	3	0	3	3	0	0	0	9
		1	40	37	6	79	29	6	20	0	218
		0	0	8.1	0	3.8	10.3	0	0	0	4.1
1998/99	IGNITIONS RELEASES % ⁽³⁾	0	3	9	0	3	3	0	0	0	18
		2	31	53	8	85	31	5	18	1	234
		0	9.7	17	0	3.5	9.7	0	0	0	7.7
1999/00	IGNITIONS RELEASES % ⁽³⁾	0	2	4	0	0	4	0	0	0	10
		0	36	46	11	79	46	1	12	3	234
		0	5.6	8.7	0	0	8.7	0	0	0	4.3
2000/01	IGNITIONS RELEASES % ⁽³⁾	0	1	8	0	1	3	0	0	0	13
		0	28	79	7	74	60	1	15	6	270
		0	3.6	10.1	0	1.4	5.0	0	0	0	4.8
2001/02	IGNITIONS RELEASES % ⁽³⁾	0	0	10	0	1	1	0	0	0	12
		0	28	75	4	69	44	0	12	9	241
		0	0	13.3	0	1.4	2.3	0	0	0	5.0
ALL YEARS	IGNITIONS RELEASES % ⁽³⁾	0	24	77	0	17	25	0	0	0	143
		14	329	497	103	808	356	30	145	30	2312
		0	7.3	15.5	0	2.1	7.0	0	0	0	6.2

Notes:

- (1) Total numbers in Hydrocarbon releases database for the period 01-10-92 TO 31-03-02
- (2) 6 months period from 01-10-92 to 31-03-93
- (3) No. of Ignitions ÷ No. of Releases = % Ignited
NB: This is **NOT** an Ignition probability
- (4) Full details of all Ignitions are given in Tables 7 a, b, and c.

Table 4 : IGNITION DETAILS

NOTES :

- 1. The following table contains detailed information on all of the ignitions which have been reported and recorded in the Hydrocarbon Releases Database between 1 October, 1992 and 31 March, 2002.**
- 2. The table is in three parts :**
 - (a) Release parameters**
 - (b) Mode of Operation/ignition sources and sequences**
 - (c) Detection modes and emergency actions**
- 3. Each ignition has a reference number, and so it is possible to read all the details supplied for any one incident by referring to its unique reference number in each of the three parts.**

Table 4(a) : IGNITIONS - RELEASE PARAMETERS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	System	Type* of Installation	Gravity/ Density (kgs/m3)	Amount Released (kgs)	@Actual Pressure (barg)	Release Duration (mins)	Equivalent Hole** (mm)
1992/93	1	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	CF	799.12	6.00	3.72	1.00	3.00
	2	Oil		Minor	Export, Oil	CF	799.12	47.90	0.00	5.00	508.00
	3	Oil		Significant	Separation, Oil Test	CF	839.08	266.78	4.14	15.00	N/A
	4	Gas		Significant	Utilities, Gas, Fuel Gas	SF	9.00	54.00	10.00	30.00	5.00
Total = 4											
1993/94	5	Non Process	Lub Oil	Significant	Gas Compression	CF	876.04	876.04	3.45	20.00	25.00
	6	Non Process	Lub Oil	Minor	Gas Compression	CF	799.12	3.00	5.00	5.00	1.00
	7	Non Process	Lub Oil	Minor	Gas Compression	CF	799.12	0.16	5.00	5.00	1.00
	8	Non Process	Methanol	Significant	Manifold, Other, (Condensate, Methanol, Etc)	SMJ	799.12	525.00	0.00	5.00	50.80
	9	Non Process	Methanol	Minor	Processing, Gas, Chemical Injection	NF	799.12	0.80	0.00	5.00	25.40
	10	Non Process	Glycol	Significant	Processing, Gas, Dehydration	SF	1123.76	766.20	0.07	300.00	10.00
	11	Non Process	Glycol	Significant	Processing, Gas, Dehydration	SF	799.12	588.00	1.03	10.00	12.70
	12	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	7.26	0.00	10.00	N/A
	13	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	3.63	0.00	0.50	N/A
	14	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	18.16	0.00	10.00	6.70
	15	Non Process	Diesel	Significant	Utilities, Oil, diesel	CF	799.12	132.00	0.00	5.00	25.40
	16	Non Process	Heat Trans Oil	Significant	Utilities, Oil, Heat Transfer Oil	CF	799.12	1044.00	10.34	10.00	9.53
	17	Non Process	Lub Oil	Minor	Utilities, Oil, Power Gen Turbines	CF	877.03	1.00	3.93	2.00	1.00
	18	Oil		Significant	Separation, Oil Production	CF	839.08	666.94	4.14	20.00	N/A
	19	Oil		Minor	Separation, Oil Test	CF	799.12	3.63	0.00	1.00	12.70
	20	Condensate		Minor	Flare, HP	CF	599.34	10.00	10.00	5.00	76.20
	21	Condensate		Minor	Processing, Gas, LPG/Condensate	SF	599.34	27.00	0.00	5.00	12.70
	22	Gas		Minor	Flowlines, Oil	CF	74.60	0.60	75.86	1.00	1.00
	23	Gas		Minor	Utilities, Gas, Fuel Gas	NF	12.70	0.03	12.41	0.25	1.00
	24	Gas		Significant	Utilities, Gas, Fuel Gas	CF	1.60	153.00	1.00	17.00	25.40
	25	Gas		Significant	Utilities, Gas, Fuel Gas	SF	1.60	210.00	1.00	10.00	38.10
	26	Gas		Significant	Vent, HP	SF	0.78	41.10	0.00	0.25	152.40
	27	Gas		Minor	Vent, HP	SF	0.80	0.04	0.00	6.00	1.00
	28	Gas		Minor	Vent, HP	SF	0.80	0.06	0.00	8.00	1.00
	29	Gas		Minor	Vent, HP	SF	0.80	0.06	0.00	8.00	1.00
	30	Gas		Significant	Vent, LP	SF	0.80	210.00	0.00	5.00	76.20
Total = 26											
1994/95	31	Non Process	Lub Oil	Minor	Export, Oil	NF	799.12	36.00	100.00	10.00	1.00

*where C=Central, S=Southern, N=Northern areas, F=Fixed, MS=Semisub, MJ=Jackup

**N/A signifies holesize not applicable to mode of release

Table 4(a) : IGNITIONS - RELEASE PARAMETERS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	System	Type* of Installation	Gravity/ Density (kgs/m3)	Amount Released (kgs)	@Actual Pressure (barg)	Release Duration (mins)	Equivalent Hole** (mm)
	32	Non Process	Lub Oil	Minor	Export, Oil	CF	799.12	3.63	0.00	5.00	N/A
	33	Non Process	Lub Oil	Significant	Gas Compression	CF	799.12	964.80	70.00	2.00	12.70
	34	Non P Process	Lub Oil	Minor	Gas Compression	SF	799.12	3.00	5.00	5.00	1.00
	35	Non P Process	Lub Oil	Minor	Gas Compression	NF	799.12	3.00	5.00	5.00	1.00
	35	Non P Process	Lub Oil	Minor	Gas Compression	NF	799.12	3.00	5.00	5.00	1.00
	36	Non P Process	Diesel	Minor	Gas Compression	CF	799.12	7.26	5.00	30.00	N/A
	37	Non P Process	Glycol	Minor	Processing, Gas, Chemical Injection	SF	799.12	6.00	5.00	2.00	2.00
	38	Non P Process	Glycol	Minor	Processing, Gas, Dehydration	SF	1048.85	4.30	0.07	36.00	1.00
	39	Non Process	Glycol	Minor	Processing, Gas, Dehydration	SF	799.12	22.00	1.03	60.00	1.00
	40	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	SMJ	799.12	18.00	30.00	10.00	1.00
	41	Non Process	Fuel Oil	Significant	Utilities, Gas, Power Gen Turbines	NMS	799.12	141.00	10.00	5.00	5.00
	42	Non Process	Diesel	Minor	Utilities, Oil, Diesel	NF	799.12	3.63	0.00	30.00	N/A
	43	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	CF	799.12	0.30	4.80	1.00	1.00
	44	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	CF	799.12	10.90	4.83	3.00	1.80
	45	Non Process	Heli-Fuel	Minor	Utilities, Oil, Heli-Fuel/ Jet-Fuel	CMJ	799.12	0.60	0.00	15.00	1.00
	46	Non Process	Diesel	Significant	Utilities, Oil, Power Gen Turbines	CF	835.00	835.00	30.00	3.00	11.80
	47	Non Process	Diesel	Significant	Utilities, Oil, Power Gen Turbines	CF	835.00	835.00	30.00	3.00	11.80
	48	Oil		Significant	Utilities, Oil, Power Gen Turbines	NMS	799.12	7291.20	250.00	2.00	25.40
	49	Condensate		Minor	Flare, HP	CF	799.12	10.00	0.00	5.00	N/A
	50	Condensate		Minor	Processing, Gas, Sour (H2S/CO2) Treatment	CF	599.34	5.99	5.00	0.50	25.40
	51	Gas		Significant	Flare, HP	NF	1.50	40.50	0.79	165.00	N/A
	52	Gas		Minor	Gas Compression	NF	4.90	0.20	5.00	5.00	1.00
	53	Gas		Minor	Utilities, Oil, Heat Transfer Oil	NF	9.00	0.10	10.00	1.00	1.00
	54	Gas		Minor	Vent, LP	NF	1.00	0.10	0.01	1.00	3.90
	Total = 24										
1995/96	55	Non Process	Lub Oil	Minor	Gas Compression	CF	859.05	0.20	0.00	15.00	1.00
	56	Non P Process	Lub Oil	Significant	Gas Compression	NF	869.04	60.83	10.00	7.00	2.70
	57	Non P Process	Glycol	Minor	Processing, Gas, Dehydration	CF	799.12	29.30	0.00	720.00	1.00
	58	Non P Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	CF	835.00	0.84	30.00	5.00	1.00
	59	Non Process	Diesel	Minor	Utilities, Oil, diesel	CF	835.00	0.84	30.00	0.08	2.30
	60	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	NF	799.12	0.08	5.00	1.00	1.00
	61	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	CF	884.03	7.00	0.00	16.00	38.10
	62	Gas		Significant	Processing, Gas, LPG/Condensate	SF	1.20	14.40	0.69	8.00	12.70

*where C=Central, S=Southern, N=Northern areas, F=Fixed, MS=Semisub, MJ=Jackup

**N/A signifies holesize not applicable to mode of release

Table 4(a) : IGNITIONS - RELEASE PARAMETERS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	System	Type* of Installation	Gravity/ Density (kgs/m3)	Amount Released (kgs)	@Actual Pressure (barg)	Release Duration (mins)	Equivalent Hole** (mm)
	63	Gas		Minor	Vent, LP	CF	1.00	0.50	0.00	2.00	6.00
Total = 9											
1996/97	64	Non Process	Lub Oil	Minor	Export, Oil	CF	799.12	0.40	17.24	7.00	1.00
	65	Non Process	Lub Oil	Significant	Utilities, Gas, Power Gen Turbines	CF	799.12	79.91	2.40	5.00	5.40
	66	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	CF	799.12	1.60	9.00	1.30	1.00
	67	Non Process	Diesel	Minor	Utilities, Oil, Diesel	SMJ	849.07	0.85	2.00	3.00	1.00
	68	Non Process	Diesel	Minor	Utilities, Oil, Diesel	NF	849.07	0.85	2.07	2.00	1.00
	69	Non Process	Diesel	Minor	Utilities, Oil, Diesel	NF	799.12	0.80	0.00	2.00	12.70
	70	Non Process	Diesel	Significant	Utilities, Oil, Diesel	NF	799.12	150.00	103.45	8.00	12.70
	71	Non Process	Diesel	Significant	Utilities, Oil, Diesel	NF	799.12	70.00	103.45	32.00	12.70
	72	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.40	23.00	1.00	1.00
	72	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.40	23.00	1.00	1.00
	73	Non Process	Lub Oil	Minor	Utilities, Oil, Diesel	CF	799.12	0.80	0.00	20.00	1.00
	74	Non Process	Lub Oil	Minor	Gas Compression	NF	799.12	15.98	1.75	1.00	N/A
	75	Oil		Significant	Flare, HP	CF	799.12	127.04	0.17	3.00	N/A
	76	Condensate		Minor	Gas Compression	SF	599.34	2.72	0.00	0.50	N/A
	77	Condensate		Minor	Import, Gas	SF	699.23	0.70	0.00	1.00	1.00
	78	Gas		Minor	Drains, Closed	CF	0.70	0.07	0.00	2.00	N/A
	79	Gas		Minor	Drilling, Development, Gas Well, <100 Metres	SF	0.80	0.80	0.00	1.00	9.10
	80	Gas		Significant	Processing, Gas, Sour (H2S/CO2) Treatment	CF	0.80	2.00	0.00	1.00	203.20
	81	Gas		Significant	Utilities, Gas, Power Gen Turbines	NF	9.00	5.00	10.00	2.00	N/A
Total = 18											
1997/98	82	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.80	50.00	2.00	1.00
	83	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	10.00		16.70	3.00
	84	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	5.00	68.97	5.00	1.00
	85	Gas		Minor	Drilling, Development, Gas Well, <100 Metres	SF	68.25	0.15	82.89	0.25	1.00
	86	Gas		Minor	Export, Oil	CF	0.80	0.90	0.00	0.50	25.40
	87	Gas		Minor	Import, Oil	NF	0.85	0.10	0.00	0.10	25.00
	88	Gas		Significant	Metering, Oil	NF	0.70	6.00	0.00	5.00	12.70
	89	Gas		Significant	Processing, Gas, LPG/Condensate	NF	52.20	121.90	49.00	300.00	1.00
	90	Gas		Significant	Utilities, Gas, Fuel Gas	NF	9.00	25.50	10.00	0.50	25.40
Total = 9											

