

European downstream oil industry safety performance

Statistical summary of reported incidents – 2009

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ABSTRACT

The sixteenth such report by CONCAWE, this issue includes statistics on work-related personal injuries for the European downstream oil industry's own employees as well as contractors for the year 2009. Data were received from 33 companies representing more than 97% of the European refining capacity. Trends over the last sixteen years are highlighted and the data are also compared to similar statistics from related industries. In addition, this report presents the results of the first Process Safety Performance Indicator data gathering exercise amongst the CONCAWE membership.

KEYWORDS

Accidents, AIF, CONCAWE, FAR, fatality, incidents, injury, LWI, LWIF, LWIS, marketing, oil industry, refining, RAR, RWI, safety statistics, Process Safety Performance Indicators, Process Safety Events.

INTERNET

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SUMMARY

The collection and analysis of accident data are widely recognised by the oil industry as an essential element of an effective safety management system.

CONCAWE started compiling statistical data for the European downstream oil industry sixteen years ago and this is the sixteenth report on this topic. This report covers data collected for 2009 and includes a full historical perspective from 1993. It also includes comparative figures from other related industry sectors. Data for 2009 were submitted by 33 companies, together accounting for over 97% of the refining capacity of EU-27 plus Norway and Switzerland.

The results are reported mainly in the form of key performance indicators that have been adopted by the majority of oil companies operating in Europe as well as by other branches of industry.

Accident frequencies in the downstream oil industry in Europe are generally at low levels, which have been maintained throughout the period of reporting. Overall, the 2009 performance continues the trend of recent years with relatively low accident frequencies. Standing at 1.8, the Lost Work Incident Frequency (LWIF) indicator for 2009 is essentially equivalent to the 2008 rate of 1.7 which was the lowest recorded since these reports were started and down from 3.9 in 2002. The responsible management of safety in the oil industry has resulted in a low level of accidents despite the intrinsic hazards of the materials handled and the operations carried out. Unfortunately, the fatal accident rate (2.02 per hundred million hours worked) and the total number of fatalities (11) were the same as in 2008. In 2009, one confined space entry incident accounts for 3 fatalities (27%), road accidents also accounted for 27% of the fatalities and falls from height accounted for 2 fatalities (18%).

For the first time in 2010 CONCAWE has started to collect Process Safety Performance Indicator (PSPI) data which describe the number of Process Safety Events (PSE) expressed as unintended Loss of Primary Containment (LOPC). It is expected that within a few years sufficient data will become available to do meaningful analysis. For 2009 the member Companies were asked to provide the data available within their organisations and 18 members positively responded to this by providing their data. For these responses, a Process Safety Event Rate (PSER) indicator of 4.1 for all PSEs was established.

1. INTRODUCTION

The collection and analysis of accident data is an essential element of a modern safety management system and its importance is recognised throughout the oil industry.

CONCAWE started compiling statistical data for the European downstream oil industry sixteen years ago and this is the sixteenth report on this topic (see references of past reports in the reference list [1-15]). This report covers data collected for 2009 and includes a full historical perspective from 1993. It also includes comparative figures from other industry sectors.

The term “Downstream” represents all activities of the Industry from receipt of crude oil to products sales, through refining, distribution and retail. Not all companies operate in both the manufacturing and marketing areas but all those who do, collect data separately for “Manufacturing” (i.e. refining) and “Marketing” (i.e. distribution and retail, also including “head office” staff) and this split has also been applied in the CONCAWE data. Additionally, the data are presented for own personnel and contractors, the latter being fully integrated in all of the companies’ safety monitoring systems.

The purpose of collecting this information is twofold:

- To provide member companies with a benchmark to compare their performance against, so that they can determine the efficacy of their management systems, identify shortcomings and take corrective actions;
- To demonstrate that the responsible management of safety in the downstream oil industry results in a low level of accidents despite the hazards intrinsic to its operations.

From the outset, a majority of CONCAWE member companies have participated in these surveys. Therefore, the sample has always represented a large portion of the industry. By 1995 virtually all CONCAWE members participated, representing about 90% of the European refining capacity (somewhat less for distribution and retail). Over the years this level of participation has increased to > 97%, although the actual number of participating companies fluctuated in line with the structural changes and mergers occurring in the industry as did the percentage of the refining capacity represented. For 2009, 33 companies responded although not all companies could supply all the requested data.

