THE OFFSHORE HYDROCARBON RELEASES (HCR) DATABASE

Eur. Ing. R.A.P.Bruce,
HSE Offshore Safety Division,Technology Branch, Merton House, Bootle. L20 3DL

Following Cullen Recommendation 39 which states that :
"The regulatory body should be responsible for maintaining a database with regard to hydrocarbon leaks, spills, and ignitions in the Industry and for the benefit of Industry ",
HSE Offshore Safety Division (HSE-OSD) has now been operating the Hydrocarbon Releases (HCR) Database for approximately 3 years.
This paper deals with the reporting of Offshore Hydrocarbon Releases, the setting up of the HCR Database, the collection of associated equipment population data, and the main features and benefits of the database, including discussion on the latest output information.

Key Words : Offshore Safety; Hydrocarbons Incidents; Leak Frequencies; Database; Cullen Recommendation;

INTRODUCTION

During his investigation of the Piper Alpha disaster, and in his subsequent report [Ref.1] , Lord Cullen wrote (Vol.2, Page 299, Section 18.43):
"I am convinced that learning from accidents and incidents is an important way of improving safety performance." ..... "I consider it would be useful if there was a systematic means by which what could be learnt from incidents and near misses could be shared by all operators."
[A"near miss" is defined in the Cullen Report (P.299, Section 18.41) as a near accident that could have involved serious injury or had the potential for serious damage to property or the environment]
This judgement served to confirm the value of incident data in the assessment of major hazards, and its applicability to offshore activities.

At the time of the Piper Alpha disaster (July, 1988) most accident data sources shared a common criteria that "dangerous occurrences" involved stoppages of over 24 hours. This meant that "near misses" i.e. those hydrocarbon leaks, spills and ignitions resulting in a lower level of consequential stoppage or damage, were not being reported and were thus missing from the data being gathered at that time.

In order to address this shortfall, Lord Cullen recommended in his report (Recommendation 39) that:
" The regulatory body should be responsible for maintaining a database with regard to hydrocarbon leaks, spills and ignitions in the industry and for the benefit of the industry."

As a result of other Cullen Recommendations (Nos.23-26) the Health and Safety Executive, Offshore Safety Division (HSE-OSD) took over the responsibility for offshore safety from the Department of Energy, in April, 1991. As the new Regulatory Body, HSE-OSD therefore also assumed responsibility for the setting up of the Hydrocarbon Releases (HCR) Database in line with Cullen Recommendation 39.

Since item (i) of Cullen Recommendation 39 required that the regulatory body should " discuss and agree with Industry, the method of collection and use of the data", it was necessary to set up the formal lines of communication required to achieve this.

A Joint Working Party (JWP) with Industry on Failure Rate Data (FRD) was formed to carry out such discussion, and an inaugural meeting was held in April, 1992. Membership of the JWP has increased slightly over the past two years, and now comprises a total of twelve members drawn from the United Kingdom Offshore Operators Association (UKOOA); the International Association of Drilling Contractors (IADC); the British Rig Owners Association (BROA) ; the Exploration and Production (E & P) Forum; the Affiliates of the Safety and Reliability Society (SaRS) representing Offshore Risk Consultants ; the British Chemical Engineering Contractors Association (BCECA) representing the offshore designers; and the Health and Safety Executive, Offshore Safety Division (HSE-OSD) including the Chair and Secretariat.

The JWP on FRD remains the main forum through which the views and decisions of Industry are obtained with regard to, amongst other things, the development of the HCR Database.

REPORTING OF HYDROCARBON RELEASES

In order to gather the required data on hydrocarbon leaks, spills and ignitions, HSE-OSD had to discuss and agree revisions to the existing definitions for dangerous occurrences. These definitions appear on the OIR/9A reporting form, which is the form issued by HSE-OSD for the reporting of all offshore incidents.

The original definitions covering hydrocarbon releases, fires and explosions, apart from their reporting requirement after serious injury, allowed a considerable amount of hydrocarbon to be released before reporting was necessary, and such incidents went unreported unless a 24 hours or more stoppage of work had occurred.

The main definition [definition 4 (g) on form OIR/9A] regarding hydrocarbon releases, now reads :

"Any release of petroleum hydrocarbon resulting in the stoppage of plant; the suspension of work; a flash fire; a continuous fire; an explosion; the operation of a smoke, flame, fire or gas detector at or above the lowest action point; or any specific action to prevent the possibility of a fire or an explosion; and/or any release resulting in or having the potential to cause death or serious injury to any person".