*where C=Central, S=Southern, N=Northern areas, F=Fixed, MS=Semisub, MJ=Jackup

**N/A signifies holesize not applicable to mode of release

Table 4(a) : IGNITIONS - RELEASE PARAMETERS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	System	Type* of Installation	Gravity/ Density (kgs/m3)	Amount Released (kgs)	@Actual Pressure (barg)	Release Duration (mins)	Equivalent Hole** (mm)
1998/99	91	Non Process	Lub Oil	Significant	Gas Compression	NF	869.04	465.00	100.00	5.00	5.00
	92	Non Process	Glycol	Minor	Processing, Gas, Dehydration	SF	799.12	1.20	10.34	1.00	1.00
	93	Non Process	Lub Oil	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	7.10	1.75	15.00	1.00
	94	Non Process	Lub Oil	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	2.40	1.75	5.00	1.00
	95	Non Process	Lub Oil	Significant	Utilities, Gas, Power Gen Turbines	CF	799.12	180.00	1.75	15.00	5.00
	96	Non Process	Hydraulic Oil	Significant	Utilities, Gas, Power Gen Turbines	CF	799.12	163.82	81.00	5.00	3.20
	97	Non Process	Lub Oil	Minor	Utilities, Gas, Power Gen Turbines	CF	799.12	9.00	3.00	15.00	1.00
	98	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.05	5.00	0.08	1.00
	99	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.80	82.80	3.00	1.00
	100	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	0.00	9.00	5.00	1.00
	101	Oil		Minor	Processing, Gas, Dehydration	NF	799.12	5.00	0.00	1.00	N/A
	102	Condensate		Minor	Processing, Gas, Dehydration	CF	599.34	0.20	0.00	5.00	N/A
	103	Gas		Minor	Drains, Closed	NF	0.80	0.90	0.00	0.50	457.20
	104	Gas		Significant	Export, Oil	CF	0.68	1.00	0.00	0.50	N/A
	105	Gas		Minor	Separation, Oil Test	CF	0.80	0.10	0.00	0.50	N/A
	106	Gas		Significant	Utilities, Gas, Power Gen Turbines	CF	9.00	5.00	10.00	2.00	N/A
	107	Gas		Significant	Vent, HP	NF	0.75	0.03	0.00	5.00	1.00
	108	Gas		Minor	Vent, LP	NF	0.80	0.10	0.00	13.80	1.00
Total = 18											
1999/00	109	Non Process	Diesel	Minor	Utilities, Gas, Power Gen Turbines	NF	799.12	1.00	5.00	4.00	N/A
	110	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	11.99	124.00	4.50	1.40
	111	Non Process	Diesel	Minor	Utilities, Oil, Diesel	NF	799.12	1.60	3.45	10.00	1.00
	112	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	31.96	124.00	4.00	1.40
	113	Non Process	Lub Oil	Significant	Utilities, Oil, Power Gen Turbines	NF	849.07	85.00	10.00	20.00	1.90
	114	Condensate		Significant	Flare, LP	CF	471.00	100.00	8.50	2.00	N/A
	115	Gas		Minor	Export, Oil	CF	0.80	0.80	0.00	1.00	9.10
	116	Gas		Minor	Manifold, Oil	CF	1.20	0.09	0.14	10.00	1.00
	117	Gas		Minor	Utilities, Gas, Fuel Gas	NF	3.20	0.01	2.62	0.06	N/A
	118	Gas		Minor	Utilities, Gas, Power Gen Turbines	SF	2.90	0.00	2.76	0.50	3.50
Total = 10											
2000/01	119	Non Process	Lub Oil	Minor	Utilities, Oil, Diesel	CF	799.12	0.40	5.00	2.50	1.00
	120	Non Process	Diesel	Minor	Gas Compression	CF	799.12	15.98	5.00	0.50	6.30
	121	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	4.00	123.99	0.42	1.60
	122	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	2.00	40.00	2.00	1.00
	123	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	799.12	3.40	110.00	5.00	1.00

*where C=Central, S=Southern, N=Northern areas, F=Fixed, MS=Semisub, MJ=Jackup

**N/A signifies holesize not applicable to mode of release

Table 4(a) : IGNITIONS - RELEASE PARAMETERS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	System	Type* of Installation	Gravity/ Density (kgs/m ³)	Amount Released (kgs)	@Actual Pressure (barg)	Release Duration (mins)	Equivalent Hole** (mm)
	124	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	849.07	0.42	0.07	1.30	1.00
	125	Non Process	Lub Oil	Minor	Gas Compression	CF	886.02	44.30	80.99	5.00	1.60
	126	Non Process	Diesel	Significant	Utilities, Gas, Power Gen Turbines	NF	799.12	79.91	0.55	1.00	17.20
	127	Oil		Minor	Export, Oil	NF	799.12	0.20	0.00	1.00	2.20
	128	Gas		Minor	Utilities, Gas, Fuel Gas	CF	19.90	0.70	17.00	6.00	1.00
	129	Gas		Significant	Export, Gas	SF	85.00	1.80	103.45	3.00	1.00
	130	Gas		Minor	Gas Compression	NF	0.80	0.03	0.00	0.25	4.10
	131	Gas		Minor	Utilities, Gas, Fuel Gas	CF	20.00	0.02	20.69	0.16	1.00
Total = 13											
2001/02	132	Condensate		Minor	Flare, LP	SMJ	798.40	57.11	1.00	1.00	11.54
	133	Gas		Significant	Vent, LP	NF	0.88	2.30	0.01	30.00	999
	134	Gas		Minor	Well, Oil Production, Surface	CF	0.82	0.90	0.01	1.00	999
	135	Non Process	Diesel	Minor	Utilities, Oil, Diesel	CF	860.00	6.00	3.00	3.00	1.76
	136	Non Process	Hydraulic Oil	Minor	Gas Compression	CF	798.40	3.43	0.01	6.00	4.00
	137	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	CF	798.40	0.80	0.01	5.00	2.12
	138	Non Process	Lub Oil	Minor	Utilities, Oil, Diesel	CF	0.80	0.50	3.80	1.00	0.85
	139	Non Process	Lub Oil	Minor	Utilities, Oil, Power Gen Turbines	CF	798.40	3.75	0.49	60.00	0.50
	140	Non Process	Lub Oil	Minor	Utilities, Oil, Power Gen Turbines	CF	798.40	3.75	0.49	60.00	0.50
	141	Non Process	Lub Oil	Minor	Utilities, Oil, Power Gen Turbines	NF	798.40	1.00	1.75	1.00	2.06
	142	Non Process	Lub Oil	Minor	Utilities, Oil, Heat Transfer Oil	NF	798.40	1.00	83.00	1.00	999
	143	Non Process	Lub Oil	Minor	Utilities, Oil, Diesel	NF	0.80	0.08	2.50	1.00	0.38
Total = 12											

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
1992/93	1	Non P Process	Lub Oil	Minor	Testing	Impinging on Hot Exhaust Manifold.	30	1			
	2	Oil		Minor	Construction Hot Work	Sparks from welding operation ignited hydrocarbons.					1
	3	Oil		Significant	Start-up	The HP flare, which was lit at the time of oil carryover.					1
	4	Gas		Significant	Shutting down	Following shutdown to platform gas turbine driven generator, caused by loss of fuel gas pressure, fire started inside turbines inlet air plenum.		1			
Total = 4											
1993/94	5	Non P Process	Lub Oil	Significant	Testing	Hot surface on the turbine exhaust pipework.		1			
	6	Non P Process	Lub Oil	Minor	Normal Production	Hot surface of power turbine exhaust cowling.	60	1			
	7	Non P Process	Lub Oil	Minor	Start-up	On restart, after shutdown, natural temperature rise flashed off pool of oil.	30				1
	8	Non Process	Methanol	Significant	Drilling	Fluid ran down to a beam where a welder was working, welders sparks ignited release.					1
	9	Non Process	Methanol	Minor	Maintenance Hot Work	Hot welding spelter falling from above. Hot work had been suspended, as was reinstated after drain down. At this point spillage occurred and was ignited.					1
	10	Non Process	Glycol	Significant	Normal Production	Reboiler flame itself. The reboiler tube fails allowing glycol into contact with the heat source, ie the flame.				1	2
	11	Non Process	Glycol	Significant	Normal Production	Glocol entered fire tube.					1
	12	Non Process	Diesel	Minor	Reinstatement	Diesel in turbine exhaust space ignited by hot gases of combustion.					1
	13	Non Process	Diesel	Minor	Reinstatement	Ignited by burning gas / exhaust gases.		1			
	14	Non Process	Diesel	Minor	Reinstatement	Hot exhaust gases and hot surface caused ignition of diesel fuel in duct.					1
	15	Non Process	Diesel	Significant	Maintenance Cold Work	Hot surface of diesel engine exhaust diffuser.	4800				1
	16	Non Process	Heat Trans Oil	Significant	Testing	Oil reached ignition temperature upon contact with a hot, unlagged flange.					1
	17	Non Process	Lub Oil	Minor	Maintenance Cold Work	Vaporised oil ignited from hot turbine exhaust.	180				1
	18	Oil		Significant	Start-up	Ignition source was flare system, which was lit at the time of the carryover		1			
	19	Oil		Minor	Maintenance Cold Work	Possibly static electricity from container and/or from operators clothing.		1			
	20	Condensate		Minor	Start-up	Gas condensate spilled onto flare tip platform and ignited.					1
	21	Condensate		Minor	Construction Hot Work	Welder cutting into redundant pipework.					1
	22	Gas		Minor	Maintenance Hot Work	Welders spark from hot work site adjacent to (and above) the leak. This produced a 'gas ring' type of flame, - steady blue circular flame, two or three inches high.				1	
	23	Gas		Minor	Inspection	Spark from a 24 volt lead going to earth.		1			