The geographical area of coverage is primarily the EU-27 together with Norway Switzerland and Croatia.

A number of key performance indicators have been adopted by the majority of oil companies operating in Europe as well as by other industries. Although there are differences in the way different companies collect basic data, these fairly straightforward parameters allow an objective comparison. There are differences noted between companies in their precise definitions or interpretation of metrics, meaning direct comparison of data from different companies could lead to erroneous conclusions. For this reason, we do not report individual company data but rather aggregates, averages and range of variation.

Although the results of individual respondents are not included in this report, it is noteworthy that the majority of participating companies are willing to share their data openly with other companies. This reflects the industry approach that safety is a non-competitive issue where all can learn from the experience of others and help each other to improve.

2. PERFORMANCE INDICATORS

A number of safety performance indicators have become “standard” in the oil industry and in many other industry sectors. They are mostly expressed in terms of event frequency - the number of hours worked being the common denominator representing the level of activity. Such parameters have the advantage of relying on a small number of straightforward inputs, which allows meaningful statistical analysis even when the data sets are incomplete. The performance indicators considered in this report are:

- The number of work-related fatalities and the associated Fatal Accident Rate (FAR) is expressed as the number of fatalities per 100 million hours worked.
- The All Injury Frequency (AIF) includes all recordable injuries and is expressed as the number of injuries per million hours worked.¹
- The Lost Workday Injury Frequency (LWIF) is calculated from the number of LWIs divided by the number of hours worked expressed in millions.
- Related to LWIF is the Lost Workday Injury Severity (LWIS) expressing the average number of lost workdays per LWI.
- The Road Accident Rate (RAR) expressed in number of road accidents per million kilometres travelled.
- The Process Safety Performance Indicators (PSPI) [16,17] measure the number of Process Safety Events (PSEs) expressed as the number of unplanned or uncontrolled releases of any material, including non-toxic and non-flammable materials from a process with the severity defined by the consequences experienced or released amount thresholds.

A more complete set of definitions is given in **Appendix 1** and the PSE criteria are further explained in **Appendix 2**.

There are, however, subtle differences in the way these parameters are used by different companies and how the data is collected and reported. The features, relevance and reliability of each indicator are further discussed below.

Fatalities and FAR

Because of their very low numbers, fatalities and, therefore, FAR are not reliable indicators of the safety performance of a Company or Industry. A single accident can produce several fatalities and cause an abnormal high in the indicator for a certain year. Conversely, the lack of fatalities is certainly no guarantee of a safe operation. Indeed the well-known safety triangle suggests that for every fatality there have been many incidents with less serious injury outcomes (see figure 9a). These less severe incidents provide the opportunities to address equipment, standards, training, attitudes and practices that may prevent the near-misses, relatively minor incidents and, ultimately, the more serious accidents.

¹ AIF is often referred to as TRCF – Total Recordable Case Frequency. Refer Appendix 1.

LWIF and LWIS

The LWIF is the most common indicator in the oil and other industries and has been in use for many years. It is now common practice to include not only a company's own staff but also contractors in the statistics and this is done almost universally in the oil industry. All companies without exception collect employee LWIF data for at least their own staff and this is, therefore, the most representative and reliable indicator of all.

Not all companies keep track of the number of lost days so that the overall LWIS has to be calculated taking account only of those companies that report such data.

AIF

As LWIF figures become progressively lower, these appear to reach a plateau and are prone to wider variations in relative terms. Companies that have achieved very low LWIF levels, therefore, need a more meaningful indicator to monitor trends and detect improvements or deterioration of performance. AIF provides such an indicator, since it records fatalities, Restricted Work Injuries (RWI) and Medical Treatment Cases (MTC) in addition to the number of LWI cases. Although AIF is still less widely used than LWIF, reporting improves year by year with more companies including this indicator into their performance reporting. It should also be noted that not all companies operate a restricted work system and also restricted working is not allowed in some countries, which is a potential cause of some distortion in the LWIF data.

As the total number of injuries is not reported by all companies, only the worked hours for which this number is available are taken into account in the calculation of the overall AIF figure.