This revised definition has now lowered the reporting threshold sufficiently to cover the" near misses" and the leaks, spills and ignitions discussed in the Cullen Report.

At the same time, a new voluntary reporting scheme was set up. This scheme invites the operator to provide further details, on a voluntary basis, of the hydrocarbon released.
Details to be provided on the new "Hydrocarbon Release Report Supplementary Information" form (OIR/12) include :

- Date, time and geographical location of incident, including Installation details
- Hydrocarbon type, including density/gravity, Gas to Oil Ratio (GOR), level of H_2S
- Quantity released, and Duration of leak
- Location of leak, including an itemised check list indicating system and equipment involved
- Hazardous area classification
- Equivalent hole diameter, based on hydraulic equivalent hole, d = 4A/p where A = Actual cross-sectional area of hole and p = wetted perimeter.
- Module Ventilation and Weather Conditions
- System Pressure, maximum allowable and actual at time of release
- Total (isolatable)Hydrocarbon Inventory in system
- Means of Detection, i.e. type(s) of detector activated and/or sight/sound/smell indications
- Extent of dispersion/accumulation
- Cause of Leak, including an itemised check list indicating any failure in design, equipment, operational, and/or procedural aspects, plus operational mode in the area at the time
- Ignition details , including delay time (if any) and sequence of events, plus ignition source
- Emergency actions taken, with tick list for either Automatic or Manual Shutdown, Blowdown, Deluge, and/or CO_2/Halon, plus Call to Muster at either Stations or Lifeboats.

The new OIR/12 forms were issued to Industry in August, 1992, with the first completed forms being received in HSE-OSD in early October, 1992, and so it was decided to make the start date 1 October, 1992 for all data in the HCR Database.

The receipt of correctly completed OIR/12 forms is important to ensure good output data from the database, and so "Guidance on the Reporting of Offshore Hydrocarbon Releases" was issued to Industry in August, 1993. (OTO 93 018) [Ref.2]

The guidance contained in that document was aimed at consistency in completion of both the OIR/9A form and the OIR/12 form.

It is hoped to maintain this consistency after the proposed Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations (RIDDOR) [Ref.3] are implemented offshore in 1996.

Industry organisations are being consulted on the definitions to be included in the proposed regulations, and it is expected that there will be a smooth transition to the new RIDDOR reporting scheme, certainly with regard to the reporting of Offshore Hydrocarbon Releases. This, in turn, should ensure continuity of data received.

POPULATION DATA

Cullen Recommendation 39 also mentions the determination of trends and the use of data for the purposes of carrying out QRA (items (ii) and (iii) respectively).

To validate trends, once determined, it is necessary to know the size of the affected population. For example, 5 leaks from a population of 100 equipment items, can be seen to be more significant than 5 leaks from a population of 10,000 such items.
Also, leak frequencies are a prerequisite for the QRA of hydrocarbon incidents, for example as initiating events in event trees, or as base data in fault tree analyses, and these are expressed in terms of "per equipment year" or "per activity"(e.g. per well drilled).

Therefore, to facilitate the validation of trends and the calculation of leak frequencies it was decided that systems and equipment population data would need to be obtained and be input into the Hydrocarbon Releases (HCR) Database.

Following extensive discussions with Industry via the JWP on FRD, and a pilot study which tested the effectiveness of the questionnaire and associated guidance, the population data exercise received Ministerial approval in July, 1994.

Population data gathering packages containing questionnaire, guidance, transmittal and acknowledgement slips, were then distributed to Industry in August, 1994, and the bulk of the data was eventually received in HSE-OSD by end August, 1995. This was approximately 6 months later than expected, but was due to the substantial extra demand for already scarce engineering resources. Although a voluntary exercise, the response from Industry has been excellent with all operators and owners participating in the survey.

A separate report on the results of the exercise itself is scheduled for publication before the end of 1995, and in the meantime the population data is being input into the database to enable leak frequency calculations to be made.

The submission of Safety Cases under the Safety Case Regulations [Ref.4] will be used to monitor the need for population updates. The submission of a design safety case will trigger the request for population data for a new installation, and similarly an abandonment safety case will signal the need to freeze the data for an old installation.