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
	24	Gas		Significant	Start-up	Hot gases ignited in exhaust stack.			1		
	25	Gas		Significant	Shut Down	Hot exhaust stack.			1		
	26	Gas		Significant	Construction Hot Work	Local welding activity.		1			
	27	Gas		Minor	Normal Production	Snow squall - lightning.		1			
	28	Gas		Minor	Normal Production	Snow/sleet squall - lightning.		1			
	29	Gas		Minor	Normal Production	Sleet squall - lightning.		1			
	30	Gas		Significant	Normal Production	Lightning strike.			1		
Total = 26											
1994/95	31	Non Process	Lub Oil	Minor	Reinstatement	Damaged seal ring blocked circulation of seal oil, causing localised heating.					1
	32	Non Process	Lub Oil	Minor	Construction Hot Work	Stray welding spark from work ongoing.					1
	33	Non Process	Lub Oil	Significant	Normal Production	Hot surfaces of running machinery within turbine enclosure. (Particularly exhaust system)		1			
	34	Non Process	Lub Oil	Minor	Normal Production	Hot exhaust duct.					1
	35	Non Process	Lub Oil	Minor	Start-up	Lub oil mist ignited on hot surface. (Turbine output shaft)				1	
	36	Non Process	Diesel	Minor	Reinstatement	Exhaust gases.		2	1		
	37	Non Process	Glycol	Minor	Construction Hot Work	Welding work in progress.				1	
	38	Non Process	Glycol	Minor	Start-up	Mechanical tube failure led to glycol ignition inside fire tube. Ignited glycol burnt the flame arrestor which allowed burning glycol to exit the reboiler and drop to the deck with a resultant pool fire.					1
	39	Non Process	Glycol	Minor	Normal Production	Flame was present in addition to normal burner flame in central fire tube of regenerator.				1	
	40	Non Process	Diesel	Minor	Normal Production	Hot surface.					1
	41	Non Process	Fuel Oil	Significant	Normal Production	Burst line on no.1 engine spraying fuel onto no.4 engine exhaust manifold		1			2
	42	Non Process	Diesel	Minor	Reinstatement	Excess diesel ignited in the transition duct (wet start on a hot engine) causing explosion and flame migration into engine compartment due to diesel drain in duct being partially blocked.		2	1		
	43	Non Process	Lub Oil	Minor	Testing	Turbocharger hot surface.		1			
	44	Non Process	Lub Oil	Minor	Normal Production	Hot surface of pump body had apparently ignited contaminants within the perfectio fluid.		1			
	45	Non Process	Heli-Fuel	Minor	Maintenance Cold Work	Heli-fuel made contact with engine exhausts.		1			
	46	Non Process	Diesel	Significant	Normal Production	Hot surface of gas turbine.					1
	47	Non Process	Diesel	Significant	Normal Production	Hot surface of machine.					1

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
	48	Oil		Significant	Drilling	Fuel pipe fractured on no.1 diesel, spraying fuel onto no.4 engine. No.4 engine exhaust manifold caused fuel to ignite.		1			
	49	Condensate		Minor	Construction Cold Work	Flare tip ignited condensate/vapour causing internal explosions within the flare system. A series of explosions resulted. (Approx. 12 in number)			1		
	50	Condensate		Minor	Sampling	Condensate ignited due to electrostatic source. (Unsatisfactory earthing bond)		1			
	51	Gas		Significant	Normal Production	A series of explosions caused by ignition of low volume, low pressure, gas combined with air and inert gases from adjacent system. Flare itself was source of ignition.		1	2		
	52	Gas		Minor	Start-up	Internal combustion of extraneous material/gas in exhaust ducting.			1		
	53	Gas		Minor	Construction Hot Work	Sparks from welding of pipe supports above.				1	
	54	Gas		Minor	Maintenance Hot Work	Wind blown sparks from 'burning' hot work approx. 10ft from ignition.				1	
Total = 24											
1995/96	55	Non Process	Lub Oil	Minor	Normal Production	The heat from exhaust was sufficient to cause a small flash fire when the lagging was disturbed during damping down /removal.		1			
	56	Non Process	Lub Oil	Significant	Normal Production	Hot surface of exhaust ducting or power turbine.	30	1			2
	57	Non Process	Glycol	Minor	Normal Production	Not known - surface temp of still column, 180 oC.	715			1	
	58	Non Process	Diesel	Minor	Reinstatement	Hot surface of machine.		1			
	59	Non Process	Diesel	Minor	Reinstatement	Hot surface of machine.		1			
	60	Non Process	Lub Oil	Minor	Reinstatement	Turbine exhaust collector.		1			
	61	Non Process	Lub Oil	Minor	Testing	Suspect heat from engine turbocharger.		1			
	62	Gas		Significant	Construction Hot Work	Flame from burning torch. (Oxyacetylene)		1			
	63	Gas		Minor	Construction Hot Work	Sparks from welding operations.				1	
Total = 9											
1996/97	64	Non Process	Lub Oil	Minor	Reinstatement	Heat generated between the rotating stationary mechanical seal faces was the source of ignition.		1			
	65	Non Process	Lub Oil	Significant	Shutting Down	Hot metal surface of turbine casing.	300	1			
	66	Non Process	Diesel	Minor	Testing	Thought to be hot surface of burner inlet pipework.		1			
	67	Non Process	Diesel	Minor	Normal Production	Exhaust of number one main engine.		1			
	68	Non Process	Diesel	Minor	Normal Production	High temperature on top of caterpillar engine.	60	1			
	69	Non Process	Diesel	Minor	Maintenance Cold Work	Flash fire on hot turbine exhaust.		1			

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
	70	Non Process	Diesel	Significant	Start-up	Fire caused by ignition of some burners while diesel fuel from the unit burner poured into transition cone and eventually ignited.	480				1
	71	Non Process	Diesel	Significant	Reinstatement	Excess liquid fuel ignited by gas burners.	1620				1
	72	Non Process	Diesel	Minor	Start-up	Residual heat.	45	1			
	73	Non Process	Lub Oil	Minor	Normal Production	Leaking engine exhaust and oil from leaking lube oil lines along with high temperatures.	1200	1			
	74	Non Process	Lub Oil	Minor	Reinstatement	Lub oil/water wash fluid contact with hot exhaust.	60				1
	75	Oil		Significant	Start-up	This was a flaring incident, therefore no actual ignition occurred. A flame was already present.	60	1			
	76	Condensate		Minor	Start-up	Condensate heavy ends in fuel. Detected by heat detector causing shutdown.		1			
	77	Condensate		Minor	Construction Cold Work	While removing a check valve from 12" flowline using a 110 volt grinder to remove the bolts.					1
	78	Gas		Minor	Maintenance Hot Work	Oxyacetylene burning torch.		1			
	79	Gas		Minor	Maintenance Hot Work	Gas ignition caused by welding torch at wellhead.		1			
	80	Gas		Significant	Maintenance Hot Work	Welding operations.		1			
	81	Gas		Significant	Start-up	Unspent gas entered the exhaust resulting in combustion and overpressure within the exhaust ducting.			1		
Total = 18											
1997/98	82	Non Process	Diesel	Minor	Reinstatement	Hot turbine surface.		1			
	83	Non Process	Diesel	Minor	Maintenance Hot Work	Sparks from welding on the process deck above dripping through to the marine deck.				1	
	84	Non Process	Diesel	Minor	Start-up	Hot turbine casing.	240	1			
	85	Gas		Minor	Drilling	Cutting torch.				1	
	86	Gas		Minor	Maintenance Hot Work	Welding Equipment.		1			
	87	Gas		Minor	Sampling	Static, caused by poor electrical continuity of earth strap.		1			
	88	Gas		Significant	Maintenance Hot Work	Arc welding of flange to pipe stub.			1	2	
	89	Gas		Significant	Normal Production	Spark from damaged trace heating cable.	9999				1
	90	Gas		Significant	Start-up	Excess gas ignited by burners.	30		1		
Total = 9											
1998/99	91	Non Process	Lub Oil	Significant	Start-up	Heat from heat exhaust ignited oil saturated lagging.	3600	1			
	92	Non Process	Glycol	Minor	Normal Production	Glycol entered the boiler flame tube and ignited.		1			
	93	Non Process	Lub Oil	Minor	Maintenance Cold Work	Turbine exhaust (two UV flame detectors activated		1			

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
	94	Non Process	Lub Oil	Minor	Shut Down	and CO2 manually discharged). Turbine had been shutdown for approx 15 minutes prior to alarm. Turbine exhaust - single UV flame detection (alarm on central control room fire and gas panel). CO2 operated manually by production operator. It is believed that a small fire was caused by oil coming in contact with the hot exhaust.	15	1			
	95	Non Process	Lub Oil	Significant	Normal Production	Hot surface.	15	1			
	96	Non Process	Hydraulic Oil	Significant	Normal Production	Not Known.	60			1	
	97	Non Process	Lub Oil	Minor	Shutting Down	Lub oil ignited by the hot surface of the power turbine casing.					1
	98	Non Process	Diesel	Minor	Reinstatement	Hot surface of burner inlet pipework.		1			
	99	Non Process	Diesel	Minor	Start-up	Hot surface of turbine fuel pipework at gas generator, within turbine enclosure.		1			
	100	Non Process	Diesel	Minor	Normal Production	Hot surface of burner. Quantity so small no automatic detection picked up. Area operator noticed small amount of smoke from turbine vent.		1			
	101	Oil		Minor	Cleaning	Filter basket had been removed from pipeline hydrocarbon present. The basket was removed, and a blue flash was apparent when it was flushed with water. It is thought that the hose was not anti-static and was source of ignition.		1			
	102	Condensate		Minor	Maintenance Hot Work	There was no hydrocarbon release. Affected system was completely isolated from hydrocarbon sources and had been isolated, purged, flushed, a small residue was contained in a section of pipe being cut up for removal. Ignited by sparks/heat from a grinder.		1			
	103	Gas		Minor	Maintenance Cold Work	Presumed to be static. Not proven. Other ignition sources considered. Residual current in the pump motor and the cathodic protection.		1			
	104	Gas		Significant	Start-up	Hot surfaces in turbine.			1		
	105	Gas		Minor	Construction Hot Work	Air operated grinder.		1			
	106	Gas		Significant	Construction Cold Work	Flames were seen at turbine exhaust - unburnt gas reached exhaust due to delay in ignition sequence software.		1			
	107	Gas		Significant	Normal Production	Lightning		1			
	108	Gas		Minor	Normal Production	Lightning during snow squalls.		1			
Total = 18											
1999/00	109	Non Process	Diesel	Minor	Reinstatement	Exhaust temperature. (ie hot exhaust)	480				1
	110	Non Process	Diesel	Minor	Normal Production	Suspect hot turbine casing surface. No flame was		1			

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
	111	Non Process	Diesel	Minor	Reinstatement	seen during this incident. On the basis that 2xIR Detectors had activated it is believed that a flash fire had occurred, investigations are ongoing.					
	112	Non Process	Diesel	Minor	Reinstatement	Smoke caused by diesel supply fitting to one of the combustion cans leaking onto hot surfaces. On removal of the heat shield an area of black carbon could be seen around the lower half of the turbine casing this indicated that ignition did occur. Suspect hot turbine casing surface as ignition source.	120	1			
	113	Non Process	Lub Oil	Significant	Shut Down	Hot surfaces within the enclosure.		1			
	114	Condensate		Significant	Normal Production	Platform flare tip.					1
	115	Gas		Minor	Construction Hot Work	Welders arc.		1			
	116	Gas		Minor	Maintenance Hot Work	Burning torch from adjacent red hot work.				1	
	117	Gas		Minor	Maintenance Hot Work	Welding operation. (Being undertaken)		1			
	118	Gas		Minor	Normal Production	Very small ignition on backfire, resulting in flame path.		1			
Total = 10											
2000/01	119	Non Process	Lub Oil	Minor	Routine Maintenance	Hot exhaust		1			
	120	Non Process	Diesel	Minor	Maintenance Replacement	Hot exhaust trunking		1			
	121	Non Process	Diesel	Minor	Normal Production	Conducted heat on combustion chamber		1			
	122	Non Process	Diesel	Minor	Normal Production	Hot surface of the turbine casing					1
	123	Non Process	Diesel	Minor	Normal Production	Diesel onto hot surface		1			
	124	Non Process	Diesel	Minor	Normal Production	Hot surface				1	
	125	Non Process	Lub Oil	Minor	Normal Production	Assumed to be wet surfaces within enclosure		1			
	126	Non Process	Diesel	Significant	Start Up	Diesel fuel seeped into combustion system and ignited producing excessive smoke		1			
	127	Oil		Minor	Construction Hotwork	Source of ignition was spark from grinding of pipe with disc grinder					1
	128	Gas		Minor	Normal Production	Hot tubing casing		1			
	129	Gas		Significant	Construction Hotwork	Assumed to be as a result of welding work ongoing near the flange in a specially constructed habitat. No witness statements can confirm or deny this	60			1	
	130	Gas		Minor	Maintenance Hotwork	Ignition occurred when shell was being pre-heated by means of naked flame, oxy-acetylene was the flame		1			
	131	Gas		Minor	Normal Production	Hot surface				1	
Total = 13											
2001/02	132	Condensate		Minor	Drilling	Condensate was injected into the gas line for burning in flare, and some fell into sea whilst burning.					1
	133	Gas		Significant	Normal Production	Lightening				1	
	134	Gas		Minor	Well Operation	Ignition due to use of unsuitable equipment, which	60	1			