RAR

It is no surprise that, since road accidents remain a major cause of both fatalities and lost time injuries, a number of companies have chosen to segregate and monitor these separately. The data are still incomplete and there are also issues as to the precise definition of a road accident. The overall figures should therefore be considered as indicative only. For this reason, CONCAWE only reports RAR data for the whole downstream industry and for all personnel involved (own staff and contractors), since the level of reporting is insufficient for the segmented data to be analysed. It must be noted, however, that the vast majority of road accidents occur in distribution and retail activities where both sales employees and truck drivers travel longer distances.

3. 2009 RESULTS

Table 1 summarises the number of submissions and illustrates some key aspects of the data that were not supplied by all companies.

Table 1 Completeness of submissions for 2009

No of companies	Manufacturing			Marketing		
	Own staff	Contractors	All workers	Own staff	Contractors	All workers
Submission	33	31		23	20	
Including						
Road accidents ^a	11	5		14	11	
Distance travelled	13	6		14	10	
Process Safety			18			7

a) Several Companies do not report their Road accidents separately

Most companies submitted data for their own Manufacturing and Marketing staff (several companies have no retail activity). Total own staff injuries are recorded by all companies, in the Manufacturing and/or Marketing categories, but this is not the case for lost days. A number of companies do not record road accidents separately and even fewer log the distance travelled. Contractor data are generally less complete.

The Process Safety data were requested for the first time for all workers in both Manufacturing and Marketing sectors for 2009. A positive outcome of 18 companies submitted PSE data for the Manufacturing operations and 7 of those also included Marketing PSE data. This augurs well for the future in terms of the ability to make meaningful analysis of these measures. The results are presented in chapter 4.

The aggregated 2009 results per sector and for the whole of the European downstream oil industry are shown in **Table 2**. **Figure 1** shows the average performance indicators and their range of variability (minimum and maximum) amongst reporting companies. **Figures 2a** and **3a** show the results for total AIF and total LWIF, on a cumulative frequency basis which allows individual companies to benchmark their own results against the group. For AIF (**Figure 2b**) and LWIF (**Figure 3b**), which are the most universally used indicators, we also show the average per quartile for manufacturing, marketing, own staff, contractors and total downstream performance, enabling detailed benchmarking.

Table 2 Aggregated 2009 results for all reporting companies

Sector		Manufacturing			Marketing			Both Sectors		
		OS	CT	AW	OS	CT	AW	OS	CT	AW
Work Force										
Hours worked	Mh	115	127	242	163	140	303	278	268	545
Fatalities		3	6	9	1	1	2	4	7	11
Fatal Accident Rate	F/100 Mh	2.6	4.7	3.7	0.6	0.7	0.7	1.4	2.6	2.0
Lost work incidents	LWI	253	283	536	284	179	463	537	462	999
Lost time through LWI	days	8,372	8,052	16,424	5,797	3,787	9,584	14,169	11,839	26,008
LWI frequency	LWI/Mh	2.2	2.2	2.2	1.7	1.3	1.5	1.9	1.7	1.8
LWI severity	lost days/LWI	33.1	28.5	30.6	20.4	21.2	20.7	26.4	25.6	26.0
All recordable incidents	AI	644	778	1,422	534	230	764	1,178	1,008	2,186
All incidents frequency	AI/Mh	5.6	6.1	5.9	3.3	1.6	2.5	4.2	3.8	4.0
Distance travelled	million km							295	742	1036
Road Accidents	RA							385	425	810
Road Accident Rate	RA/million km							1.3	0.6	0.78

OS: Own staff; CT; Contractors; AW: All workers

Figure 1 Average 2009 performance indicators with range of variability (min/max - range)

