.

OFFSHORE TECHNOLOGY REPORT OTO 2000 112

Offshore Hydrocarbon Releases Statistics, 2000

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Health & Safety Executive

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Offshore Hydrocarbon Releases Statistics, 2000

Prepared by
Health & Safety Executive

OFFSHORE HYDROCARBON RELEASES

STATISTICS, 2000

(FOR THE PERIOD 1-10-92 TO 31-3-00 INCLUSIVE)

CONTENTS

EXECUTIVE SUMMARY

There were 1801 reported releases in the period between 1 October 1992 to 31 March 2000, of which 7.5% were classified major, 58.5% were classified significant, and the remaining 34% were classified minor.

The total number of releases reported in 1999/2000 equalled the 1998/99 figure (i.e. 234), the incident "plateau" of the previous 4 years being sustained, and, in fact, the numbers reported for the past two years are higher than in 1994/95. The monthly average also remains "plateaued" at 18 to 20 over the five year period.

The overall number of major releases in 1999/2000 decreased from last year's figure (down from 15 to 12), but the number of major gas releases in that figure increased from 8 to 11. The overall number of significant releases decreased from 134 to 127 over the same period, with significant gas releases also dropping from 85 to 79. In contrast, the overall number of minor releases reported in 1999/2000 increased in comparison with last year's figure (up from 85 to 95), and minor gas releases also showed an increase (up from 31 to 45).

There were 118 reported ignitions (6.6% of all releases) over the period 1 October 1992 to 31 March 2000. Although there were no ignited major releases, 38 (32%) of all ignitions involved significant releases (15 gas and 23 liquids).

This report also contains statistics on detection modes, emergency actions, and causation, but offers no root cause analysis at this stage. However, because incident numbers have reached a sustained plateau, and the absence of any downward trend, OSD has launched a 3-part Process Integrity initiative (see Appendix 1) aimed at raising industry awareness to the problem and identifying their root causes, with a view to achieving a significant break through the existing plateau. The planned separate analysis report, referred to in OTO 1999 079[1], has consequently been postponed so it can include the conclusions and feedback from inspections and investigations conducted within the initiative. The forthcoming report will also cover trends,

[1]Offshore Technology Report OTO 1999 079, *Offshore Hydrocarbon Releases Statistics, 1999*. Available free on request from HSE-OSD on tel :0151-951-3099 or fax: 0151-951-3098.

causation complexity, and other significant matters identified from an overall analysis of the contents of the OSD Hydrocarbon Releases database.

NB Since the addition of a single year's data has had no significant impact upon the failure rates for individual systems or items of equipment, it has been agreed with industry that detailed failure rate tables need only be included in the Offshore Hydrocarbon Releases Statistics report in alternate years. The failure rate tables will therefore next be updated in the 2001 report. For current failure rates, reference should be made to the tables as they appear in the 1999 report, OTO 1999 079[2].

[2]See footnote 1

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, Offshore Safety Division (OSD) on form OIR/12. These data have been technically checked against the "parent" OIR/9B form details, and then entered into the database by OSD since database start-up on 1 October 1992.

This report, OTO 2000 112, covers the period 1 October 1992 to 31 March 2000. It is the fifth report on statistics obtained from the HCR Database, and is the third 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, in view of the reporting plateau (see earlier comment), and the absence of any downward trend, OSD has launched a 3-part Process Integrity initiative (see Appendix 1) aimed at raising industry awareness to the problem and identifying their root causes, with a view to achieving a significant break through in the existing plateau. OSD's stated aim is to encourage industry to reduce the number of releases by 50% over the next three years.

As stated in the Executive Summary, the planned separate analysis report has consequently been postponed to take advantage of the feedback from the resultant inspections and investigations.

As also mentioned in the Executive Summary, the detailed failure rate tables: (a) *System Failure Rates & Severity / Hole Size Distribution*; *(b) Equipment Failure Rates & Severity / Hole Size Distribution*; and *(c) Drilling / Well Operations* : *Severity /Hole Size Distribution,* are excluded from this report as they are now to be included in the Offshore Hydrocarbon Releases Statistics report in alternate years. Thus the tables, and the associated guidance and discussion, will be next updated in the 2001 report. In the meantime, reference should be made to the tables and text as they appear in the 1999 report (OTO 1999 079[3]).

Feedback on the contents of this statistics report for 2000 would be appreciated. This can be provided by completing the single page questionnaire form at the back of the report and returning it to OSD at the address indicated on the form.

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[3] See footnote 1

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 4.0 contains the data tables referred to in the report, all of which are listed in a separate section 4.0 index.

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

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

- Type of hydrocarbon, viz. liquids (oil/condensate/non-process[4]), gas, or 2-phase
- Severity of release, i.e. major, significant, or minor (Appendix 2)
- Type of installation, viz. fixed (incl. Floating Production Systems or FPS), mobile or subsea
- Location of installation on the UK Continental Shelf (UKCS) viz. Northern (above 59^0 Latitude), Central (56^0 to 59^0 Latitude) or Southern area (below 56^0 Latitude, including Irish Sea and English Channel)
- Year of occurrence (12 months 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), and 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.

[4]Non-process hydrocarbon liquids are defined as: diesel, helifuel, lubricants, etc.

3. STATISTICS

A total of **1801** hydrocarbon release incident reports were received, checked and input during the 7½ year period since the start-up of the Hydrocarbon Releases (HCR) Database on 1 October 1992, up to 31 March 2000 inclusive.

The following subsections comprise detailed discussion of the statistics contained in the tables and figures in sections 4.0 and 5.0 respectively.

Caution should be exercised when interpreting the 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. 1008 out of 1801 (56%). The other types, ranked in decreasing order, were oil 287 (15.9%), non-process 205 (11.4%), 2-phase 163 (9.1%) and condensate 138 (7.7%).

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 3.7 - “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 5.0, shows the monthly reporting frequencies since October 1992 up to the end of March 2000. Major milestones which occurred during the reporting period are also listed.

Reporting reached a peak of 325 in 1994/95, probably attributable to more detailed reporting following the issue of the OIR/12 form in August, 1992, and to comprehensive guidance[5] 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 seems to have reached a plateau with the annual totals for the following years to date being 226, 218, 234 and 234, and the monthly reporting rate fluctuating between 18 to 20 in the same period. In view of the reporting plateau comment, and the absence of any downward trend, OSD has launched a 3-part Process Integrity initiative (see Appendix 1) aimed at raising industry awareness to the problem and identifying their root causes, with a view to achieving a significant break through the existing plateau.

3.3 Severity analysis

3.3.1 *All releases*

All releases have been classified according to agreed revised severity criteria which now includes release rate (see Appendix 2).

Table 1 in Section 4.0 shows that, of the 1801 reported releases to 31 March 2000, 135 were classified major (7.5% of all leaks), 1058 were significant releases (58.5%) and the remaining 608 were minor (34%).