*numbers signify order of ignition, i.e. 1=first, 2=second

Table 4(b) : IGNITIONS - MODE OF OPERATION & IGNITION SOURCES/SEQUENCES

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Operation	Ignition Source	Delay Time(s)	Ignition Sequence*			
								Flash	Explosion	Jet	Pool
2001/02	135	Non Process	Diesel	Minor	Shut Down	resulted in static build-up and discharge.					
	136	Non Process	Hydraulic Oil	Minor	Normal Production	Surface temperature of the turbine Hydraulic oil released onto turbine exhaust lagging and heated above auto ignition.	360	1		1	
	137	Non Process	Lub Oil	Minor	Normal Production	Hot exhaust surface.	180			1	
	138	Non Process	Lub Oil	Minor	Testing	Not known.		1			
	139	Non Process	Lub Oil	Minor	Normal Production	Lube oil soaked and baked into lagging, eventually reached hot surface of turbine exhaust underneath the insulation and reached its flash point.	360	1			
	140	Non Process	Lub Oil	Minor	Normal Production	Lube oil soaked into the turbine exhaust lagging and eventually seeped through to the hot exhaust surface underneath. Oil baked solid and reached ignition temperature when machine was operating at full load.	360	1			
	141	Non Process	Lub Oil	Minor	Normal Production	Initial investigations show source was oil mist soaked gasket in the exhaust system		1			
	142	Non Process	Lub Oil	Minor	Normal Production	Overheating of auxiliary pump casing located within hydraulic reservoir.	15	1			
	143	Non Process	Lub Oil	Minor	Normal Production	Engine exhaust - 1/4" pipe blew off lub oil filter.		1			
Total = 12											

Table 4(c) : IGNITIONS - DETECTION MODES & EMERGENCY ACTIONS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Detection	Emergency Actions Taken
1992/93	1	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Manual CO2/Halon
	2	Oil		Minor	Visual	Other Action
	3	Oil		Significant	Visual	Manual Shutdown
	4	Gas		Significant	Heat	Auto Shutdown, Auto CO2/Halon
Total = 4						
1993/94	5	Non Process	Lub Oil	Significant	Visual	Manual Shutdown, Muster at Stations, Other Action
	6	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Other Action
	7	Non Process	Lub Oil	Minor	Flame	Manual Shutdown, Manual Blowdown, Other Action
	8	Non Process	Methanol	Significant	Visual	None
	9	Non Process	Methanol	Minor	Visual	Other Action
	10	Non Process	Glycol	Significant	Flame	Auto Shutdown, Auto Blowdown, Manual Deluge, Manual CO2/Halon, Muster at Stations, Other Action
	11	Non Process	Glycol	Significant	Visual	Manual Shutdown, Other Action
	12	Non Process	Diesel	Minor	Visual	None
	13	Non Process	Diesel	Minor	Visual	Auto Shutdown, Auto CO2/Halon
	14	Non Process	Diesel	Minor	Smoke, Flame	Manual CO2/Halon
	15	Non Process	Diesel	Significant	Visual	Manual Shutdown, Manual CO2/Halon, Muster at Stations
	16	Non Process	Heat Transfer Oil	Significant	Visual	Other Action
	17	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Other Action
	18	Oil		Significant	Visual	Auto Shutdown
	19	Oil		Minor	Flame	Auto Shutdown, Auto Blowdown, Auto Deluge, Muster at Lifeboats, Other Action
	20	Condensate		Minor	Visual	None
	21	Condensate		Minor	Visual	Other Action
	22	Gas		Minor	Visual	Muster at Lifeboats, Other Action
	23	Gas		Minor	Gas	Other Action
	24	Gas		Significant	Temperature Change	Auto Shutdown, Muster at Stations, Other Action
	25	Gas		Significant	Visual	Auto Shutdown, Manual CO2/Halon, Other Action
	26	Gas		Significant	Visual	Other Action
	27	Gas		Minor	Visual	Manual CO2/Halon
	28	Gas		Minor	Visual	Manual CO2/Halon
	29	Gas		Minor	Visual	Manual CO2/Halon
	30	Gas		Significant	Visual	Manual Shutdown, Manual CO2/Halon

Table 4(c) : IGNITIONS - DETECTION MODES & EMERGENCY ACTIONS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Detection	Emergency Actions Taken
Total = 26						
1994/95	31	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Other Action
	32	Non Process	Lub Oil	Minor	Visual	Muster at Stations, Other Action
	33	Non Process	Lub Oil	Significant	Heat	Auto Shutdown, Auto Blowdown, Manual CO2/Halon, Muster at Stations, Other Action
	34	Non Process	Lub Oil	Minor	Visual	Other Action
	35	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Muster at Stations, Other Action
	36	Non Process	Diesel	Minor	Sound	Manual Shutdown, Other Action
	37	Non Process	Glycol	Minor	Visual	Other Action
	38	Non Process	Glycol	Minor	Flame	Auto Shutdown, Manual Blowdown, Manual Deluge, Manual CO2/Halon, Muster at Stations, Other Action
	39	Non Process	Glycol	Minor	Visual	Manual Shutdown, Other Action
	40	Non Process	Diesel	Minor	Visual	Muster at Stations, Other Action
	41	Non Process	Fuel Oil	Significant	Visual	Manual Shutdown, Other Action
	42	Non Process	Diesel	Minor	Flame	Auto CO2/Halon
	43	Non Process	Lub Oil	Minor	Flame	Manual Shutdown, Auto Deluge, Other Action
	44	Non Process	Lub Oil	Minor	Visual	Other Action
	45	Non Process	Heli-Fuel	Minor	Visual	Other Action
	46	Non Process	Diesel	Significant	Flame	Manual Shutdown
	47	Non Process	Diesel	Significant	Flame	Manual Shutdown
	48	Oil		Significant	Smoke	Manual Shutdown, Manual CO2/Halon, Muster at Stations, Other Action
	49	Condensate		Minor	Sound	Manual Shutdown, Muster at Stations, Other Action
	50	Condensate		Minor	Visual	Auto Deluge
	51	Gas		Significant	Sound	Other Action
	52	Gas		Minor	Sound	Other Action
	53	Gas		Minor	Visual	Other Action
	54	Gas		Minor	Visual	Other Action
Total = 24						
1995/96	55	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Muster at Stations, Other Action
	56	Non Process	Lub Oil	Significant	Heat	Auto Shutdown, Manual Blowdown, Manual CO2/Halon, Other Action
	57	Non Process	Glycol	Minor	Visual	Manual Shutdown, Muster at Stations
	58	Non Process	Diesel	Minor	Flame	Manual Shutdown
	59	Non Process	Diesel	Minor	Flame	Auto Shutdown, Auto CO2/Halon, Muster at Stations
	60	Non Process	Lub Oil	Minor	Visual	Other Action

Table 4(c) : IGNITIONS - DETECTION MODES & EMERGENCY ACTIONS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Detection	Emergency Actions Taken
	61	Non Process	Lub Oil	Minor	Heat	Manual Shutdown, Auto Deluge, Muster at Stations, Other Action
	62	Gas		Significant	Visual	Other Action
	63	Gas		Minor	Visual	Manual Shutdown, Manual CO2/Halon, Muster at Stations, Other Action
Total = 9						
1996/97	64	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Auto Deluge, Muster at Stations, Other Action
	65	Non Process	Lub Oil	Significant	Smoke, Flame	Auto Shutdown, Auto CO2/Halon, Muster at Stations
	66	Non Process	Diesel	Minor	Flame	Auto Shutdown, Auto CO2/Halon, Muster at Stations
	67	Non Process	Diesel	Minor	Smoke	Manual Shutdown, Other Action
	68	Non Process	Diesel	Minor	Visual	Manual Shutdown, Other Action
	69	Non Process	Diesel	Minor	Visual	Other Action
	70	Non Process	Diesel	Significant	Flame	Manual Shutdown, Muster at Stations, Other Action
	71	Non Process	Diesel	Significant	Flame	Manual CO2/Halon
	72	Non Process	Diesel	Minor	Flame	Manual Shutdown
	73	Non Process	Lub Oil	Minor	Smoke	Manual Shutdown
	74	Non Process	Lub Oil	Minor	Visual	Auto Shutdown, Manual CO2/Halon, Muster at Stations
	75	Oil		Significant	Visual	Manual Shutdown, Manual Blowdown, Muster at Stations
	76	Condensate		Minor	Heat	Auto Shutdown
	77	Condensate		Minor	Visual	Other Action
	78	Gas		Minor	Visual	Muster at Stations, Other Action
	79	Gas		Minor		Other Action
	80	Gas		Significant	Visual	Other Action
	81	Gas		Significant	Visual	Other Action
Total = 18						
1997/98	82	Non Process	Diesel	Minor	Flame	Auto Shutdown, CO2/Halon, Muster at Stations
	83	Non Process	Diesel	Minor	Visual	Other Action
	84	Non Process	Diesel	Minor	Visual	Manual Shutdown, Auto CO2/Halon
	85	Gas		Minor	Visual	Other Action
	86	Gas		Minor	Gas	Other Action
	87	Gas		Minor	Visual	Other Action
	88	Gas		Significant	Visual	Other Action
	89	Gas		Significant	Flame	Auto Shutdown, Auto Blowdown, Auto Deluge, Muster at Stations
	90	Gas		Significant	Sound	None
Total = 9						

Table 4(c) : IGNITIONS - DETECTION MODES & EMERGENCY ACTIONS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Detection	Emergency Actions Taken
1998/99	91	Non Process	Lub Oil	Significant	Visual	Muster at Stations, Other Action
	92	Non Process	Glycol	Minor	Visual, Flame	Manual Shutdown, Manual CO2/Halon, Muster at Stations, Other Action
	93	Non Process	Lub Oil	Minor	Visual	Manual CO2/Halon
	94	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Manual CO2/Halon
	95	Non Process	Lub Oil	Significant	Visual	Manual Shutdown, Other Action
	96	Non Process	Hydraulic Oil	Significant	Flame	Auto Shutdown, Manual CO2/Halon, Muster at Stations
	97	Non Process	Lub Oil	Minor	Visual	Other Action
	98	Non Process	Diesel	Minor	Flame	Manual Shutdown, Manual CO2/Halon
	99	Non Process	Diesel	Minor	Flame	Auto Shutdown, Manual CO2/Halon
	100	Non Process	Diesel	Minor	Visual	Manual Shutdown
	101	Oil		Minor	Gas	Other Action
	102	Condensate		Minor		Other Action
	103	Gas		Minor	Flame, Gas	Auto Shutdown, Auto Blowdown, Auto Deluge, Muster at Stations
	104	Gas		Significant	Sound	Manual Shutdown, Other Action
	105	Gas		Minor	Visual	Other Action
	106	Gas		Significant	Visual	None
	107	Gas		Significant	Flame	Auto Shutdown, Manual CO2/Halon
	108	Gas		Minor	Heat	Manual CO2/Halon
Total = 18						
1999/00	109	Non Process	Diesel	Minor	Flame	Other Action
	110	Non Process	Diesel	Minor	Flame	Auto Shutdown, Muster at Stations
	111	Non Process	Diesel	Minor	Heat, Gas	Manual Shutdown
	112	Non Process	Diesel	Minor	Visual, Flame	Auto Shutdown, Muster at Stations
	113	Non Process	Lub Oil	Significant	Flame	Auto Shutdown, Auto CO2/Halon, Muster at Stations
	114	Condensate		Significant	Visual	Manual Shutdown
	115	Gas		Minor	Visual	Other Action
	116	Gas		Minor	Visual	Muster at Stations
	117	Gas		Minor	Visual	Other Action
	118	Gas		Minor	Visual	Manual Shutdown, Manual Blowdown, Other Action
Total = 10						
2000/01	119	Non Process	Lub Oil	Minor	Visual	Other Action, Muster at Lifeboats
	120	Non Process	Diesel	Minor	Flame	Auto CO2 / Halon, Other Action
	121	Non Process	Diesel	Minor	Flame	Auto Shutdown, Manual CO2/Halon, Other Action