For Mobile Installations, a safety case must be submitted for acceptance in advance of arrival in UK waters, and any departure from UK waters must also be notified (although this notification is given separately from the safety case system). In both cases, the population data will be updated to suit.

Safety cases are also required for major modifications, and so any significant changes in the population will be signalled well in advance to allow timely updates to take place.

Drilling and well operations data will be updated each year via a one-page questionnaire.

DATABASE DESIGN

The HCR Database design is ORACLE® - based and was designed and built by HSE [Ref.5]. It was decided to carry out the design of the database in two phases:

Phase 1 allowed the input, storage and interrogation of the OIR/12 hydrocarbon release reports data, with a limited output capability. This was completed and tested by 31 May, 1993, and all hydrocarbon releases reports received since 1 October, 1992 , are now in the database.

Phase 2 allowed the addition of, storage of, and link-ups with the population data, such that the required leak frequencies could be determined. This was only completed at the end of August, 1995, and the facility to produce outputs using population data became available thereafter.

Population data is now being input into the database, and the next outputs report (see below) should also include leak frequency data.

OUTPUTS

So, having obtained all this data on releases (and population data) and input it into the HCR Database, what do we do with it ? This section of the paper covers examples of the type of output reports currently available, each containing information from the database, for the period 1 October, 1992 to 31 March, 1995, a total of **621** reports.

Breakdown by Hydrocarbon Type (Figure 1)

It can be seen from the Pie-chart, that by far the largest proportion (58.8%) of releases reported were gas releases. The other types, ranked in order of decreasing percentage, were oil (15.9 %), 2-phase(8.7 %), non-process (8.5 %), and condensate (8.1 %). These figures in themselves are not surprising since almost all installations handle gas, whereas only Northern and Central area installations handle oil and 2-phase hydrocarbons.

Other contributing factors to the higher incidence of gas releases could be that gas is usually subjected to higher pressures and temperatures than other hydrocarbons, and, being gas, it requires much more stringent containment measures than those required for liquids.

Breakdown by System Type (Figure 2)

The Bar-chart indicates that the systems involving most releases include Gas Compression (high pressure/high temperature), followed by Gas Utilities.
This would confirm the higher incidence of gas releases as discussed above.
Oil Export and Oil Flowlines contributed to most oil releases.
Production Wells contributed to most 2-phase releases.
Condensate Export and Metering contributed to most condensate releases.
Drilling systems contributed to most non-process releases, and, as would be expected, also dominated the systems figures for Mobile Installations.

Breakdown by EquipmentType (Figure 3)

From the barchart, the types of equipment involving the greatest numbers of releases are Pipework and Instruments. Again, this is no surprise, because virtually all systems on offshore installations employ pipework items (piping, valves, flanges) and instruments in their make-up.
[Note that the definition of "Instrument" includes the flanges, valves and small bore piping (1" diam. or less) associated with the Instrument itself.]

Breakdown by Installation Type and Location (Figure 4)

Fixed Installations, including FPS and Subsea : A total of **596** or 96 % of all releases involved fixed installations. As would be expected, gas releases at **350** in total dominated the numbers of releases attributable to all Fixed platforms in all areas of the UKCS, with Northern Area Fixed platforms having **116** , Central Area Fixed platforms **137** , and Southern Area Fixed Platforms having **71** gas releases. Floating Production Platforms experienced **26** gas and **10** oil releases, with **4** two-phase releases making up the remainder. There were no releases reported for Subsea Installations (separately registered, i.e. not satellite wells) during the period.

Mobile Installations, including Flotels : A total of **25** or 4 % of all releases involved mobile installations. Incidents were evenly split between Semi-sub and Jack-up installations.
All Jack-ups were located in the Southern Area of the UKCS at the time of incident, and gas releases comprised 92 % of the total reported for this category. Semi-sub incidents were distributed amongst the North, Central and Southern Areas, with the Central Area having 7 out of the **13** incidents. 60 % of the incidents involved gas releases.
Flotels were not involved in any of the above releases.

Ignitions

There were **20** ignited releases reported on OIR/12 forms in the period to end March, 1995. However, it has been discovered that, in the same period, a further **47** incidents attributable to hydrocarbons ignitions had been reported under the "Fire/Explosion" category [definition 4 (e) on OIR/9A] which was meant to cover only non-hydrocarbon incidents. This meant that OIR/12 forms had not been volunteered for these incidents, and consequently they did not appear in the Hydrocarbon Releases Database.