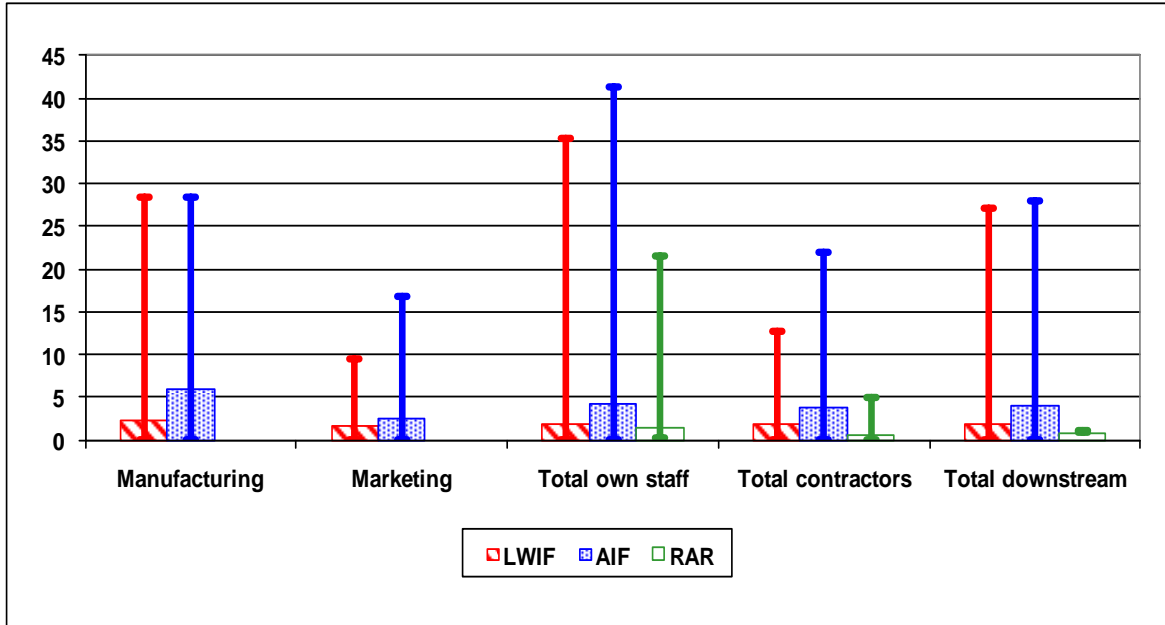


Figure 2a Cumulative Frequency Analysis All Injury Frequency (AIF)