Figure 3 in section 5.0 shows the reporting patterns by year for major, significant and minor releases in both tabular and line graph form. The overall number of major re-

[5] Revised to encompass RIDDOR 95, OTO 96 956, *Revised Guidance on Reporting Offshore Hydrocarbon Release,* is available free on request from HSE-OSD on tel :0151-951-3099 or fax: 0151-951-3098.

leases in 1999/2000 decreased from last year's figures (down from 15 to 12), but within that figure the number of major gas releases increased from 8 to 11. The overall number of significant releases also decreased (from 134 to 127) over the same period, with significant gas releases also dropping from 85 to 79. In contrast, the overall number of minor[6] releases reported in 1999/2000 increased in comparison with last year's figure (up from 85 to 95), and minor gas releases also showed an increase (up from 31 to 45).

3.3.2 *Gas releases*

Figure 4 in section 5.0 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 continued in 1999/2000, with a further increase of 9% over the previous year (up from 124 to 135). Major gas releases also showed an upward trend from the low of 6 in 1997/98, and have now reached 11 in 1999/2000. However, this still falls short of the 1993/94 - 1994/95 high of 16.

3.3.3 *Liquid releases*

1Figure 5 in section 5.0 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.

[6]It 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 are reported, however minor.

3.3.4 *2-phase releases*

Figure 6 in section 5.0 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 5.0, 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 2.80×10^{-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 (1.38×10^{-1} leaks per system year), and fuel gas (1.29×10^{-1} leaks per system year).

3.5 Equipment

3.5.1 *Equipment : highest 15 failure rates*

The barchart in figure 8, section 5.0, 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 7.62×10^{-2} leaks per equipment year, and reciprocating compressors at 5.79×10^{-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 (279 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 tubing in particular) have been recognised and guidlines[7] have been produced for addressing loss of containment, etc..

3.6 Installation type/location versus release type & severity

Table 2 in section 4.0 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 59^0 Latitude North), Central (56^0 to 59^0 Latitude North), or Southern (below 56^0 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 2000) 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 1728 (95.95%) of releases reported. In contrast, only 73 releases (4.05%) 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.

[7] *Guidelines for the Management, Design, Installation and Maintenance of Small Bore Tubing Systems.* ISBN 0 85293 275 8. Published in 2000 by the Institute of Petroleum.

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.

Fixed floating installations (including FPSO and FSU) had the highest overall leak rate of 2.81 leaks per installation year, with 6.79% major. Fixed attended installations in the Central North Sea had the next highest leak rate of 2.7 leaks per installation year, with 5.75% of these being major releases. Northern fixed attended installations were next, with 2.66 leaks per installation year, with 6% major releases. Southern fixed attended installations had a leak rate of 0.40 leaks per installation year, with 6.41% major, and Southern normally unattended installations (NUI) leak rate was 0.23 leaks per installation year, with 21.7% 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 that there may therefore be a greater propensity for hydrocarbon releases of all types on the larger installations. In view of the smaller numbers of these installations, it is also expected that failure rates would be much greater than those in the Southern Sector.

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 0.27 leaks per installation year, with 7.9% major releases.

Northern and Central release figures combined gave an overall leak rate for semi-submersible mobile drilling and accommodation units of 0.16 leaks per installation year, with 20% major releases.

3.7 Ignitions

3.7.1 *Ignition summary*

Table 3, section 4.0, 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 118 reported ignitions (i.e. 6.6% of all releases) over the 7½ year period, none of which were major.

There were 36 gas ignitions (30.5% of all ignitions), of which 15 were classed as significant releases (ignition rate 2.3%), and 21 as minor (ignition rate 8.4%). There were no major ignited gas releases.

There were 82 liquid ignitions (69% of all ignitions) of which 23 were classed as significant releases (ignition rate 8.4%), and 59 as minor (ignition rate 17.3%). 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, but that ALL ignitions are reportable no matter how minor.

3.7.2 *Ignition details*

Table 4, section 4.0, comprises three parts which contain full details of every ignition reported in the 7½ years to 31 March 2000.

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 4.0, 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 1925 detection modes connected with the total 1801 reported releases, more than one mode being effective on some releases. Gas detectors detected 43% of all releases (60% of gas releases), and the remaining releases were mainly detected by means other than equipment designed for the purpose (see 3.8.2 over page).

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 4.0. 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 1925 modes, 1084 (56%) involved means of detection other than by dedicated detection systems. Of the 1084 occasions where 'other' means of detection were involved, 835 (77%) were visually detected. Of these, 48 (6% of visual detection) involved major releases, 460 (55% of visual detection) involved significant releases, and 327 (39%) 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 4.0, 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 CO_2/Halon systems, plus whether any musters and/or any other emergency actions were carried out.

Nearly two-thirds of releases (1184) required shutdown action (359 automatic, 825 manual), of which 98 (8% of shutdowns) were for major releases. Blowdown operated on 533 (220 auto, 313 manual = 30% of all releases) of which 59 (11% of blowdowns) were for major releases. There were 493 musters (454 at stations, 39 at lifeboats = 27% of all releases), 56 of which (11% of musters) were for major releases.

In contrast, deluge only operated on 37 releases (2% of all releases), of which 9 (24% of deluge) were for major releases, and only 47 (3% of all releases) involved the use of CO_2/Halon systems, of which only 1 was for a major release.
There was a total of 62 releases (5 major, 36 significant, 21 minor) where no reported emergency actions were taken. This represents 3.7% of all major releases, 3.5% of significant releases, and 3.4% of minor releases. This indicates that, regard-

less of severity, 96.5% of all reported releases involved some sort of emergency action (albeit only “other emergency action” in some cases).

Specific emergency actions taken for all ignitions reported to 31 March 2000 are included in table 4(c).

3.10 Causation & operating mode versus release type & severity

Table 8, section 4.0, 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 1192 (66%). Operational faults were next with 986 (55%), procedural faults 517 (29%), and design faults 283 (16%).

The proportion of releases occurring during normal production was 48% compared to that during intervention type activities such as start-up / reinstatement (18%), drilling / workover (10%), 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 816 occasions (45% of all incidents), followed by ‘improper operation’ which occurred on 433 occasions (24%).

4.0 TABLES

CONTENTS

(All single page tables unless noted otherwise)

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	TOTAL
MAJOR	LIQUID	1	4	1	2	3	1	2	0	**14**
	GAS	9	16	16	12	14	6	8	11	**92**
	2-PHASE	2	4	3	6	2	6	5	1	**29**
	TOTAL	12	24	20	20	19	13	15	12	**135**
SIGNIFICANT	LIQUID	12	32	53	30	40	40	31	36	**274**
	GAS	34	97	132	86	74	79	85	79	**666**
	2-PHASE	4	22	9	18	15	20	18	12	**118**
	TOTAL	50	151	194	134	129	139	134	127	**1058**
MINOR	LIQUID	9	53	56	34	54	37	53	46	**342**
	GAS	10	40	51	24	20	29	31	45	**250**
	2-PHASE	0	3	4	0	4	0	1	4	**16**
	TOTAL	19	96	111	58	78	66	85	95	**608**
ALL	LIQUID	22	89	110	66	97	78	86	82	**630**
	GAS	53	153	199	122	108	114	124	135	**1008**
	2-PHASE	6	29	16	24	21	26	24	17	**163**
	TOTAL	**81**	**271**	**325**	**212**	**226**	**218**	**234**	**234**	**1801**