These reports have been checked with a view to generating retrospective OIR/12 reports for each. The current position is that the additional number of recordable hydrocarbon ignitions involved has been established at **39**, which will increase the total number of ignitions to **59**, or approximately 9% of all releases.

This number breaks down into **31** non-process ignitions; **6** oil ignitions;**4** condensate ignitions; **18** gas ignitions; and **0** two-phase ignitions.

Further analysis of ignition types and causes, etc. will be given in the next outputs report.

Leak Frequency Outputs (Figure 5)

A standard screen in the HCR Database allows Leak Frequency data to be obtained on a selected system and/or equipment type, in terms of equipment (or system) years, and an example is shown in the figure.[It is important to note that in this case the figure shows test data, and is for illustrative purposes only.]
The leak frequency is calculated by dividing the total releases found in the database relating to the system/equipment selected, by the total system/equipment years, and the result appears on the right hand side as shown in the figure.

It is hoped to provide details of leak frequencies following completion of population data input, and these should appear in the next outputs report.

Hole Size Distribution Outputs (Figure 6)

A standard screen in the HCR Database allows Hole Size Distribution data to be obtained on a selected system and/or equipment type, and the figure shows how the total releases found are distributed within the designated Size Bands. [It is important to note that in this case the figure shows test data, and is for illustrative purposes only.]

It is expected that these distributions will become more defined after several years of data are gathered. However, interrogation of initial hole size distribution figures for the period to 31 March, 1995 shows that the majority of those reported in the period were below 10mm in size.

Trends Analyses:

(a) Reporting Trends : 1991 to 1995 (Figure 7)

The graph shows the monthly reporting frequencies since January, 1991, up to the end of January, 1995. Major milestones which occurred during the reporting period are also shown on the graph. Apart from the expected step increase in numbers of releases reported due to the lowering of the reporting threshold following the issue of the revised definition in April, 1992, and the issue of the OIR/12 form in August, 1992, there has been a gradual increase in the monthly averages for the years 1992, 1993, and 1994. It is probable that this trend is attributable to gradual reduction of under-reporting because of increased awareness of requirements following the issue of comprehensive guidance in August, 1993. Awareness probably increased yet further after the issue of the first outputs report in September, 1994.

On examination of the numbers reported each month, it can be seen that reporting generally "peaks" around mid-year, and then drops down to a "low" around the year end. It is already known that the summer months are generally a time of low UK hydrocarbon consumption/low output when many platforms have their annual shutdowns, and when associated maintenance and construction activities are at their highest. It is also known that the winter months are usually a time of high UK hydrocarbon consumption/high output with minimal interruption of production during this period.There are a few factors which could perhaps explain this apparently seasonal fluctuation.

For example, reduced production, shutdown, start-up or re-instatement could introduce pressure and temperature gradients leading to unequal expansion or contraction which in turn could lead to hydrocarbon leaks. Other interventionist activities such as maintenance, construction, etc. also upset the balance of operating plant and thus can contribute to causation of releases.

However, on examination of the operating mode in the area at the time of each incident, it was discovered that the proportion of "normal production" type incidents versus the "intervention" type incidents remained roughly the same in both winter and summer, i.e. a 60:40 split.

An investigation into the reported causation factors (sorted on the OIR/12 form into Design, Equipment, Operational and Procedural) revealed that equipment failures (i.e. corrosion, material defects, mechanical failure, etc.) were a contributing factor in approximately 80 % of "normal operation" incidents, followed by operational failures (i.e. incorrectly fitted, improper operation, left open, opened when containing hydrocarbons, etc.).at 60%.

For "intervention" type incidents, the main contributing factors were operational failures at 70%, and equipment failures at 60%.

It is interesting to note that procedural failures were higher for"intervention" type incidents than for "normal production" incidents (38 % vs 19 %).

(b) Emergency Actions

Another trends analysis was carried out on the emergency actions taken during each of the total **621** releases to 31 March, 1995.

It was found that emergency action was taken in **475** (77 %) of releases, and an automatic alarm was involved in **307** (78 %) of those **475** releases.

164 (34 %) of the **475** involved automatic intervention by emergency systems, i.e. Shutdown, Blowdown, Deluge, and/or CO_2/Halon, the remainder involved manual intervention.

177 of the **475** releases resulted in a muster, either to stations or to lifeboats, which is over 37% of those involving emergency action.