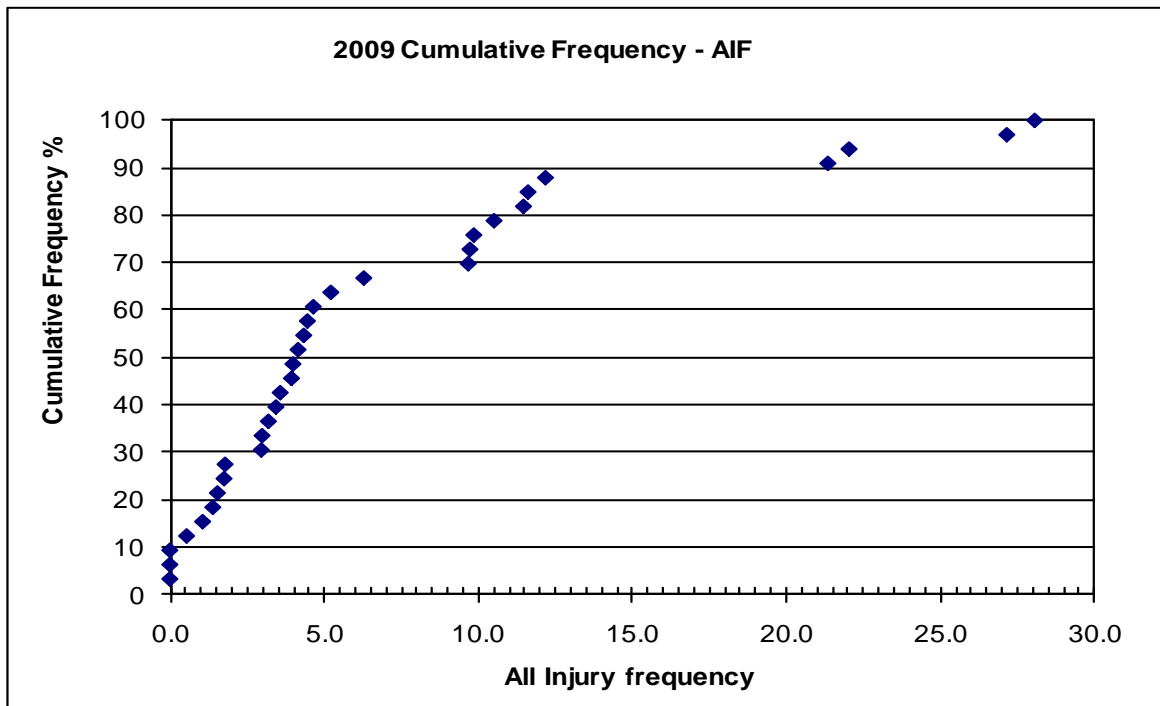


Figure 2b AIF distribution Average value per quartile for each sector

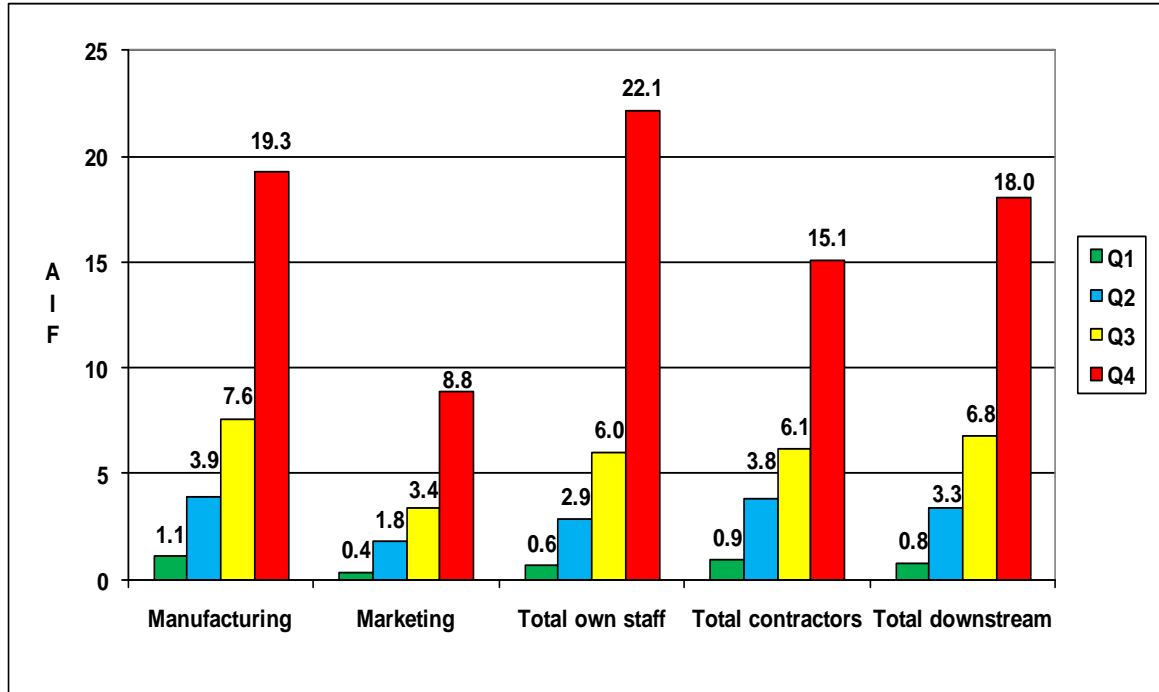


Figure 3a Cumulative Frequency Analysis Lost Work Injury Frequency (LWIF)