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

NOTES :

1. **Data covers the period from 1st October, 1992 to 31st March, 2000.**

2. **Northern Area (N) = 59^0 N Latitude and above.**
   Central Area (C) = between 56^0 N Latitude and 59^0 N Latitude.
   Southern Area (S) = 56^0 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 2000.**

4. **COUNT of mobile installations comprises known fleet operating in UK waters during 1999/2000.**

5. **COUNT of subsea installations excludes single well satellite/tie-backs.**

6. **YEARS = estimated number of installation years (as at 31st March 2000) 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. **Failure rates may be calculated by dividing Release Type TOTALS by Installation YEARS.**

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

INSTALLATION TYPE		99/00 POPULATION COUNT	99/00 POPULATION YEARS	RELEASE TYPE: LIQUIDS Maj	LIQUIDS Sig	LIQUIDS Min	GAS Maj	GAS Sig	GAS Min	2-PHASE Maj	2-PHASE Sig	2-PHASE Min	TOTALS
(1) FIXED = 1728 or 95.95 % of TOTAL RELEASES													
NORTHERN FIXED	**MANNED**	28	204	3	65	98	19	210	79	9	53	8	**544**
	NUI	3	22.5	0	0	0	0	0	0	0	0	0	**0**
CENTRAL FIXED	**MANNED**	37	226	1	88	141	27	217	84	7	40	4	**609**
	NUI	8	58	0	0	1	0	0	0	0	1	0	**2**
SOUTHERN FIXED	**MANNED**	68	487	2	28	37	15	86	30	0	0	0	**198**
	NUI	92	454	2	19	5	19	45	10	2	4	0	**106**
FPS		22	94	2	57	50	9	89	32	7	16	3	**265**
SUBSEA		19	-	0	0	0	0	2	0	1	0	1	**4**
TOTAL		277	-	10	257	332	89	649	235	26	114	16	**1728**
(2) MOBILES = 73 or 4.05 % of TOTAL RELEASES													
SEMI-SUB (incl. 1 Mobile Accomm. Unit)	**N**	31	221	3	7	1	0	2	0	1	1	0	**15**
	C			0	5	3	1	5	1	2	3	0	**20**
	S			0	0	0	0	0	0	0	0	0	**0**
JACK-UP (0 Mobile Accomm. Unit)	**N**	20	138	0	0	0	0	0	0	0	0	0	**0**
	C			1	0	2	2	1	1	0	0	0	**7**
	S			0	5	4	0	9	13	0	0	0	**31**
TOTAL		51	-	4	17	10	3	17	15	3	4	0	**73**
GRAND TOTAL		**328**	**-**	**14**	**274**	**342**	**92**	**666**	**250**	**29**	**118**	**16**	**1801**

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**	0	1	2	0	1	0	0	0	0	**4**
	RELEASES	1	12	9	9	34	10	2	4	0	**81**
	% [3]	0	8.3	22.2	0	2.9	0	0	0	0	**4.9**
1993/94	**IGNITIONS**	0	7	10	0	4	5	0	0	0	**26**
	RELEASES	4	32	53	16	97	40	4	22	3	**271**
	% [3]	0	21.9	18.9	0	4.1	12.5	0	0	0	**9.6**
1994/95	**IGNITIONS**	0	5	15	0	1	3	0	0	0	**24**
	RELEASES	1	53	56	16	132	51	3	9	4	**325**
	% [3]	0	9.4	26.8	0	0.8	5.9	0	0	0	**7.4**
1995/96	**IGNITIONS**	0	1	6	0	1	1	0	0	0	**9**
	RELEASES	2	30	34	12	86	24	6	18	0	**212**
	% [3]	0	3.3	17.6	0	1.2	4.2	0	0	0	**4.2**
1996/97	**IGNITIONS**	0	4	10	0	2	2	0	0	0	**18**
	RELEASES	3	40	54	14	74	20	2	15	4	**226**
	% [3]	0	10	18.5	0	2.7	10	0	0	0	**8**
1997/98	**IGNITIONS**	0	0	3	0	3	3	0	0	0	**9**
	RELEASES	1	40	37	6	79	29	6	20	0	**218**
	% [3]	0	0	8.1	0	3.8	10.3	0	0	0	**4.1**
1998/99	**IGNITIONS**	0	3	9	0	3	3	0	0	0	**18**
	RELEASES	2	31	53	8	85	31	5	18	1	**234**
	% [3]	0	9.7	17	0	3.5	9.7	0	0	0	**7.7**
1999/00	**IGNITIONS**	0	2	4	0	0	4	0	0	0	**10**
	RELEASES	0	36	46	11	79	45	1	12	4	**234**
	% [3]	0	5.6	8.7	0	0	8.9	0	0	0	**4.3**
ALL YEARS	**IGNITIONS**	0	23	59	0	15	21	0	0	0	**118**
	RELEASES	14	274	342	92	666	250	29	118	16	**1801**
	% [3]	0	8.4	17.3	0	2.3	8.4	0	0	0	**6.6**

Notes:

(1) Total numbers in Hydrocarbon releases database for the period 01-10-92 TO 31-03-00

(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

Full details of all Ignitions are given in Tables 4 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, 2000.**

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	CF	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, Gas	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
	32	Non Process	Lub Oil	Minor	Export, Oil	CF	799.12	3.63	0.00	5.00	N/A

*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)
	33	Non Process	Lub Oil	Significant	Gas Compression	CF	799.12	964.80	70.00	2.00	12.70
	34	Non Process	Lub Oil	Minor	Gas Compression	SF	799.12	3.00	5.00	5.00	1.00
	35	Non Process	Lub Oil	Minor	Gas Compression	NF	799.12	3.00	5.00	5.00	1.00
	35	Non Process	Lub Oil	Minor	Gas Compression	NF	799.12	3.00	5.00	5.00	1.00
	36	Non Process	Diesel	Minor	Gas Compression	CF	799.12	7.26	5.00	30.00	N/A
	37	Non Process	Glycol	Minor	Processing, Gas, Chemical Injection	SF	799.12	6.00	5.00	2.00	2.00
	38	Non 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	60.00	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 Process	Lub Oil	Significant	Gas Compression	NF	869.04	60.83	10.00	7.00	2.70
	57	Non Process	Glycol	Minor	Processing, Gas, Dehydration	CF	799.12	29.30	0.00	720.00	1.00
	58	Non 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
	63	Gas		Minor	Vent, LP	CF	1.00	0.50	0.00	2.00	6.00

*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)
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	180.00	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	Utilites, Oil, Diesel	CF	799.12	0.80	50.00	2.00	1.00
	83	Non Process	Diesel	Minor	Utilites, Oil, Diesel	CF	799.12	10.00		16.70	3.00
	84	Non Process	Diesel	Minor	Utilites, 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											
1998/99	91	Non Process	Lub Oil	Significant	Gas Compression	NF	869.04	465.00	100.00	5.00	5.00

*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)
	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											

*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(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 Process	Lub Oil	Minor	Testing	Imping 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 Process	Lub Oil	Significant	Testing	Hot surface on the turbine exhaust pipework.		1			
	6	Non Process	Lub Oil	Minor	Normal Production	Hot surface of power turbine exhaust cowling.	60	1			
	7	Non 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	