318 (67 %) of the **475** releases involving emergency action were greater than 10 kgs. For methane (CH_4) releases, this means at least 10 m^3 at STP. Given that a well mixed (10% gas/air) quantity will give a considerable explosion, particularly if constrained in a closed, congested module, it is considered that the lowering of the reporting threshold in order to capture these occurrences was well justified. After all, the initial Piper Alpha explosion was estimated to have involved about 60 kgs of gas, causing devastation and disaster, but had this not escalated it may not even have been reportable under the definitions in force at that time !

Although the majority of releases were of significant size and involved emergency action, only **53** (11%) were over 60 minutes duration from discovery to cessation, thus indicating that the previous reporting criteria of 24 hours stoppage was inappropriate.

From the extent of the actions taken by offshore workers when hydrocarbon releases occur, it is clear that the industry perceives that these are dangerous occurrences, and that automatic detection and automatic emergency action, including muster, is demonstrably necessary even for relatively small amounts and/or durations.

It is concluded that the current definition of hydrocarbon releases as contained on the OIR/9A form and repeated in the CD for RIDDOR [see Ref.3], covers the " near misses" and the leaks, spills and ignitions discussed in the Cullen Report, and is currently accepted by industry as valid and reportable under the heading of dangerous occurrence.

(c) Reporting of Trends

The above, somewhat simple, trends analyses have been carried out to illustrate the capability and versatility of the Hydrocarbon Releases Database. Such investigations are ongoing since there are now, at the time of presentation, only three years of data in the database which may still be considered insufficient information to fully validate any discovered trends. It may be a further two years before sufficient data has been gathered to produce robust trends analysis.

It is proposed to examine all the various data categories within the database, particularly causation factors, to try to identify meaningful relationships and to validate trends for reporting to Industry in the future. A data mining package (Knowledge Seeker) will be employed to carry out the more complex investigations.

Any such trends would then be reported, either immediately if critical to offshore safety, or in the annual report if significant enough to be brought to the attention of Industry as a whole.

DATA DISSEMINATION

The first outputs from the HCR Database were published together with figures on fatalities, serious injuries, etc.in a combined report "Offshore Accident and Incident Statistics Report, 1993" (OTO 94 010) issued in September, 1994. [Ref.6]

Part 2 of that report contained hydrocarbon releases figures for the period 1 October, 1992 to 31 March, 1994. More up to date information in some of the main data categories has been provided in this paper, and the next report on Offshore Hydrocarbon Releases for the period up to 31 March, 1995, will also contain Leak Frequency data in addition to the types of data already provided in the initial report.

As stated earlier, it is also planned to publish the findings of the Population Data Gathering Exercise in a separate study report, probably before the end of 1995. Any alterations to the "core" population data would also be reported on an annual basis in the annual statistics report .

All operators contributing to the reporting of releases will be provided with a copy of the "raw" input data should they require it. This data will be supplied in ASCII format on 3.5" diskettes formatted to 1.44Mb MS-DOS, and will be in a non-attributable form. Each set of diskettes will be accompanied by instructions which, as well as containing details of the fields and records involved, should allow the recipient to download the data into their chosen database environment.

BENEFITS

The Hydrocarbon Releases (HCR) Database will provide valuable information relevant to offshore safety management, which in turn will aid in the improvement of process safety offshore.

It meets the requirements of Cullen Recommendation 39 by providing the data necessary to meet the current shortfall, and by aiding Industry in the quantification of offshore risks from hydrocarbons.

It will provide valuable data to the Offshore Industry for use in complying with the new goal-setting regulations currently being introduced.

Through time, and with the addition of appropriate population data, the leak frequency and hole size distribution data generated by the HCR Database should prove beneficial to Industry, resulting ultimately in improved risk evaluation calculations, which in turn will lead to greater confidence in the risk levels quoted in Offshore Safety Cases.

The regulations governing prevention of fire and explosion, and emergency response (PFEER) on offshore installations [Ref.7], call for a fire and explosion analysis to be carried out and for provisions to be taken against fire and explosion effects by means of prevention, control and mitigation. The PFEER regulations also call for an evacuation, escape and rescue (EER) analysis for establishment of suitable measures for EER. The output data from the HCR Database is seen as a valuable aid in enabling more meaningful fire and explosion analyses to be carried out, and should similarly contribute towards data for the EER analyses.