Table 4(c) : IGNITIONS - DETECTION MODES & EMERGENCY ACTIONS

Year	Ref.	Hydrocarbon Type	Non Process Type	Severity	Mode of Detection	Emergency Actions Taken
	122	Non Process	Diesel	Minor	Flame	Manual Shutdown
	123	Non Process	Diesel	Minor	Visual	Manual Shutdown
	124	Non Process	Diesel	Minor	Flame	Manual Shutdown, Manual CO2/Halon
	125	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Auto Blowdown, Auto CO2 / Halon, Muster at Stations
	126	Non Process	Diesel	Significant	Smoke	Manual Shutdown, Muster at Stations
	127	Oil		Minor	Flame, Visual	Other Action
	128	Gas		Minor	Gas	Auto Shutdown, Auto Blowdown, Muster at Stations, Other Action
	129	Gas		Significant	Flame, Visual	Manual Shutdown, Other Action
	130	Gas		Minor	Flame, Visual	None
	131	Gas		Minor	Flame	Auto Shutdown, Auto CO2 / Halon
Total = 13						
2001/02	132	Condensate		Minor	Smoke	Manual Shutdown, Other Action
	133	Gas		Significant	Visual	Manual Shutdown
	134	Gas		Minor	Flame, Visual	Auto Shutdown
	135	Non Process	Diesel	Minor	Visual	Auto Shutdown, Manual CO2/Halon, Muster at Stations, Other Action
	136	Non Process	Hydraulic Oil	Minor	Visual	Manual Shutdown, Manual Blowdown, Muster at Stations , Other Action
	137	Non Process	Lub Oil	Minor	Smoke	Manual Shutdown, Manual CO2/Halon, Other Action
	138	Non Process	Lub Oil	Minor	Visual	Manual Shutdown, Other Action
	139	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Manual CO2/Halon, Muster at Stations, Other Action
	140	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Auto CO2 / Halon, Muster at Stations
	141	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Auto CO2 / Halon, Muster at Stations
	142	Non Process	Lub Oil	Minor	Level Change	Other Action
	143	Non Process	Lub Oil	Minor	Flame	Auto Shutdown, Manual Deluge, Muster at Stations, Other Action
Total = 12						

Table 5 : MEANS OF DETECTION : SUMMARY

HYDRO-CARBON TYPE	S E V E R I	DETECTION MODE					TOTALS	
		HEAT	SMOKE	FLAME	GAS	OTHER	MODES	LEAKS
LIQUIDS	Maj	0	0	0	2	12	14	14
	Sig	6	6	13	76	257	358	330
	Min	4	10	33	82	383	512	496
GAS	Maj	0	1	0	66	40	107	103
	Sig	1	4	5	460	409	879	809
	Min	1	2	7	209	162	381	355
2-PHASE	Maj	0	0	0	14	20	34	30
	Sig	0	2	1	49	101	153	145
	Min	0	0	2	4	27	33	30
TOTALS	Maj	0	1	0	82	72	155	147
	Sig	7	12	19	585	767	1390	1284
	Min	5	12	42	295	572	926	881
GRAND TOTALS		12	25	61	962	1411	2471	2312

Notes:

1. Totals for the period 1-10-92 to 31-03-02
2. More than one type of detection may occur in relation to any one incident
3. Further breakdown of "OTHER" is shown in Table 6

Table 6 : “OTHER” MEANS OF DETECTION

Detection Mode	LIQUIDS			GAS			2-PHASE			TOTAL
	Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min	
Visual	10	237	345	22	245	101	17	87	25	1089
Sound	0	2	6	4	73	18	1	6	1	111
Change (pressure, level, temperature)	2	8	5	6	4	1	0	2	0	28
Smell	0	9	27	5	76	35	0	2	1	155
Hand-held Detection	0	0	0	0	7	5	0	0	0	12
ROV	0	1	0	3	4	2	2	4	0	16
TOTALS	12	257	383	40	409	162	20	101	27	1411
GRAND TOTALS	652			611			148			

Notes:

1. Data for the period 1-10-92 to 31-03-02
2. More than one type of detection may occur in relation to any one incident

Table 7 : EMERGENCY ACTIONS versus RELEASE TYPE & SEVERITY

TYPE OF ACTION	HYDROCARBON TYPE											TOTALS
	LIQUIDS			GAS			2-PHASE			Min		
	Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min			
SHUTDOWN	AUTO	1	40	68	38	190	91	7	24	2	461	
	MANUAL	8	162	239	38	336	127	15	88	19	1062	
	NONE	5	128	189	27	253	137	8	33	9	789	
BLOWDOWN	AUTO	1	19	29	23	154	47	4	16	2	295	
	MANUAL	2	39	45	29	192	66	7	41	8	429	
	NONE	11	272	422	51	463	242	19	88	20	1588	
DELUGE	AUTO	0	0	7	4	18	4	0	1	0	34	
	MANUAL	0	2	2	6	3	0	3	0	0	16	
	NONE	14	328	487	93	788	351	27	144	30	2262	
CO ₂ /HALON	AUTO	0	5	12	0	7	1	0	1	0	26	
	MANUAL	0	7	15	1	5	5	0	0	0	33	
	NONE	14	318	469	102	797	349	30	144	30	2253	
MUSTER	AT STATIONS	2	56	68	40	239	118	15	42	2	582	
	AT LIFEBOATS	0	4	5	3	20	9	0	2	0	43	
	NONE	12	270	423	60	550	228	15	101	28	1687	
OTHER ACTION TAKEN	YES	5	172	272	43	327	153	14	58	16	1060	
	NO	9	158	224	60	482	202	16	87	14	1252	
TOTAL OTHER ACTION TAKEN		14	330	496	103	809	355	30	145	30	2312	

Notes :

1. Data for the period 1-10-92 to 31-03-02
2. There may be more than one type of action taken in relation to any one incident

Table 8 : CAUSATION & OPERATING MODE versus RELEASE TYPE & SEVERITY

CAUSATION FACTORS	HYDROCARBON TYPE & SEVERITY											TOTALS
	LIQUIDS			GAS			2-PHASE			Min		
	Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min			
DESIGN FAULT	2	48	66	25	137	40	3	23	4	348		
CORROSION/EROSION	0	52	98	5	66	40	9	39	5	314		
MECHANICAL DEFECT	6	157	227	50	377	129	13	60	15	1034		
MATERIAL DEFECT	2	12	13	2	35	11	0	4	1	80		
OTHER EQUIPMENT	1	12	23	5	36	15	1	9	2	104		
INCORRECTLY FITTED	0	28	67	18	126	36	5	10	4	294		
IMPROPER OPERATION	5	94	114	28	180	86	7	30	5	549		
DROPPED OBJECT/OTHER IMPACT	1	7	10	2	7	7	3	3	0	1227		
LEFT OPEN/OPENED WITH HC	2	30	38	15	90	61	0	16	2	254		
OTHER OPERATIONAL	2	13	13	3	38	11	1	7	2	90		
ON-COMPLIANCE PROC / PTW	0	38	45	17	100	41	3	13	2	259		
DEFICIENT PROCEDURE	3	53	56	17	132	52	1	27	4	640		
OTHER PROCEDURAL	1	4	5	3	16	5	1	1	0	36		
OPERATING MODE IN AREA AT TIME OF INCIDENT												
DRILLING/WELL OPERATION	5	30	20	7	78	46	5	24	6	221		
NORMAL PRODUCTION	6	169	288	51	385	122	15	82	17	1135		
SHUTDOWN/BLOWDOWN	1	27	19	10	62	19	3	8	1	150		
PIGGING/ FLUSHING/CLEANING/INSPECTION	1	11	13	5	34	20	1	4	1	90		
MAINTENANCE/CONSTRUCTION	0	31	51	11	70	48	1	7	2	221		
TESTING/SAMPLING	0	15	24	2	15	15	2	6	1	80		
REINSTATEMENT/START-UP	1	47	82	17	165	85	3	14	1	415		
TOTAL No. OF RELEASES	14	330	497	103	809	355	30	145	29	2312		

Notes:

1. Data for the period 1-10-92 to 31-03-02
2. There may be several causation factors contributing to any one incident

Table 9 Release Site

Release Site (1)	by percentage	last year
Pipe flange	13%	8%
Pipe weld	13%	6%
Pipe body	6%	13%
Pipe open end	4%	16%
Valve stem	8.5%	4%
Valve body	8.5%	5%
Valve flange	0%	1%
Valve open end	4%	3%
Vessel body	2%	3%
Vessel flange	2%	3%
Vessel open end	2%	1%
Small bore piping	6%	8%
Small bore connection	4%	7%
Instrument connection	15%	3%
Pump/compressor flange	0%	2%
Pump/compressor seal	6%	3%
Hose body	0%	4%
Swivel stack	0%	1%
Other equipment seal	4%	7%

Table 10 Immediate Causes

Immediate Cause	by percentage	last year
Corrosion/internal	4%	5%
Corrosion/external	0%	7%
Erosion	9%	6%
Fatigue/vibration	21%	11%
Incorrect installation	21%	12%
Operator error	4%	11%
Degradation of material properties	28%	27%
Procedural violation	6%	4%
Inadequate isolation	2%	4%
Blockage	0%	2%
Inadequate procedures	4%	8%
Defective equipment	0%	6%

Table 11 Underlying Causes

Underlying Cause	by percentage	last year
Inadequate compliance monitoring	11%	10%
Inadequate risk assessment	13%	8%
Inadequate design	30%	29%
Inadequate procedures	23%	9%
Inadequate competency	8.5%	12%
Inadequate supervision	8.5%	5%
Incorrect material specification/usage	13%	8%
Inadequate task specification	0%	2%
Excessive workload	4%	2%
Outdated information/data	0%	1%
Incorrect installation	15%	7%
Inadequate maintenance	8.5%	?
Inadequate communication	2%	2%
Inadequate inspection/condition monitoring	32%	28%

Table 12 Failed Safeguarding system

Locked valve
Permit to work
Isolation
Change control
Procedural review
Design review (incl. HAZOP)
Competency assurance
Inspection/condition monitoring
Corrosion/erosion monitoring
Construction/commissioning review
Operational review (older installations)

Table 13 Potential New/additional safeguards

UKOOA/IP small-bore piping guide
Flange verification scheme
Regular drawing upgrades
HAZOP

Table 14 Location from HCR Database

	By percentage
BOP	<1%
Compressors	2.5%
Crude oil storage	1.5%
Filters	1.5%
Flanges	7%
Heat exchangers	2.5%
Instruments	22%
Mudshale pumps	<1%
Piping flexible	3%
Steel pipeline	<1%
Piping steel	22%
Pressure vessel	2.5%
Pump seal	6.5%
Turbines	2%
Valves	12%
Wellheads	3.5%
Christmas trees	2.5%
Not specified	4.5%

Table 15 Major/Significant Release Rates Per Manned Production Installation

ID	RELEASE RATE 01/02(00/01)	RANK 01/02(00/01)
A	1.25 (2.50)	6 (1)
B	1.00 (2.50)	8 (2)
C	3.00 (2.33)	1 (3)
D	0.75(2.25)	12(4)
E	2.00 (2.00)	2 (5)
F	2.00 (2.00)	3 (6)
G	1.50 (2.00)	5 (7)
H	1.71 (1.57)	4 (8)
I	1.23 (1.52)	7 (9)
J	0.33 (1.33)	14(10)
K	0.00 (1.00)	16(11)
L	0.00 (1.00)	17(12)
N	1.00 (1.00)	9 (14)
O	1.00 (1.00)	10(15)
P	0.83 (1.00)	11(16)
Q	0.73 (0.82)	13(17)
T	0.11 (0.43)	15(20)