*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
	23	Gas		Minor	Inspection	Spark from a 24 volt lead going to earth.		1			
	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 - lighntning.		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 pres ent 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 perfecto fluid.	60	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	

*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
	47	Non Process	Diesel	Significant	Normal Production	Hot surface of machine.				1	
	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 stationery 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			

*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
	69	Non Process	Diesel	Minor	Maintenance Cold Work	Flash fire on hot turbine exhaust.		1			
	70	Non Process	Diesel	Significant	Start-up	Fire caused by ignition of some burners while diesel fuel from the unlit 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			

*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
	93	Non Process	Lub Oil	Minor	Maintenance Cold Work	Turbine exhaust (two UV flame detectors activated and CO2 manually discharged). Turbine had been shutdown for approx 15 minutes prior to alarm.		1			
	94	Non Process	Lub Oil	Minor	Shut Down	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	

*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
	110	Non Process	Diesel	Minor	Normal Production	Suspect hot turbine casing surface. No flame was seen during this incident. On the basis that 2xIR detectors had activated it is believed that a flash fire had occurred, investigations are ongoing.		1			
	111	Non Process	Diesel	Minor	Reinstatement	Smoke caused by diesel supply fitting to one of the combustion cans leaking onto hot surfaces.		1			
	112	Non Process	Diesel	Minor	Reinstatement	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											

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

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						

Table 5 : MEANS OF DETECTION : SUMMARY

HYDRO-CARBON TYPE	SEVERITY	DETECTION MODE					TOTALS	
		HEAT	SMOKE	FLAME	GAS	OTHER	MODES	LEAKS
LIQUIDS	Maj	0	0	0	2	12	14	14
	Sig	5	4	12	57	219	297	274
	Min	3	5	22	53	268	351	342
GAS	Maj	0	1	0	57	38	96	92
	Sig	1	4	3	388	328	724	666
	Min	1	2	3	158	103	267	250
2-PHASE	Maj	0	0	0	14	19	33	29
	Sig	0	2	0	42	82	126	118
	Min	0	0	1	1	15	17	16
TOTALS	Maj	0	1	0	73	69	143	135
	Sig	6	10	15	487	629	1147	1058
	Min	4	7	26	212	386	635	608
GRAND TOTALS		**10**	**18**	**41**	**772**	**1084**	**1925**	**1801**

Notes:

1. Totals for the period 1-10-92 to 31-03-00
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	201	241	22	191	72	16	68	14	**835**
Sound	0	2	5	3	60	11	1	6	0	**88**
Change (pressure, level temperature)	2	8	2	6	4	1	0	2	0	**25**
Smell	0	7	20	5	63	15	0	2	0	**112**
Hand-held Detection	0	0	0	0	7	3	0	0	0	**10**
ROV	0	1	0	2	3	1	2	4	1	**14**
TOTALS	12	219	268	38	328	103	19	82	15	**1084**
GRAND TOTALS	**499**			**469**			**116**			

Notes:

1. Data for the period 1-10-92 to 31-03-00
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			
		Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min	
SHUTDOWN	AUTO	1	32	45	32	153	67	7	21	1	**359**
	MANUAL	8	137	172	35	290	83	15	72	13	**825**
	NONE	5	105	125	25	223	100	7	25	2	**617**
BLOWDOWN	AUTO	1	13	20	20	120	27	4	14	1	**220**
	MANUAL	2	30	29	25	143	38	7	33	6	**313**
	NONE	11	231	293	47	403	185	18	71	9	**1268**
DELUGE	AUTO	0	0	6	2	14	2	0	1	0	**25**
	MANUAL	0	2	1	4	2	0	3	0	0	**12**
	NONE	14	272	342	86	650	248	26	117	16	**1771**
CO^2/HALON	AUTO	0	5	7	0	7	0	0	1	0	**20**
	MANUAL	0	7	10	1	4	5	0	0	0	**27**
	NONE	14	262	325	91	655	245	29	117	16	**1754**
MUSTER	AT STATIONS	2	44	46	36	193	84	15	34	0	**454**
	AT LIFEBOATS	0	2	4	3	19	9	0	2	0	**39**
	NONE	12	228	292	53	454	157	14	82	16	**1308**
OTHER ACTION TAKEN	YES	5	138	171	39	262	100	13	45	7	**780**
	NO	9	136	171	53	404	150	16	73	9	**1021**
TOTALS		**14**	**274**	**342**	**92**	**666**	**250**	**29**	**118**	**16**	**1801**

Notes :

1. Data for the period 1-10-92 to 31-03-00
2. There may be more than one type of action taken in relation to any one incident

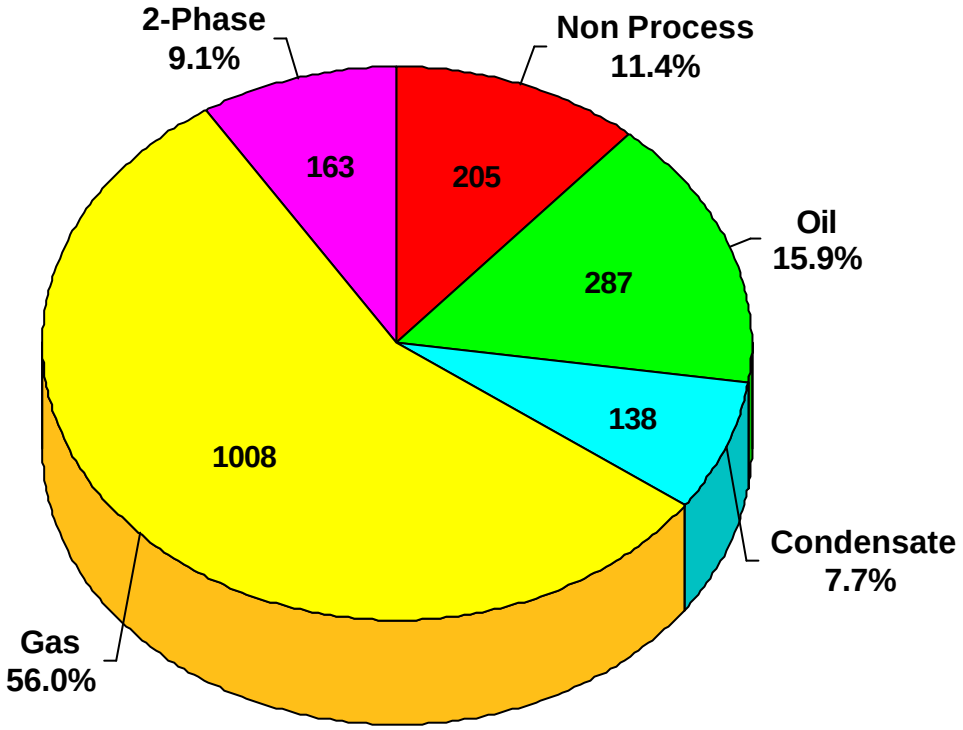
Table 8 : CAUSATION & OPERATING MODE versus RELEASE TYPE & SEVERITY