The provision of sufficiently extensive "raw" input data on a "per incident" basis, should assist Industry in, for example, the validation of computer models.

Industry should also benefit from having produced the individual systems and equipment population data for each Installation, since these may then be used in Installation-specific calculations.

Trend reports should prove useful in highlighting areas of concern requiring attention by Industry, thus aiding HSE in an important aspect of it's regulatory role.

Finally, the main measure of success of the database will be the extent to which the data are used by Industry within the next few years, and the degree to which this contributes to the development of Offshore Safety Cases, and to the overall improvement of safety offshore.

ACKNOWLEDGEMENTS

The help and encouragement of my colleagues in HSE-OSD in the preparation of this paper is acknowledged, and very much appreciated.
However, it should be noted that the views and opinions expressed in the paper are those of the author, and do not necessarily represent those of the Health and Safety Executive.

REFERENCES

Ref. [1] The Hon.Lord Cullen, Nov. 1990, The Public Inquiry into the Piper Alpha Disaster, (The Cullen Report) in 2 volumes , HMSO .

Ref.[2] Health and Safety Executive, Offshore Safety Division, August 1993, "Guidance on the Reporting of Offshore Hydrocarbon Releases", OTO 93 018, HSE Information Services, Sheffield.

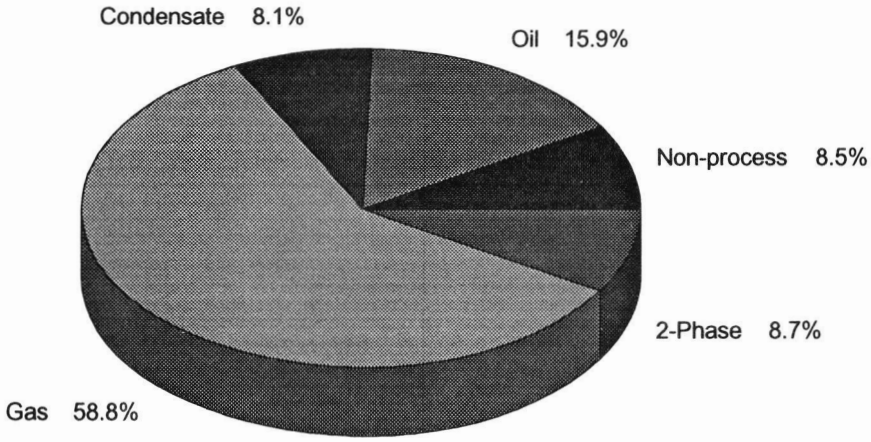
Ref.[3] Health and Safety Executive, April, 1994, "Draft proposals for the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations", Consultative Document, CD74, HSE Information Services, Sheffield.

Ref.[4] The Offshore Installations (Safety Case) Regulations, 1992, SI 1992 No.2885, Regulations 4, 5, and 8, and Schedules 2 and 3.

Ref.[5] R.A.P.Bruce, 1994, "The Offshore Hydrocarbon Releases (HCR) Database", Hazards XII : European Advances in Process Safety, Manchester, 19-21 April, I.Chem.E Symposium Series, 134, 107-122.

Ref.[6] Health and Safety Executive, Offshore Safety Division, September1994, "Offshore Accident and Incident Statistics Report, 1993", OTO 94 010 HSE Information Services, Sheffield.

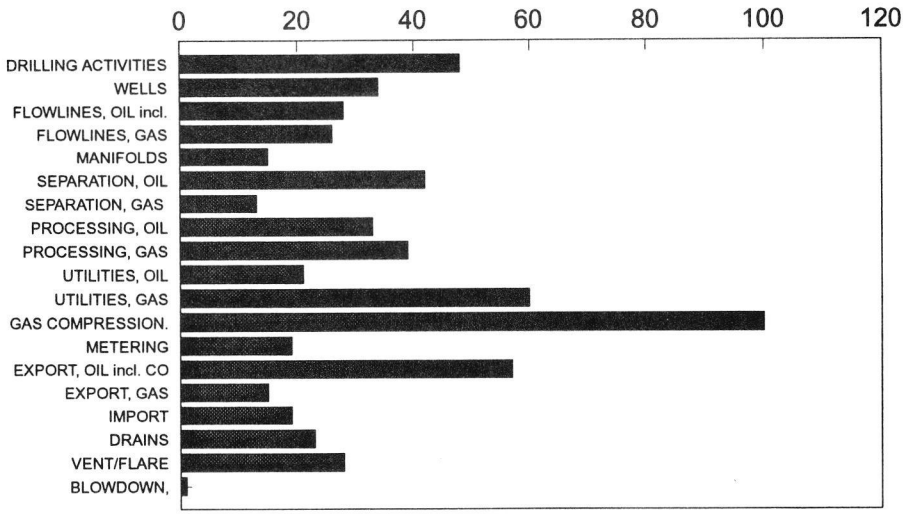
Ref.[7] The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations, 1995, SI 1995 No.743