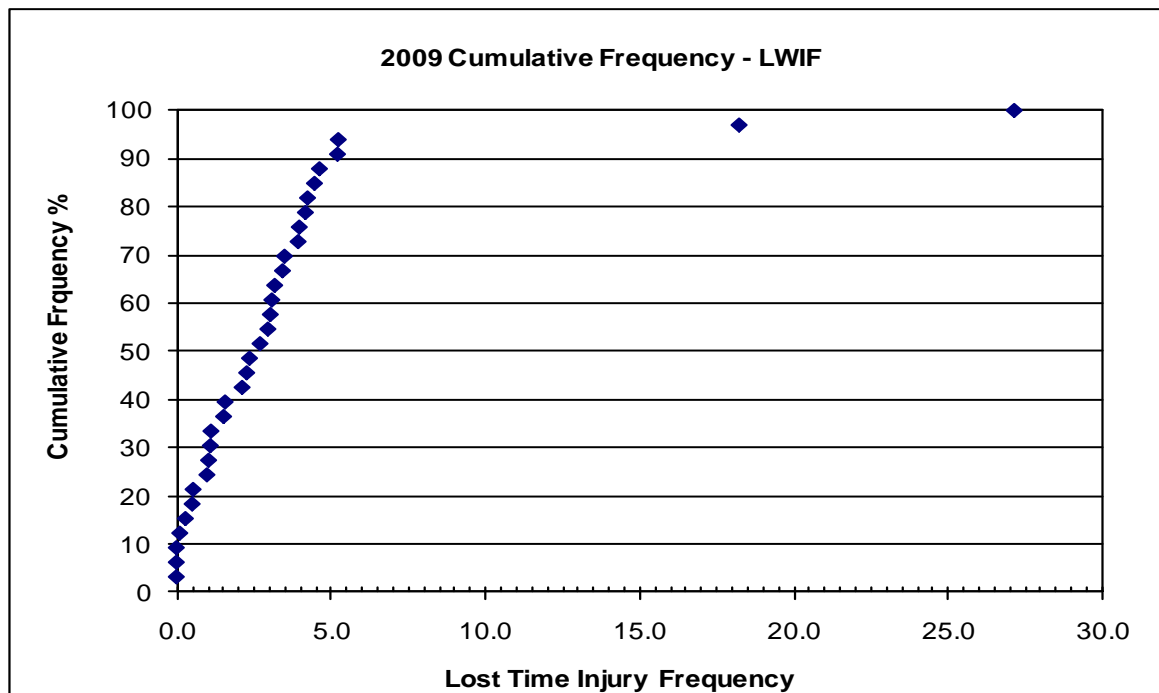
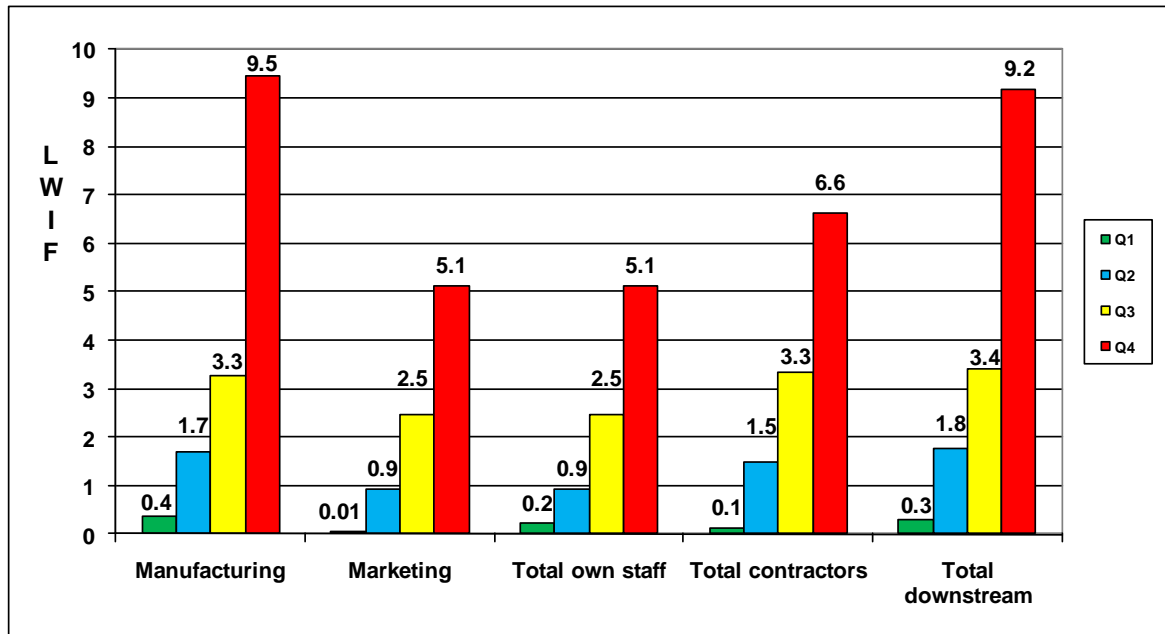
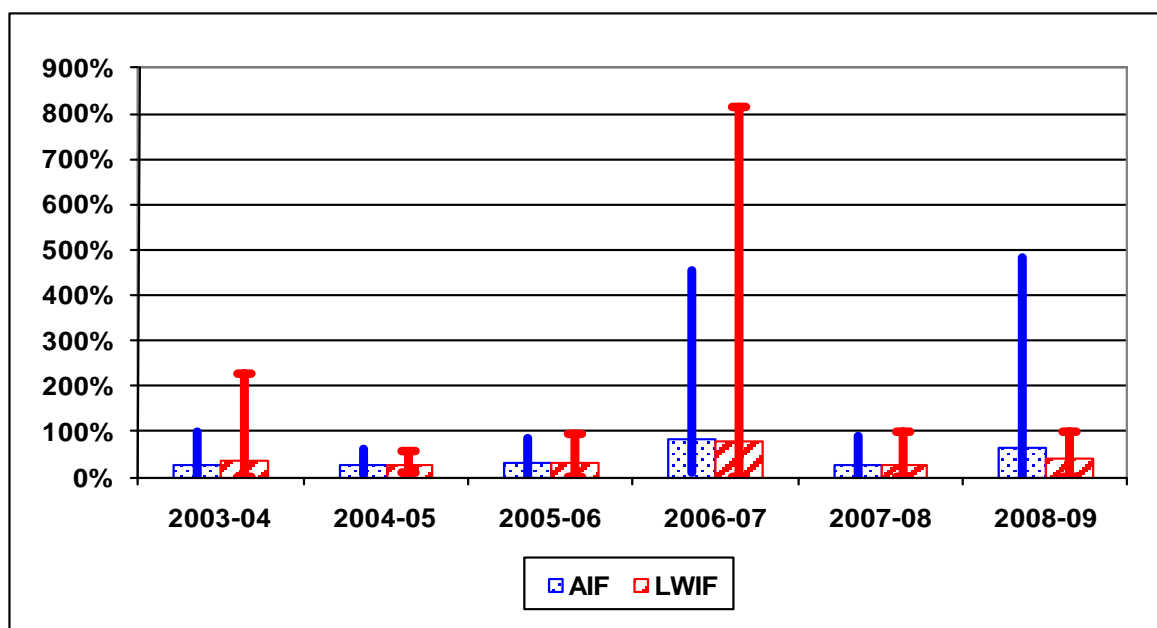