CAUSATION FACTORS		HYDROCARBON TYPE & SEVERITY									TOTALS	
		LIQUIDS			GAS			2-PHASE				
		Maj	Sig	Min	Maj	Sig	Min	Maj	Sig	Min		
DESIGN FAULT		2	40	50	22	118	28	3	17	3	**283**	
EQUIPMENT FAULT	CORROSION/EROSION	0	39	59	4	57	29	9	32	3	232	**1192**
	MECHANICAL DEFECT	6	128	164	48	304	91	13	52	10	816	
	MATERIAL DEFECT	2	11	8	2	30	9	0	3	1	66	
	OTHER	2	11	15	4	28	11	0	7	0	78	
OPERATIONAL FAULT	INCORRECTLY FITTED	0	26	47	17	106	28	5	10	1	240	**986**
	IMPROPER OPERATION	5	76	80	22	153	61	7	25	4	433	
	DROPPED/IMPACT	1	7	9	2	6	3	3	2	0	33	
	LEFT OPEN/OPENED	2	28	30	13	74	44	0	13	0	204	
	OTHER	2	12	9	3	35	7	1	5	2	76	
PROCEDURAL FAULT	NON-COMPLIANCE	0	34	27	15	79	26	3	10	0	194	**517**
	DEFICIENT PROCEDURE	3	45	46	15	113	44	1	22	1	290	
	OTHER	1	4	3	2	16	5	1	1	0	33	
OPERATING MODE IN AREA AT TIME OF INCIDENT												
DRILLING/WELL OPERATION		4	23	12	5	67	36	5	19	1	172	**1801**
NORMAL PRODUCTION		6	137	189	47	309	79	15	67	12	861	
SHUTDOWN/BLOWDOWN		2	22	15	10	56	13	2	7	0	127	
PIG/FLUSH/CLEAN/INSPECT		1	8	8	4	31	15	1	4	0	72	
MAINTENANCE/CONSTRUCTION		0	26	35	11	59	33	1	4	2	171	
TESTING/SAMPLING		0	13	18	1	13	13	2	6	1	67	
REINSTATEMENT/START-UP		1	45	65	14	131	61	3	11	0	331	
TOTAL No. OF RELEASES		**14**	**274**	**342**	**92**	**666**	**250**	**29**	**118**	**16**	**1801**	

Notes:
1. Data for the period 1-10-92 to 31-03-00
2. There may be several causation factors contributing to any one incident