1. Total number of releases reported = 621
2. Preliminary figures for the period 01-10-92 to 31-3-95

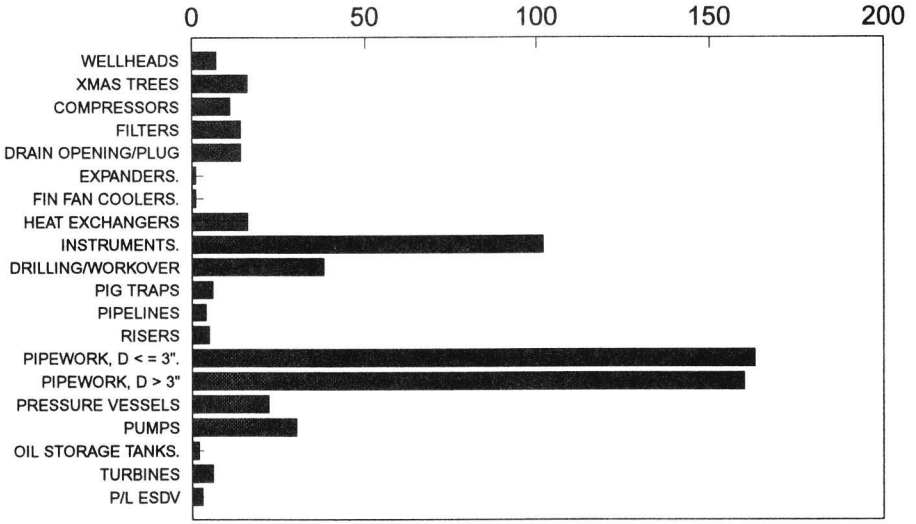
Hydrocarbon	Releases	Percentage
Non-process	53	8.53
Oil	99	15.94
Condensate	50	8.05
Gas	365	58.78
2-Phase	54	8.70
Total:	621	100.00

FIGURE 1 : BREAKDOWN BY HYDROCARBON TYPE



1. Total number of releases reported = 621, grouped into 19 system types.
2. Preliminary figures for the period 1-10-92 to 31-03-95.

FIGURE 2 : BREAKDOWN BY SYSTEM TYPE



1. Total number of releases reported = 621, grouped into 20 equipment types
2. Preliminary figures for the period 1-10-92 to 31-03-95

FIGURE 3 : BREAKDOWN BY EQUIPMENT TYPE

INSTALLATION TYPE	HYDROCARBON TYPE					TOTAL
	NON-P	OIL	COND	GAS	2-PH	
(1) FIXED = 596 or 96.0 % of TOTAL RELEASES						
NORTHERN	2	35	13	116	29	195
CENTRAL	27	51	22	137	17	254
SOUTHERN	19	0	14	71	2	106
FPS	1	10	0	26	4	41
SUBSEA	0	0	0	0	0	0
TOTAL	49	96	49	350	52	**596**
(2) MOBILES = 25 or 4.0% of TOTAL RELEASES						
SEMI-SUBMERSIBLES N	2	1	0	1	0	4
C	0	1	1	3	2	7
S	2	0	0	0	0	2
JACK-UPS N	0	0	0	0	0	0
C	0	0	0	0	0	0
S	1	0	0	11	0	12
TOTAL	5	2	1	15	2	**25**
					GRAND TOTAL	**621**

NOTES :

1. **Where N = NORTHERN = above 59° N**
   C = CENTRAL = between 56° and 59° N
   S = SOUTHERN = below 56° N