Figure 3b LWIF distribution Average value per quartile for each sector



The average performance indicator figures clearly hide a wide range of individual values that vary two orders of magnitude between reporting companies. **Figure 4** shows that the variability is significantly less when looking at year-on-year figures for each company individually.

Figure 4 Year-on-year performance indicator variations Average for all reporting companies



In summary, there are large differences in reported figures between companies but, for the most part, these differences also do not change much over the years. This reflects genuinely different levels of performance and differences in the way companies collect and classify incident data.

4. PROCESS SAFETY

The American Petroleum Institute (API) has recently recommended the adoption of Process Safety Performance Indicators (PSPI) in addition to personal safety performance indicators such as those contained in this report [17]. This is intended to better address the potential causes of major process safety incidents, which can have catastrophic effects in the petroleum industry. The Safety Management Group of CONCAWE decided to expand the scope of industry wide safety performance indicators to address process safety, following the reporting guidelines that were developed by the API [16,17]. Combining a focus on process safety in conjunction with the personal safety factors collected thus far could contribute to a further reduction in serious injury rates in the industry.

CONCAWE Members were requested to report their PSPI indicators as defined by the API in 2008 [16] and as further refined in the ANSI/API recommended practise that was published in 2010 [17]. The requested PSPI-data are the number of Tier 1 and 2 Process Safety Events (PSEs), as further defined in **Appendix 2** of this report. The definitions of these differ slightly from those that are described in the ANSI/API guideline to align the quantities to SI-metric units (kg/m/sec) and the inclusion of the European Classification and Labelling definitions that are in force in the EU [18] that can be used as an alternative for classifying the PSE. However, for the time being most CONCAWE members have expressed a preference for reporting their PSEs according to the ANSI/API definitions.

As this is a new area in Safety Performance reporting, it should be noted that the Industry is on a learning trajectory. This suggest that with the growing understanding of PSPI statistics, the definitions and the practise will evolve and potentially subject to alterations, taking into account this learning.

The extent of reporting of Process Safety data (requested for first time in 2010) was more positive than expected with 58% of the Manufacturing operations and 37% of the marketing operations providing data. This allowed for some analysis to be performed.