5.0 FIGURES

CONTENTS

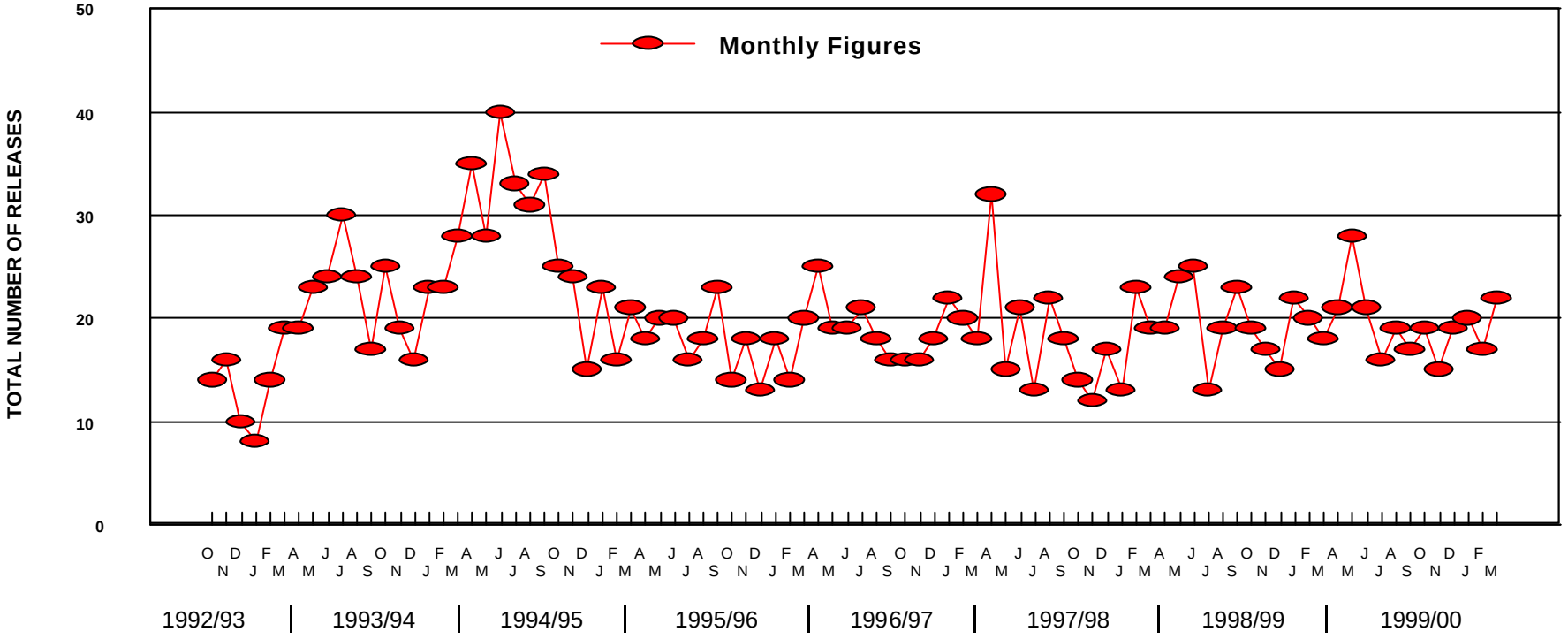


1. Total number of releases = 1801

2. Figures for the period 01-10-92 to 31-03-00

Figure 1 : BREAKDOWN BY HYDROCARBON TYPE

Figure 2 : TRENDS IN REPORTING OCT 1992 TO MAR 2000



1. Reported releases for the period 01-10-92 to 31-03-00 = 1801

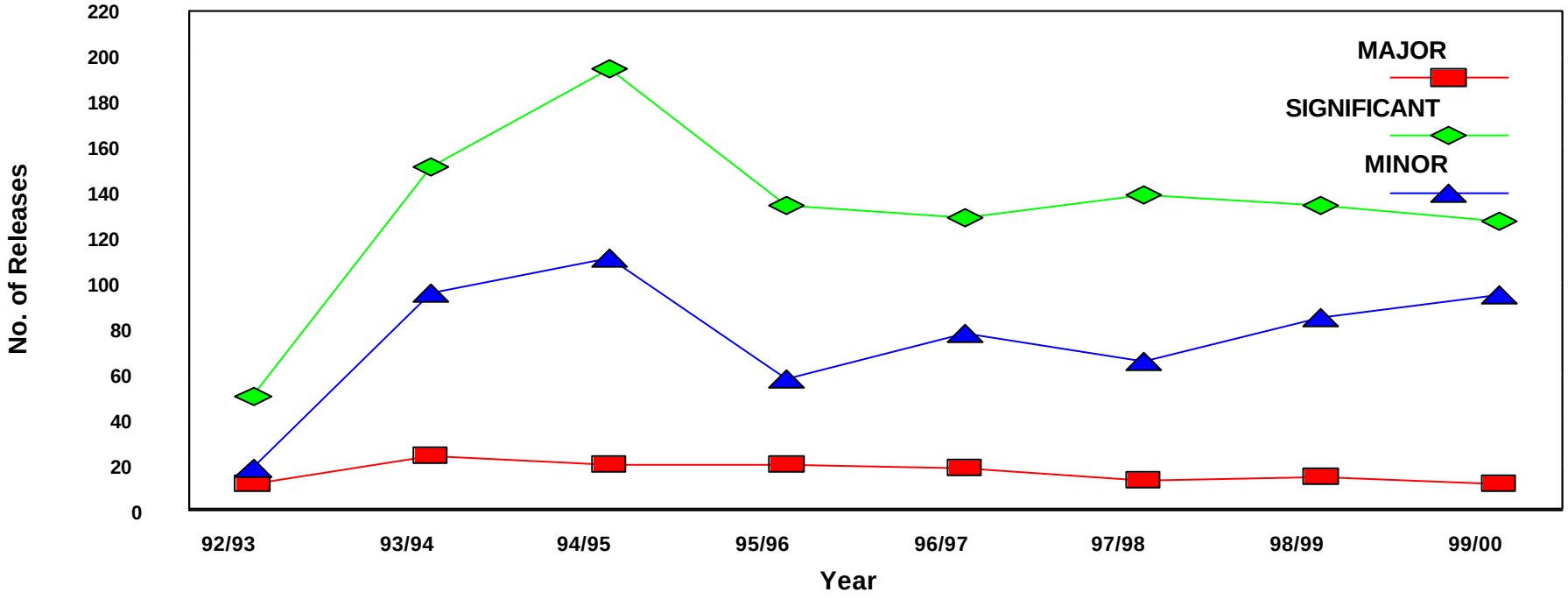
2.

Monthly average for 1992/93 = 14	(81 in total)	October 1992	Database Start-up
Monthly average for 1993/94 = 23	(271 in total)	August 1993	Guidance Issued
Monthly average for 1994/95 = 27	(325 in total)	October 1994	First Outputs Report Issued
Monthly average for 1995/96 = 18	(212 in total)	October 1995	Second Outputs Report Issued
Monthly average for 1996/97 = 19	(225 in total)	April 1996	RIDDOR Offshore
Monthly average for 1997/98 = 18	(219 in total)	October 1996	Third Outputs Report Issued
Monthly average for 1998/99 = 20	(234 in total)	November 1996	Revised Guidance Issued
Monthly average for 1999/00 = 20	(234 in total)	December 1999	Fourth Outputs Report Issue

ALL	SEVERITY	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
	MAJOR	12	24	20	20	19	13	15	12
	SIGNIFICANT	50	151	194	134	129	139	134	127
	MINOR	19	96	111	58	78	66	85	95
	TOTAL	**81**	**271**	**325**	**212**	**226**	**218**	**234**	**234**

Severity Analysis

Figure 3 : All Offshore Hydrocarbon Releases

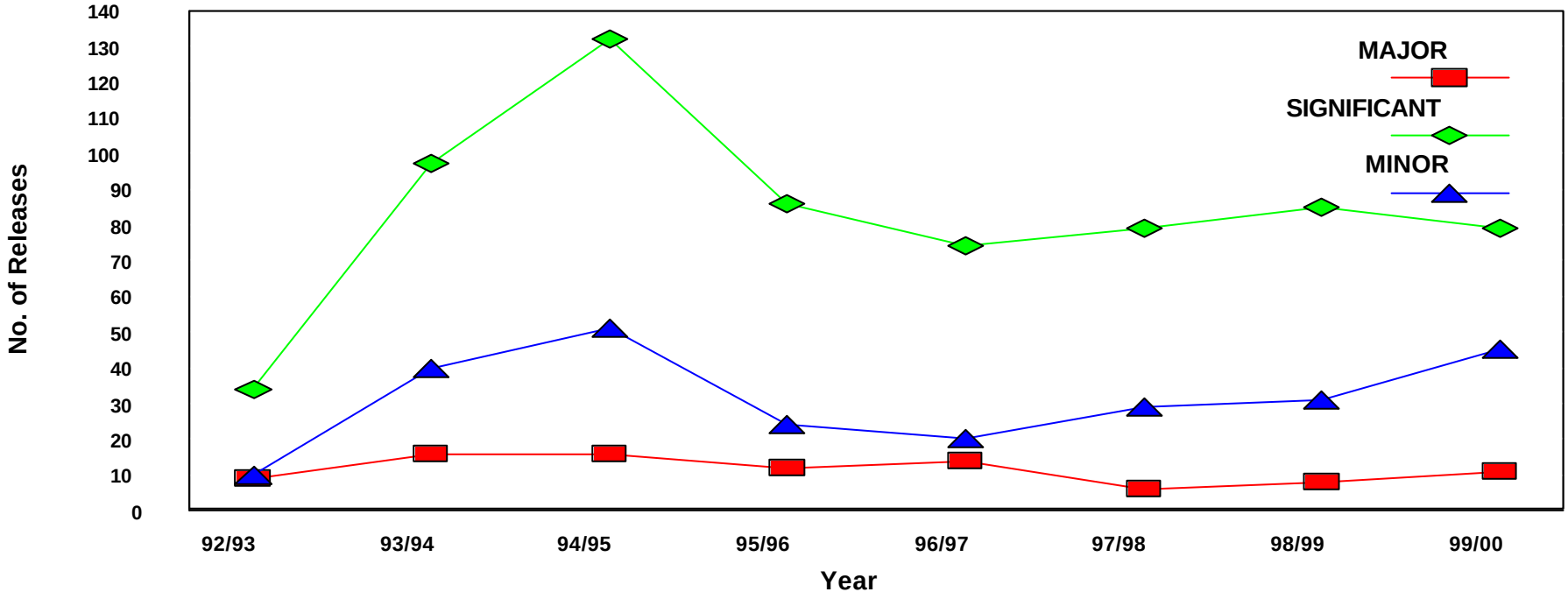


Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of releases reported to 31-03-00 = 1801

GAS	SEVERITY	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
	MAJOR	9	16	16	12	14	6	8	11
	SIGNIFICANT	34	97	132	86	74	79	85	79
	MINOR	10	40	51	24	20	29	31	45
	TOTAL	53	153	199	122	108	114	124	135