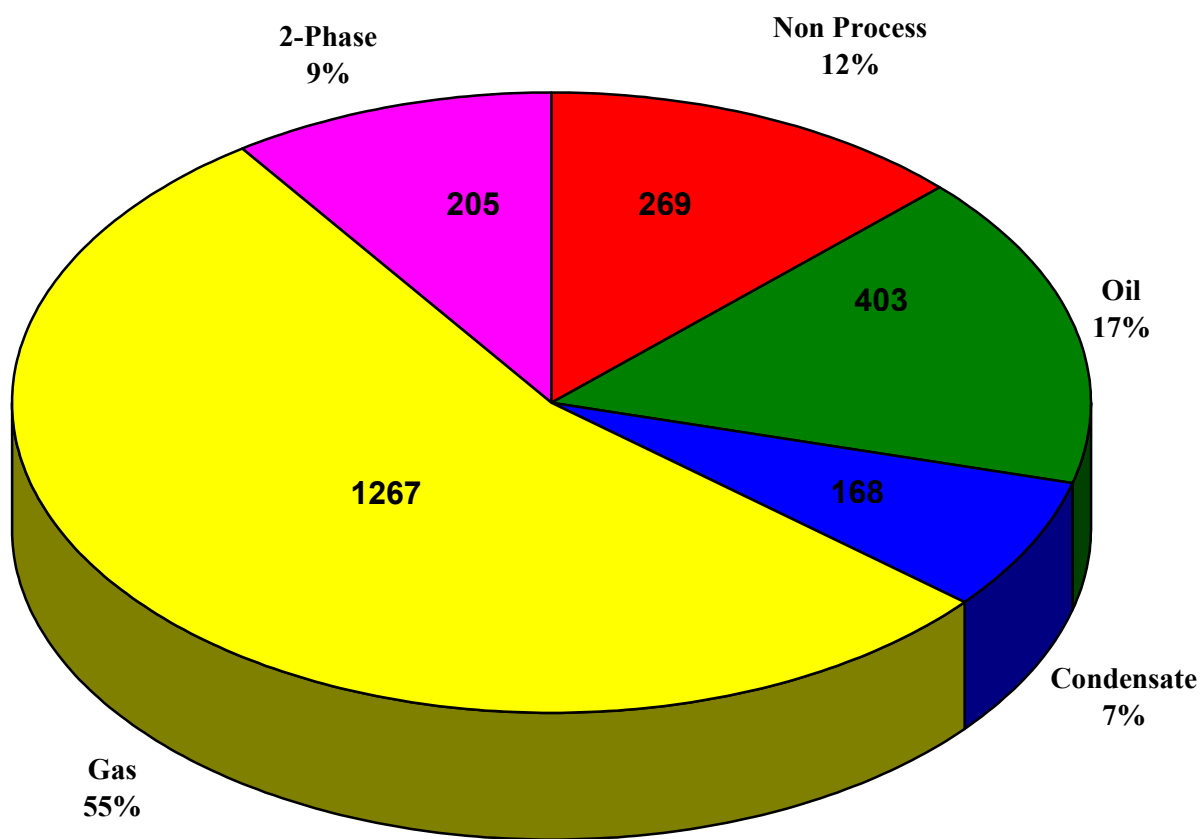
NOTES:

1. Manned production installations only (i.e. excluding Mobiles & NUI).
2. Ranked by Release rate (Releases per installation), highest first.
3. All companies retain same operator ID letter per OTO 2001 055, except:
 - (i) Merged companies (i.e. ChevronTexaco, ConocoPhillips) retain ID of first named company.
 - (ii) ExxonMobil retains Mobil ID.
 - (iii) Shell retains Shell ID but now includes Enterprise data.
4. Release rates and Rank for last year (00/01) are shown in brackets.
It is important to note that for merged companies the 00/01 Rates and Rankings of the first named company have been shown to retain anonymity and previous rankings.

6.0 FIGURES

CONTENTS

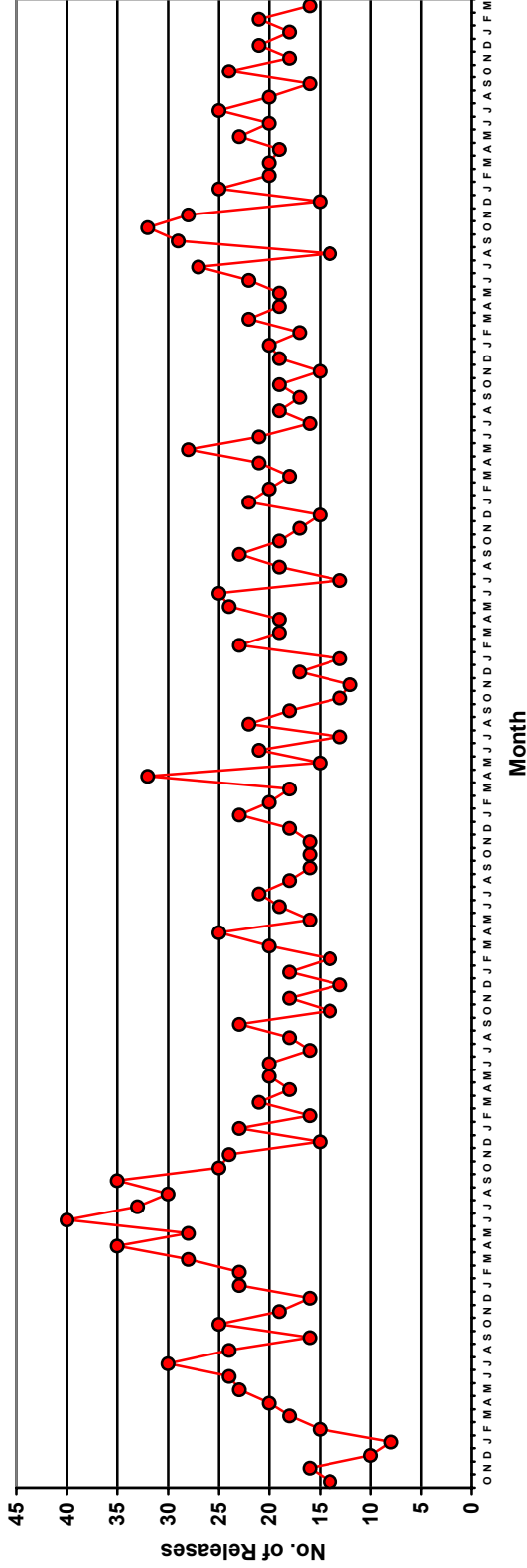
- Figure 1. Pie-chart: Breakdown by hydrocarbon type, all incidents**
- 2. Line graph: Monthly reporting frequency, Oct. 92 to Mar. 2002**
 - 3. Severity analysis: all releases**
 - 4. Line graph: Severity analysis, gas releases**
 - 5. Line graph: Severity analysis , liquid releases**
 - 6. Line graph: Severity analysis , 2-phase releases**
 - 7. Bar graph: Highest 15 system failure rates**
 - 8. Bar graph: Highest 15 equipment failure rate**



1. Total number of releases = 2312
2. Figures for the period 01-10-92 to 31-03-02

Figure 1: BREAKDOWN BY HYDROCARBON TYPE

Figure 2 : TRENDS IN REPORTING OCT 1992 TO MAR 2002



Month

1992/93

1993/94

1994/95

1995/96

1996/97

1997/98

1998/99

1999/00

2000/01

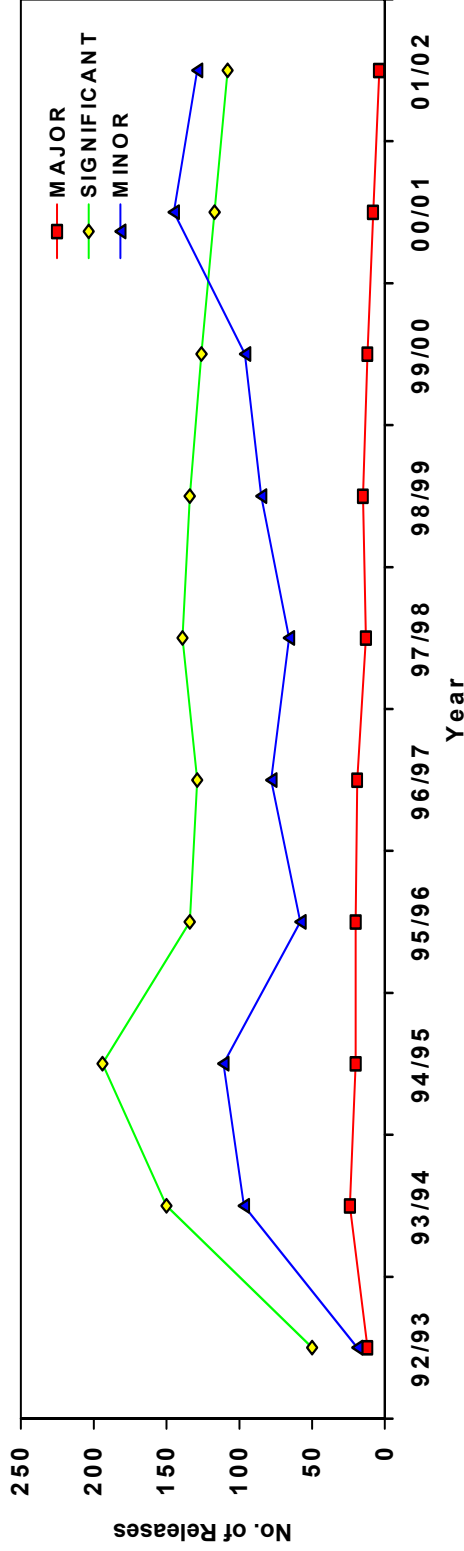
2001/02

1. Reported releases for the period 01-10-92 to 31-03-02 = 2312

2. Monthly average for 1992/93 = 14 (81 in total)
 Monthly average for 1993/94 = 23 (271 in total)
 Monthly average for 1994/95 = 27 (325 in total)
 Monthly average for 1995/96 = 18 (212 in total)
 Monthly average for 1996/97 = 19 (226 in total)
 Monthly average for 1997/98 = 18 (218 in total)
 Monthly average for 1998/99 = 20 (234 in total)
 Monthly average for 1999/00 = 20 (234 in total)
 Monthly average for 2000/01 = 23 (270 in total)
 Monthly average for 2001/02 = 20 (241 in total)
- October 1992
 August 1993
 October 1994
 October 1995
 April 1996
 October 1996
 November 1996
 December 1999
 December 2001
 January 2003
- Database Start-up
 Guidance Issued
 First Outputs Report Issued
 Second Outputs Report Issued
 RIDDOR Offshore
 Third Outputs Report Issued
 Revised Guidance Issued
 Fourth Outputs Report Issued
 Fifth Outputs Report Issued
 Sixth Outputs Report Issued

All	Severity	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
	MAJOR	12	24	20	20	19	13	15	12	8	4
	SIGNIFICANT	50	151	194	134	129	139	134	127	117	109
	MINOR	19	96	111	58	78	66	85	95	145	128
	TOTAL	81	271	325	212	226	218	234	234	270	241

Severity Analysis
Figure 3 : All Offshore Hydrocarbon Releases

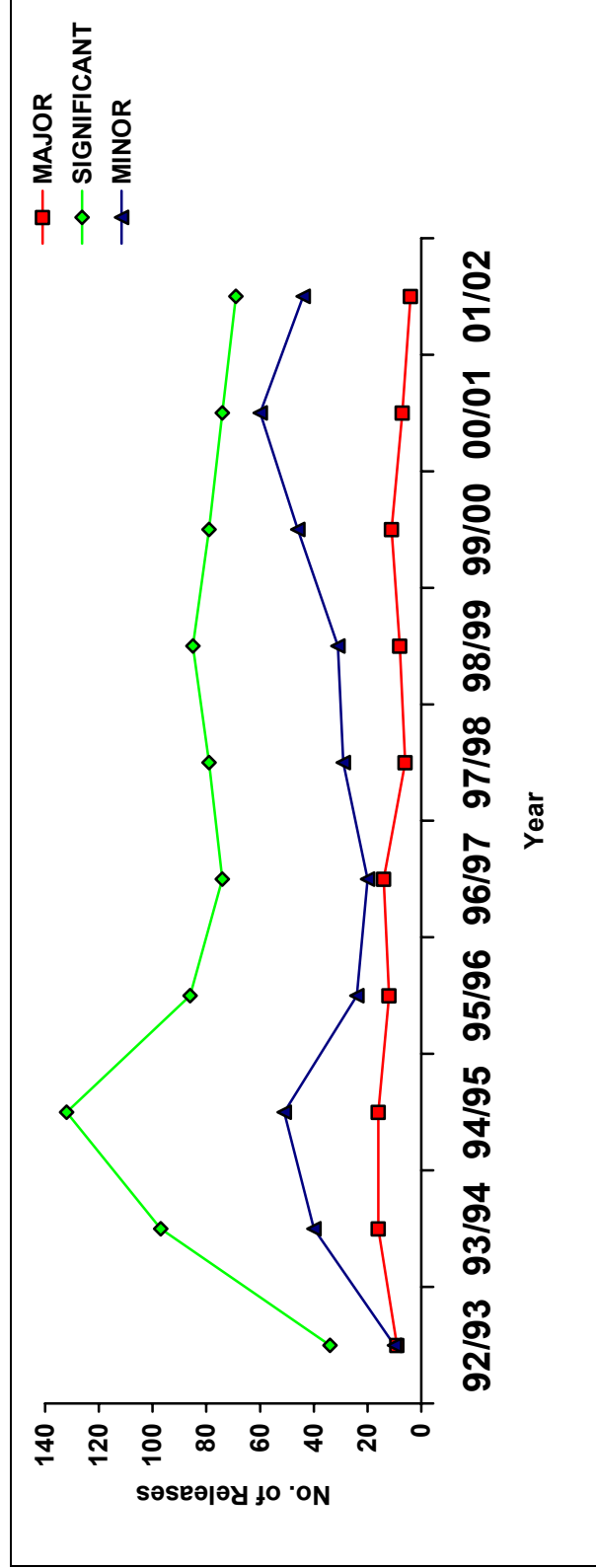


Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only.
2. Total number of releases reported to 31-03-02=2312