2. **Provisional Data from 1-10-92 to 31-03-95**

FIGURE 4 : BREAKDOWN BY INSTALLATION TYPE & LOCATION

HSE Hydrocarbon Release Standard Report Generator — *Leak Frequency*

○ SYSTEMS
◉ EQUIPMENT
○ BOTH

start year 1992/1993
end year 1994/1995

SYSTEMS

generic category	sub-1	sub-2	sub-3	translation

EQUIPMENT

generic category	sub-1	sub-2	sub-3	sub-4	translation
20	1	1	0	0	PIPING, STEEL, D < = 3".

total current population	0	leak frequency	0.01494
total system\ equip. years	5020		
total releases found	75		
total releases reported	644		

Leak | Hole | Print | Cancel | Exit

FIGURE 5 : LEAK FREQUENCY REPORT

HSE Hydrocarbon Release Standard Report Generator — *Hole Size Distribution*

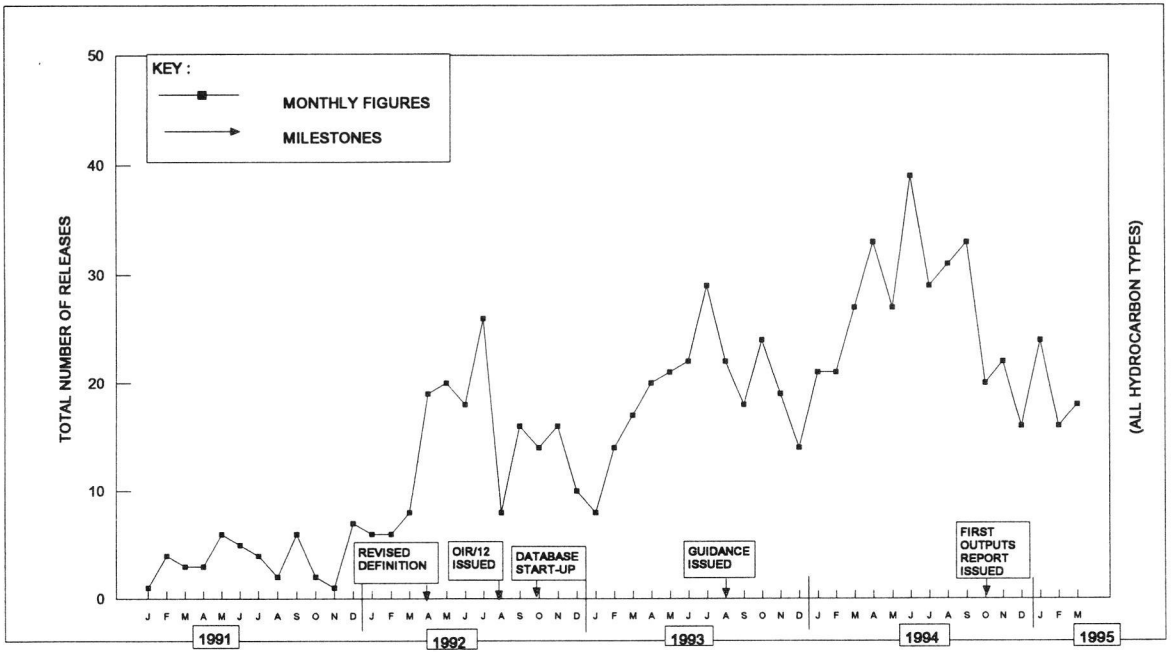
from 1992/1993
to 1994/1995

e 20 1 1 0 0 PIPING, STEEL, D < = 3".

year	Size Band (mm)						TOTAL
	<10	10<25	25<50	50<75	75<100	>=100	
1992/1993	9	2	0	0	0	0	11
1993/1994	25	6	2	0	0	0	33
1994/1995	24	4	2	1	0	0	31
Distribution	0.77333	0.16	0.05333	0.01333	0	0	75

Leak | Hole | Print | Cancel | Exit

FIGURE 6 : HOLE SIZE DISTRIBUTION REPORT



1. REPORTED RELEASES FOR THE PERIOD 1-1-91 TO 31-03-95

2. MONTHLY AVERAGE FOR 1991 = 4 (44 in TOTAL)
   MONTHLY AVERAGE FOR 1992 = 14 (167 in TOTAL)
   MONTHLY AVERAGE FOR 1993 = 19 (228 in TOTAL)
   MONTHLY AVERAGE FOR 1994 = 26 (315 in TOTAL)
   MONTHLY AVERAGE FOR 1995 = 19 (TO 31-03-95 ONLY)

FIGURE 7 : TRENDS IN REPORTING JAN1991 TO MAR1995