Severity Analysis
Figure 4 : Gas Releases



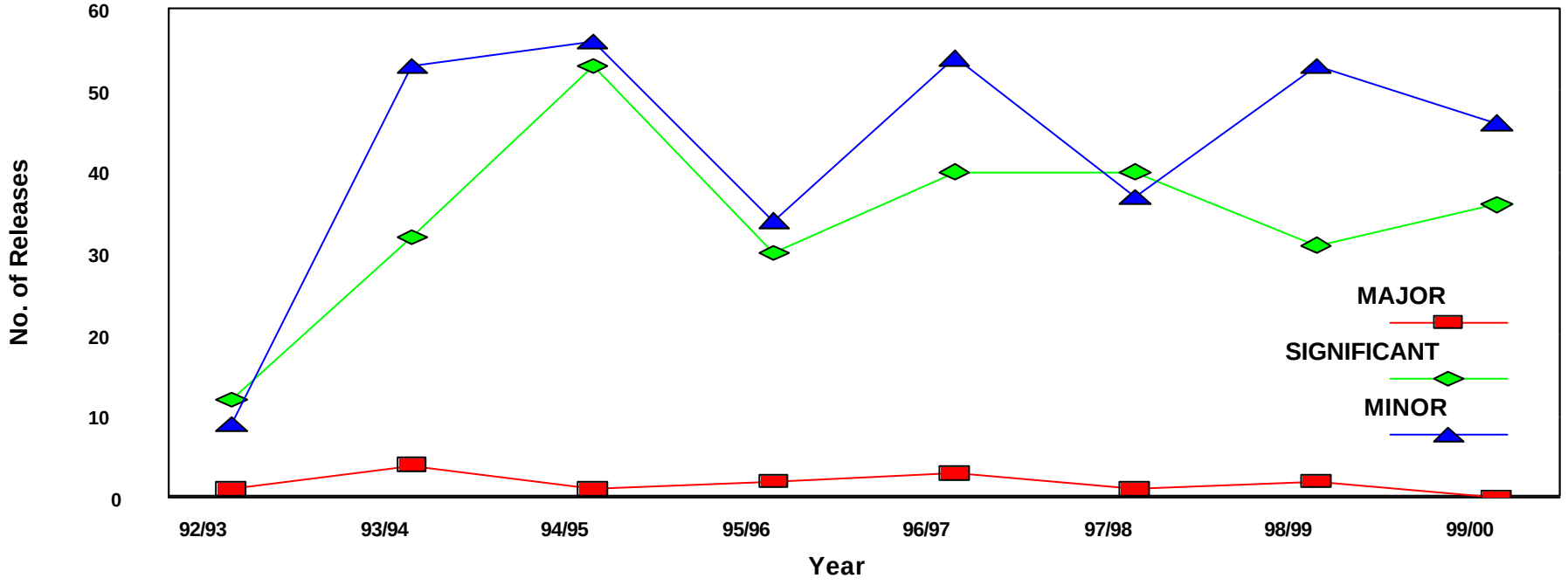
Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of gas releases reported to 31-03-00 = 1008

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

Severity Analysis

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



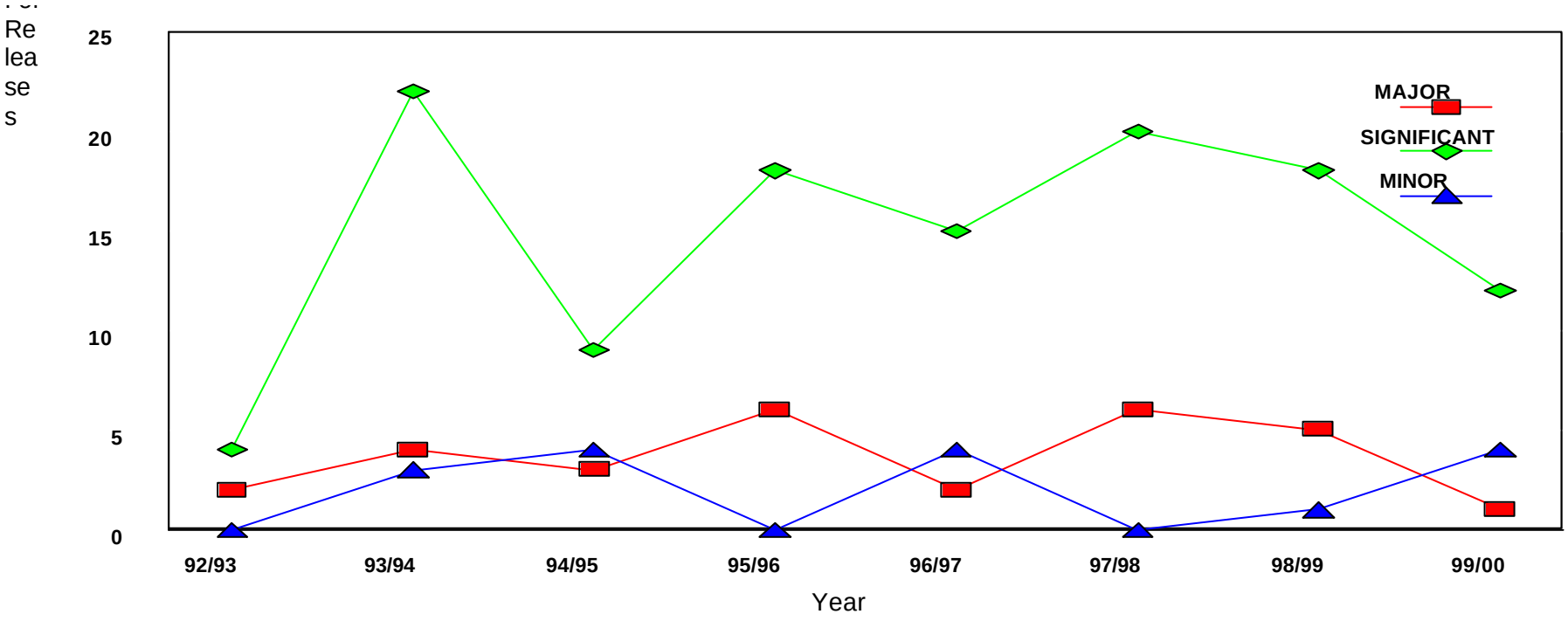
Start-up of Database on 01-10-1992

1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of liquid releases reported to 31-03-00 = 630

2-PHASE	SEVERITY	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
	MAJOR	2	4	3	6	2	6	5	1
	SIGNIFICANT	4	22	9	18	15	20	18	12
	MINOR	0	3	4	0	4	0	1	4
	TOTAL	**6**	**29**	**16**	**24**	**21**	**26**	**24**	**17**