GAS	SEVERITY	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
	MAJOR	9	16	16	12	14	6	8	11	7	4
	SIGNIFICANT	34	97	132	86	74	79	85	79	74	69
	MINOR	10	40	51	24	20	29	31	46	60	44
	TOTAL	53	153	199	122	108	114	124	136	141	117

Severity Analysis
Figure 4 : Gas Releases



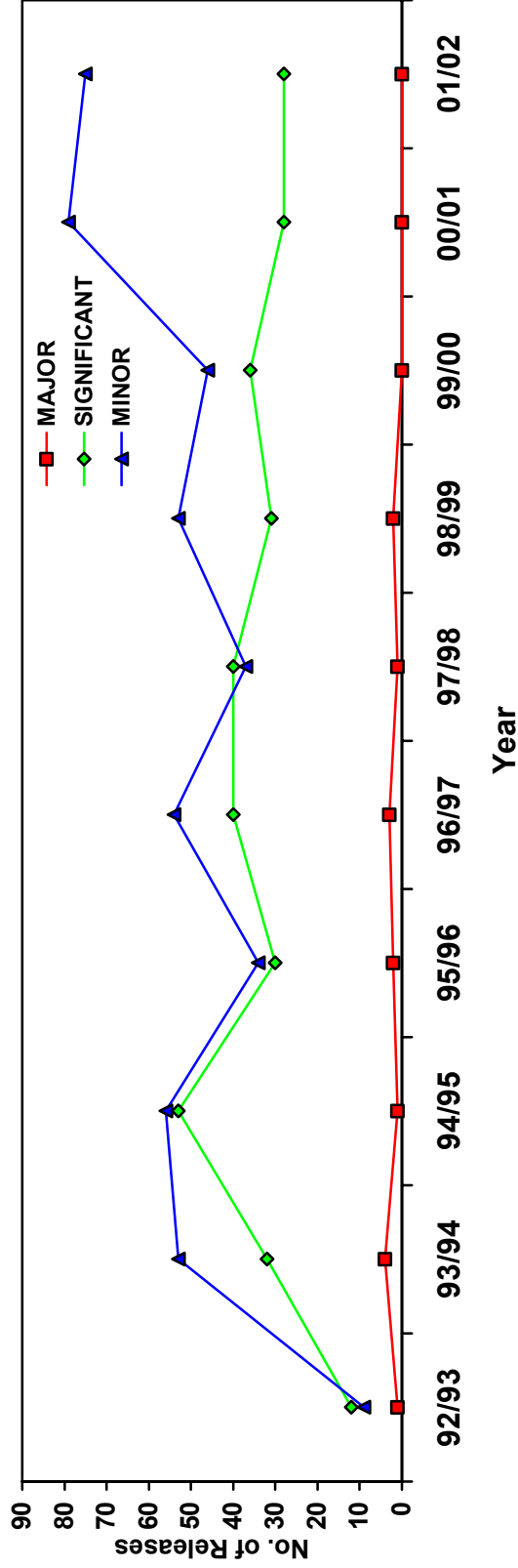
Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only
3. Total number of gas releases reported to 31-03-02 = 1267

LIQUIDS	SEVERITY	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
	MAJOR	1	4	1	2	3	1	2	0	0	0
	SIGNIFICANT	12	32	53	30	40	40	31	36	28	28
	MINOR	9	53	56	34	54	37	53	46	79	75
	TOTAL	22	89	110	66	97	78	86	82	107	103

Severity Analysis

Figure 5 : Liquid Releases (Oil, Condensate, etc.)

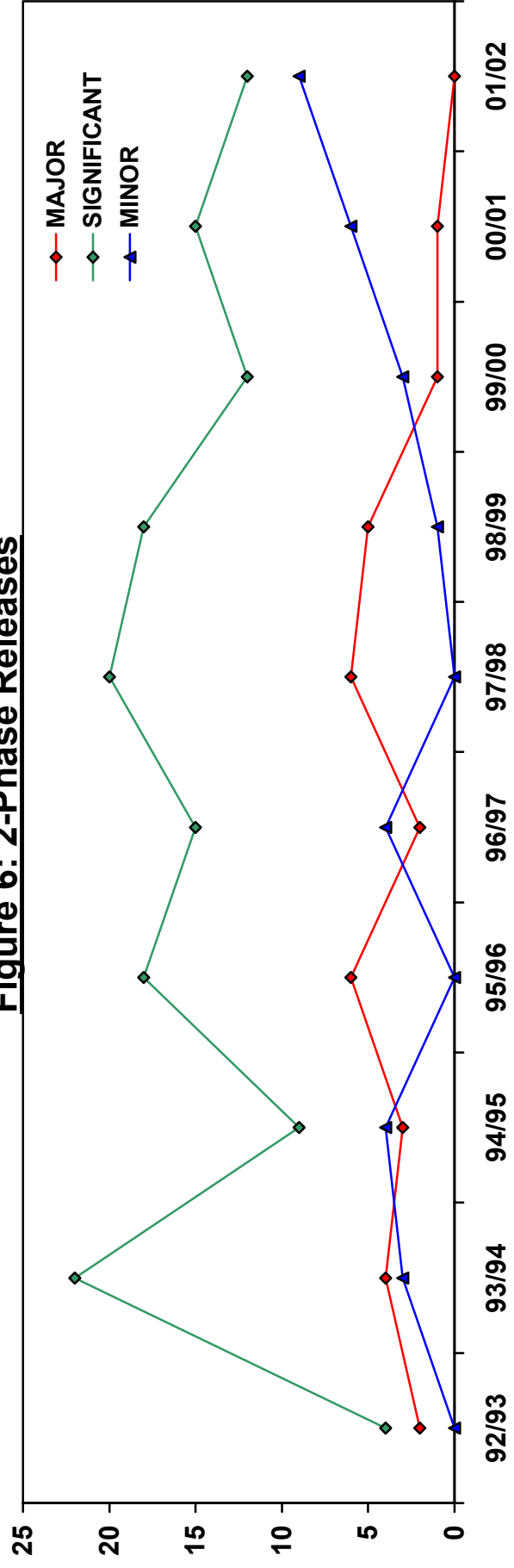


Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of liquid releases reported to 31-03-02 = 840

2-PHASE	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
SEVERITY MAJOR	2	4	3	6	2	6	5	1	1	0
SIGNIFICANT	4	22	9	18	15	20	18	12	15	12
MINOR	0	3	4	0	4	0	1	3	6	9
TOTAL	6	29	16	24	21	26	24	16	22	21

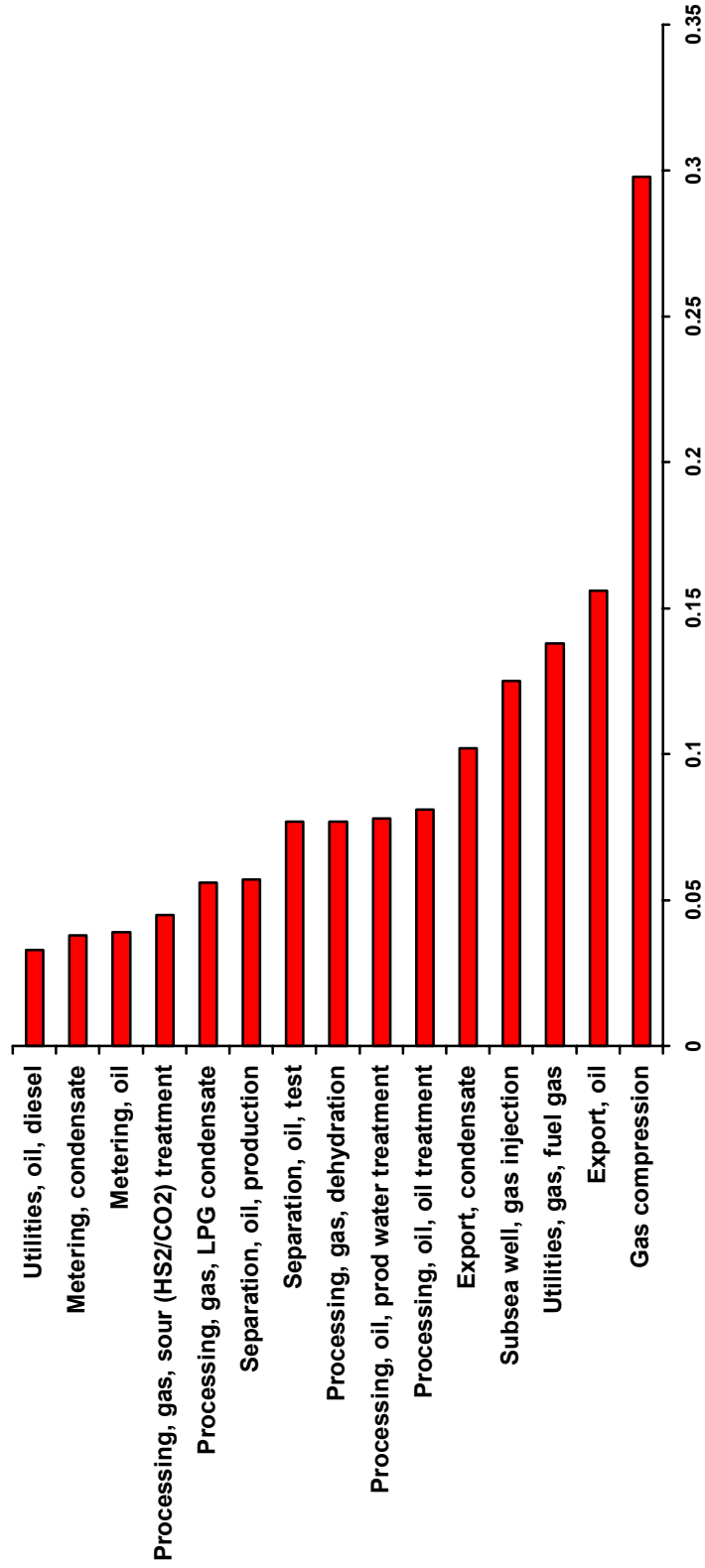
Severity Analysis
Figure 6: 2-Phase Releases



Start-up of Database on 01-10-1992

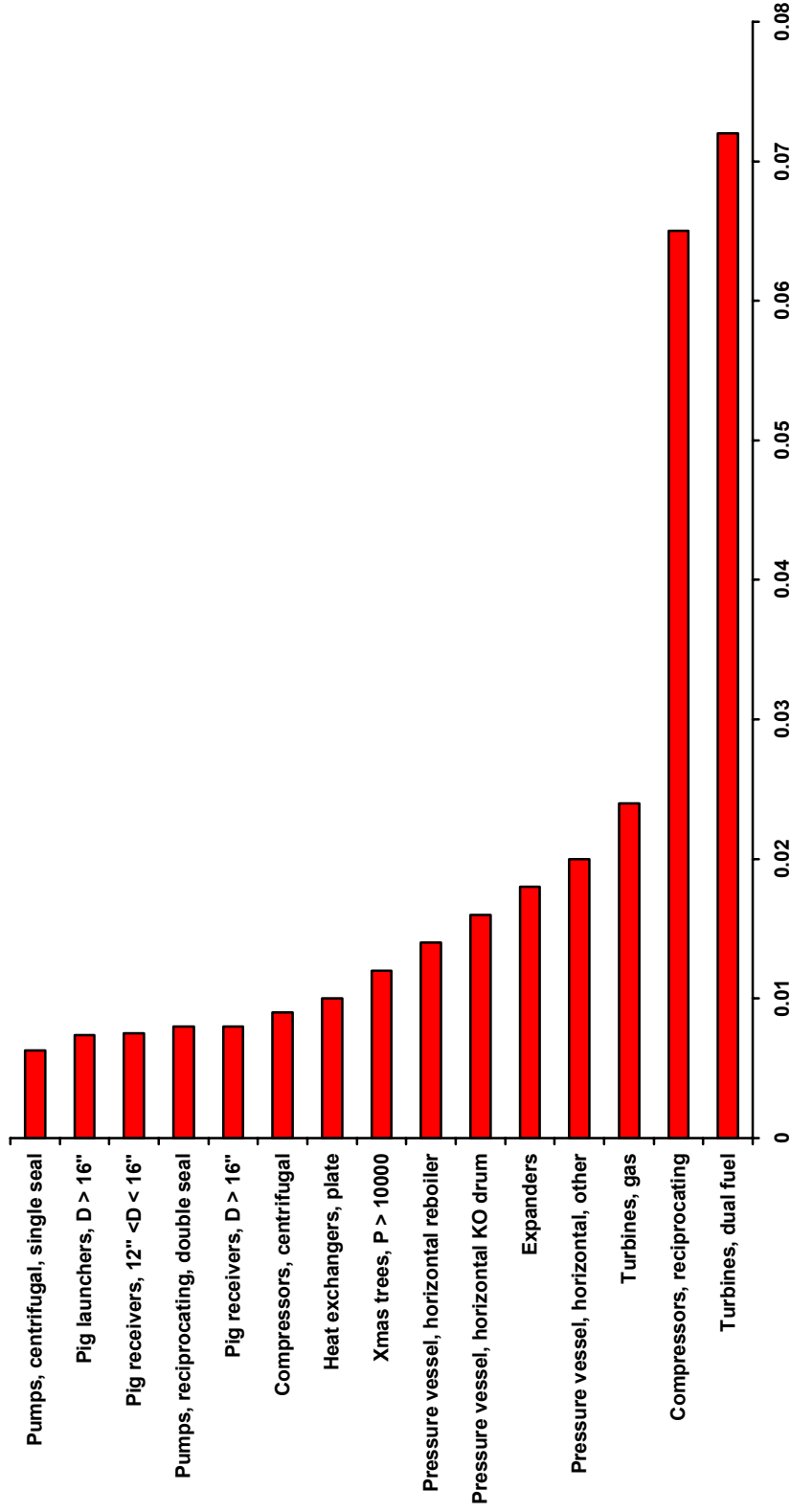
1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of 2-Phase releases reported to 31-03-02 = 205

Figure 7 : SYSTEM FAILURE RATES (leaks/system year)



1. Failure Rates shown for top 15 out of 52 system types.
2. Figures for the period 1-10-92 to 31-03-02.
3. Caution should be exercised when interpreting the failure rate for subsea gas injection well as this calculation is based on a very small equipment population.

Figure 8 : EQUIPMENT FAILURE RATES (leaks/equipment year)



1. Failure Rates shown for top 15 out of 119 equipment types.
2. Figures for the period 1-10-92 to 31-03-02.

APPENDIX 1

OSD PROCESS INTEGRITY INITIATIVE

As indicated in the executive summary and elsewhere in this statistical report for 2001/2002, OSD has undertaken an initiative to deal with Process Integrity concerns as a result of the reporting plateau shown by the offshore hydrocarbon release statistics.

The initiative is aimed at increasing the awareness of the current unsatisfactory situation, to identify root causes to bring greater emphasis on the necessity to reduce offshore hydrocarbon releases, and to influence those people in the best position to bring that about.

The Process Integrity initiative has three strands:

- 1) OSD has investigated all RIDDOR reportable hydrocarbon releases which occurred during the planning year to 31 March 2001, which included offshore visits by Inspectors for all major and some significant releases. The results of this work are documented in offshore technology report OTO 2001/055 - OSD Hydrocarbon Release Reduction Campaign - Report on the hydrocarbon release incident investigation project 01/04/2000 to 31/03/2001.
- 2) Process integrity inspections of all manned production installations, are being phased in over a three year period, i.e. 2000 to 2003.
- 3) Regular joint HSE/Industry Workshops on hydrocarbon releases will be held, at least annually, and the first two of these were held on 9 November 2000 at Ardoe House near Aberdeen, and on 7 November 2001 at Britannia Hotel, Aberdeen. A third seminar was held on 28 November 2002 at Ardoe House Hotel, Aberdeen. Proceedings for these seminars are available from UKOOA.

APPENDIX 2

SEVERITY CLASSIFICATION

As indicated in the introduction to this report, there have been discussions with the offshore industry on a classification system for hydrocarbon releases. The consensus reached is that all reported releases can be classified as minor, significant or major by applying agreed definitions and provisional classification criteria.

DEFINITIONS : The definitions were agreed as follows :

MAJOR : "Potential to quickly impact outwith the local area, e.g. affect the Temporary Refuge (TR), escape routes, escalate to other areas of the installation, causing serious injury or fatalities."

A major leak, if ignited, would be likely to cause a "major accident", i.e. it would be of a size capable of causing multiple casualties or rapid escalation affecting TR, escape routes, etc.

SIGNIFICANT : "Potential to cause serious injury or fatality to personnel within the local area and to escalate within that local area, e.g. by causing structural damage, secondary leaks or damage to safety systems."

A significant leak, if ignited, might have the potential to cause an event severe enough to be viewed as a "major accident" or be of a size leading to significant escalation within the immediate area or module.

MINOR : "Potential to cause serious injury to personnel in the immediate vicinity, but no potential to escalate or cause multiple fatalities."

A minor leak, even if ignited, would not be expected to result in a multiple fatality event or significant escalation, but could cause serious injuries or a fatality local to the leak site or within that module only.

Any offshore hydrocarbon release reportable under RIDDOR 95 can be classified under one of the above definitions, using criteria reported on the OIR/12 form. It was also decided to group all releases of hydrocarbon liquid under one category of "liquids", since oil, condensate, and non-process liquids (diesel, helifuel, glycol, etc.) share the common characteristics of flammable fluids.

CRITERIA

The simplest criteria for classification is to use inventory released. This can be further refined by taking into account hole size and duration, pressure, congestion factors and a variety of other mitigation factors. At the time of preparation of this report, the preferred criteria were based on quantity released, release rate and duration. It should be noted, however, that discussions with industry on further refinement of the criteria are still ongoing. (See 'Implementation' at the end of this Appendix.)

MAJOR :

(i) Gas Releases :

EITHER [Quantity released > 300 kg]

OR [Mass release rate > 1kg/s AND Duration > 5 mins]

This could result in a jet fire of over 10 metres length (>1kg/s) capable of causing significant escalation after 5 minutes duration, or a flash fire/explosion on reaching LFL. Where 300 kg equates to approx. 3000 m³ explosive cloud at NTP, enough to fill an entire module or deck area, and to cause serious escalation if ignited.

(ii) Liquid Releases (Oil/Condensate/Non-process) :

EITHER [Quantity released > 9,000 kg]

OR [Mass release rate > 10 kg/s AND Duration > 15 mins]

This could result in a pool fire over 10 metres in diameter (> 10 kg/s) filling a module or cutting off a deck, hindering escape and affecting more than one person directly if lasting for over 15 minutes duration.

(iii) 2-Phase Releases :

EITHER [Quantity of liquids released > 300 kg]

OR [Liquids mass release rate > 1 kg/s AND Duration > 5 mins]

Combinations of the major gas and liquids scenarios described above are possible, depending on the gas to oil ratio (GOR) involved.

MINOR :

(i) Gas Releases :

EITHER [Quantity released < 1 kg]

OR [Mass release rate < 0.1 kg/s AND Duration < 2 mins]

This could result in a jet fire of less than 5 metres length (< 0.1 kg/s) which is unstable (< 2 mins duration) and therefore unlikely to cause significant escalation, or a flash fire/explosion on reaching LFL. Where < 1 kg equates to < 10 m³ explosive cloud at NTP, probably insufficient to cause a significant hazard if ignited.

(ii) Liquid Releases (Oil/Condensate/Non-process) :

EITHER [Quantity released < 60 kgs]

OR [Mass release rate < 0.2 kg/s AND Duration < 5 mins]

This could result in a pool fire smaller than 2 metres in diameter (< 0.2 kg/s) unlikely to last long enough to hinder escape (< 5 mins), but could cause serious injury to persons nearby.

(iii) 2-Phase Releases :

EITHER [Quantity released < 1 kg]

OR [Liquids release rate <0.1 kg/s AND Duration < 2 mins]

Combinations of the gas and liquids scenarios described above are possible, depending on GOR involved.

SIGNIFICANT : (Those between major and minor.)

(i) Gas Releases :

Capable of jet fires of 5 to 10 metres lasting for between 2-5 minutes, or release rates between 0.1 to 1.0 kg/s lasting 2-5 minutes giving explosive clouds of between 10 and 3000 m³ in size.

(ii) Liquids Releases (Oil/Condensate/Non-process) :

Pool fires between 2 and 10 metres in diameter, lasting for between 5 and 15 minutes.

(iii) 2-Phase Releases :

Combinations of the gas and liquids scenarios described above are possible.

IMPLEMENTATION

All current and future releases will be classified according to the above agreed criteria for the types of hydrocarbons involved, and the results used in HCR statistics reports.

Any further refinement of the criteria will be retrospectively applied, and the severities adjusted where necessary.

It is important to note, however, that those releases with a hole size labelled N/A are special cases where the release rate is not applicable to the mode of release (e.g. open topped vessels such as shale shakers, or where carry-over of hydrocarbons from one system to another was involved). All such releases were classified by inspection of the amount released only.

**HYDROCARBON RELEASE STATISTICS, 2001
QUESTIONNAIRE**

To help improve the quality of offshore data dissemination, would you please answer the following questions on the hydrocarbon release statistics contained in this report:

1. What is your connection with the UK Offshore Oil and Gas Industry? (Tick one box)

- | | | | | | |
|--------------------------------|--------------------------|--------------------------|--------------------------|------------|--------------------------|
| Oil Company management | <input type="checkbox"/> | Oil Company employee | <input type="checkbox"/> | Academic | <input type="checkbox"/> |
| Service Company management | <input type="checkbox"/> | Service Company employee | <input type="checkbox"/> | Consultant | <input type="checkbox"/> |
| Industry Assoc. Representative | <input type="checkbox"/> | Trade Union | <input type="checkbox"/> | Journalist | <input type="checkbox"/> |
| Other (specify) _____ | | | | | |

2. Does this report satisfy your requirements with regard to Offshore Hydrocarbon releases?

- | | | | |
|------------|--------------------------|---------------|--------------------------|
| Completely | <input type="checkbox"/> | More than 50% | <input type="checkbox"/> |
| Poorly | <input type="checkbox"/> | Not at all | <input type="checkbox"/> |

3. Please indicate areas in which you think a change would be beneficial: * delete as necessary

- | | | | |
|--------------------------|--------------------------|------------------------|-----------------------------------|
| * More / less discussion | <input type="checkbox"/> | * More / less tables | <input type="checkbox"/> |
| * More / less graphs | <input type="checkbox"/> | * More / less analysis | <input type="checkbox"/> (see Q4) |

Any other details as required: _____

4. It is planned to publish a separate analysis report on offshore hydrocarbon release. Would you like to receive such reports on an annual basis?

- | | | | |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

5. Would you be prepared to pay a nominal charge to cover production costs for future reports?

- | | | | | |
|-------------------|-----|--------------------------|----|--------------------------|
| Statistics Report | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| Analysis Report | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |

6. To what use do you put the hydrocarbon release statistics?

- | | | | | | |
|----------------------------|--------------------------|-----------------------|--------------------------|----------------|--------------------------|
| Safety Case Development | <input type="checkbox"/> | Project Development | <input type="checkbox"/> | Ind. Relations | <input type="checkbox"/> |
| Reliability/Availability | <input type="checkbox"/> | Risk Assessment | <input type="checkbox"/> | Design | <input type="checkbox"/> |
| Health & Safety Management | <input type="checkbox"/> | Other (specify) _____ | | | |

Please return completed form to:

**HSE, Hazardous Installations Directorate
Data Management CD4C
2nd Floor
St. Anne's House
University Road
Bootle
L20 3RA**

THANK YOU FOR COMPLETING THIS FORM