Severity Analysis

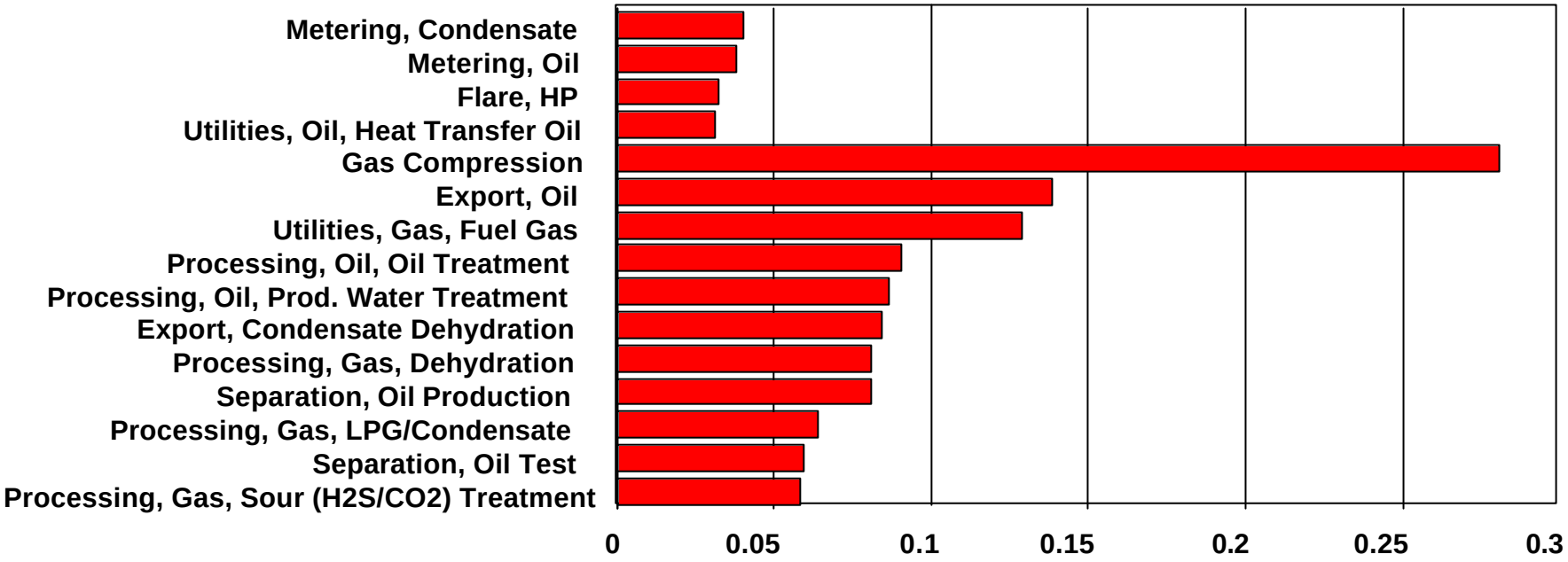
Figure 6 : 2-Phase Releases



Start-up of Database on 01-10-1992

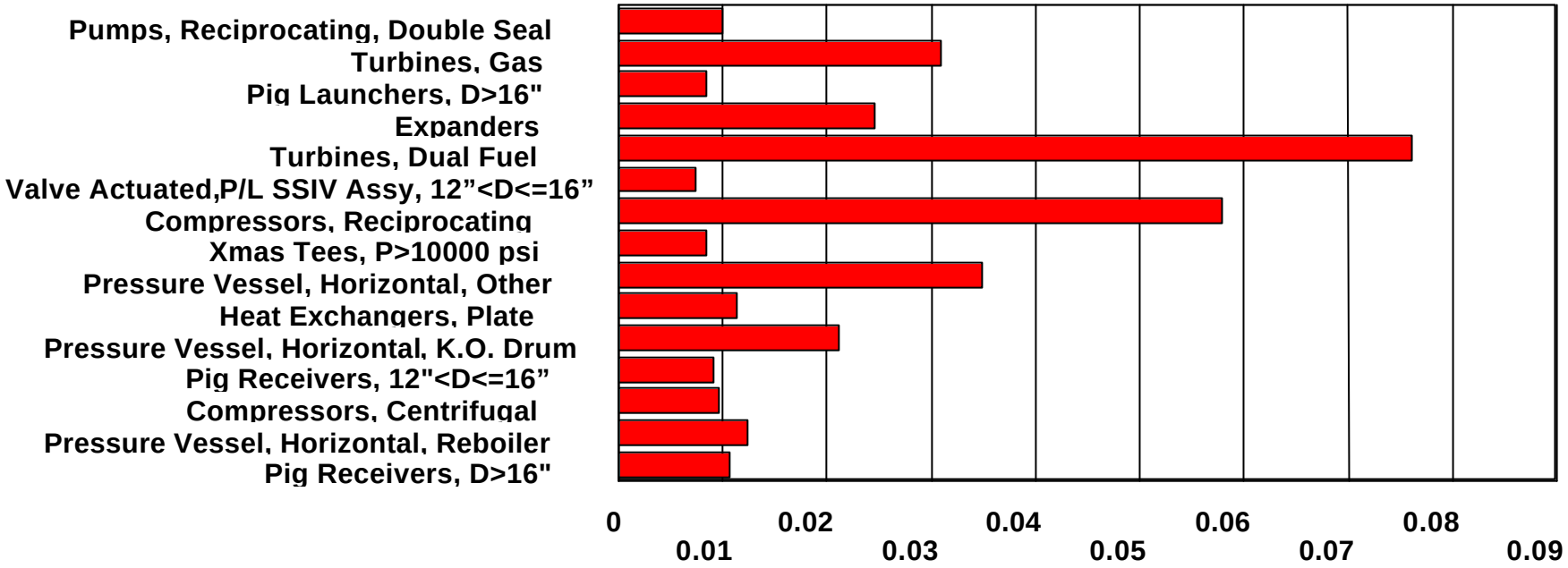
1. 1992/93 covers the period 01-10-92 to 31-03-93 only
2. Total number of 2-Phase releases reported to 31-03-00 = 163

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 31-03-00.

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 31-03-00.

APPENDIX 1

OSD PROCESS INTEGRITY INITIATIVE

As indicated in the executive summary and elsewhere in this report, OSD has launched an initiative to deal with Process Integrity concerns as a result of the reporting plateau (see earlier comments) shown by recent offshore hydrocarbon release statistics, and by trends identified from these 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 commenced on 1 April 2000 and has three strands:

1) OSD will investigate all RIDDOR reportable hydrocarbon releases which occur during the next planning year to 31 March 2001, for major and significant releases this will include offshore visits by Inspectors.

2) It is planned to conduct process integrity inspections of all manned production installations which will be phased in over the next three years, i.e. 2000 to 2003.

3) A joint HSE/Industry Workshop on hydrocarbon releases was held on 9 November at Ardoe House near Aberdeen.

The separate offshore hydrocarbon releases analysis report planned for mid-2000 (OTO 1999 079 refers) has consequently been postponed to take advantage of the feedback from the resultant inspections and investigations.

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 m^3 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>10kg/s AND Duration >15 mins]

This could result in a pool fire over 10 metres in diameter (>10kg/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>1kg/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 m^3 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 m^3 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, 2000
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	☐	Oil Company employee	☐	Academic	☐
Service Company management	☐	Service Company employee	☐	Consultant	☐
Industry Assoc. Representative	☐	Trade Union	☐	Journalist	☐

Other (specify) _____

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

Completely	☐	More than 50%	☐
Poorly	☐	Not at all	☐

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

* More / less discussion	☐	* More / less tables	☐
* More / less graphs	☐	* More / less analysis	☐ (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 ☐ No ☐

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

Statistics Report	Yes	☐	No	☐
Analysis Report	Yes	☐	No	☐

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

Safety Case Development	☐	Project Development	☐	Ind. Relations	☐
Reliability/Availability	☐	Risk Assessment	☐	Design	☐
Health & Safety Management	☐	Other (specify) _____			

Please return completed form to:

HSE, Offshore Safety Division
Data Management Team, OSD1.6
Room 201
Merton House
Stanley Road
Bootle
L20 3DL

THANK YOU FOR COMPLETING THIS FORM