The aggregated 2009 results per sector and for the whole of the European downstream oil industry are shown in **Table 3**. **Figure 5a** shows the Total Process Safety Event Rate (PSER) results on a cumulative frequency basis which allows individual companies to benchmark their own results against the group. The PSER is the number of PSE per million total work hours reported. We also show the distribution per quartile (**Figure 5b/c**).

In **Figure 6** the cumulative frequencies for the PSER are given for manufacturing only, as the data set is sufficiently robust to allow the analysis provided in these presentations.

Table 3 Aggregated 2009 Process Safety results for all reporting companies

Sector		Manufacturing	Marketing	Both Sectors
Companies	Total	33	33	33
	PS reporting	18	7	7
	%-Reporting	55%	21%	21%
Hours worked Mh	Total	242.4	303.1	545.5
	PS reporting	143.8 (99.8) ^a	50.2	194.0
	%-Reporting	59% (41%) ^a	17%	36%
T-1 PSE	# PSEs	156.0	22.0	178.0
T-2 PSE	# PSEs	430.0	196.0	626.0
T-1 PSER	PSE/Mh _{reported}	1.09	0.44	0.92
T-2 PSER	PSE/Mh _{reported}	4.31	3.90	3.23
Total PSER	PSE/Mh _{reported}	4.08	4.34	4.14

a) Between brackets the amount of hours reported by the Companies that provided T-2 PSEs is given

Figure 5a Cumulative Frequency Analysis Total PSER

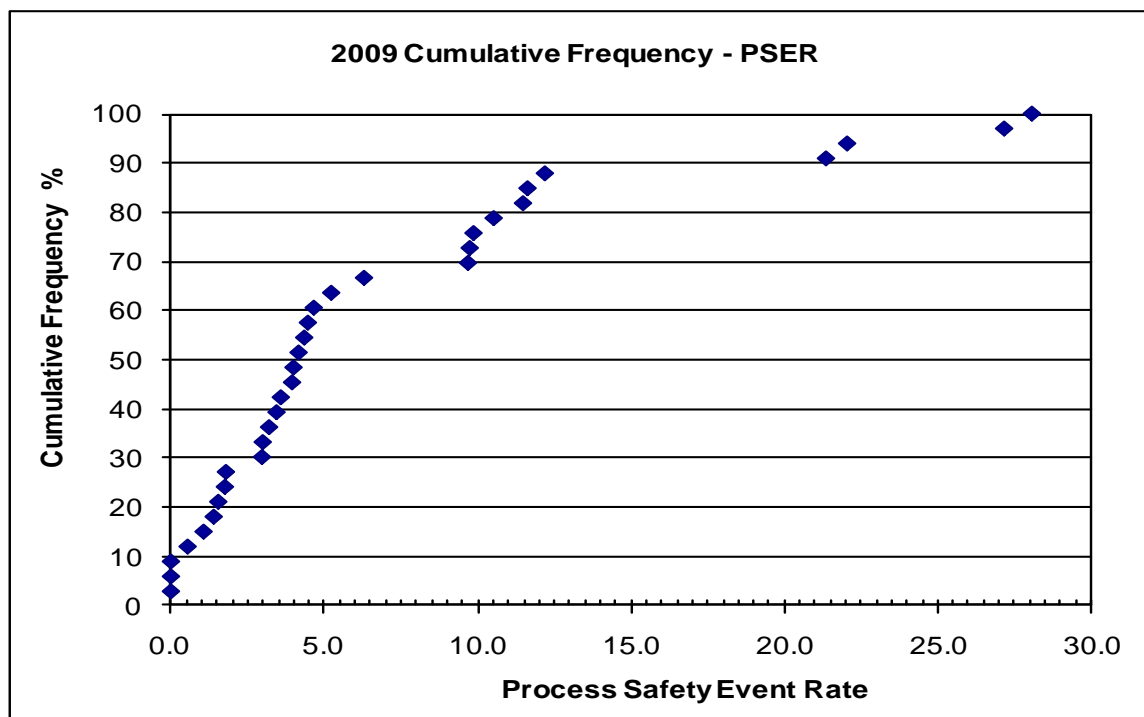


Figure 5b Total PSE distribution - Average value for each quartile

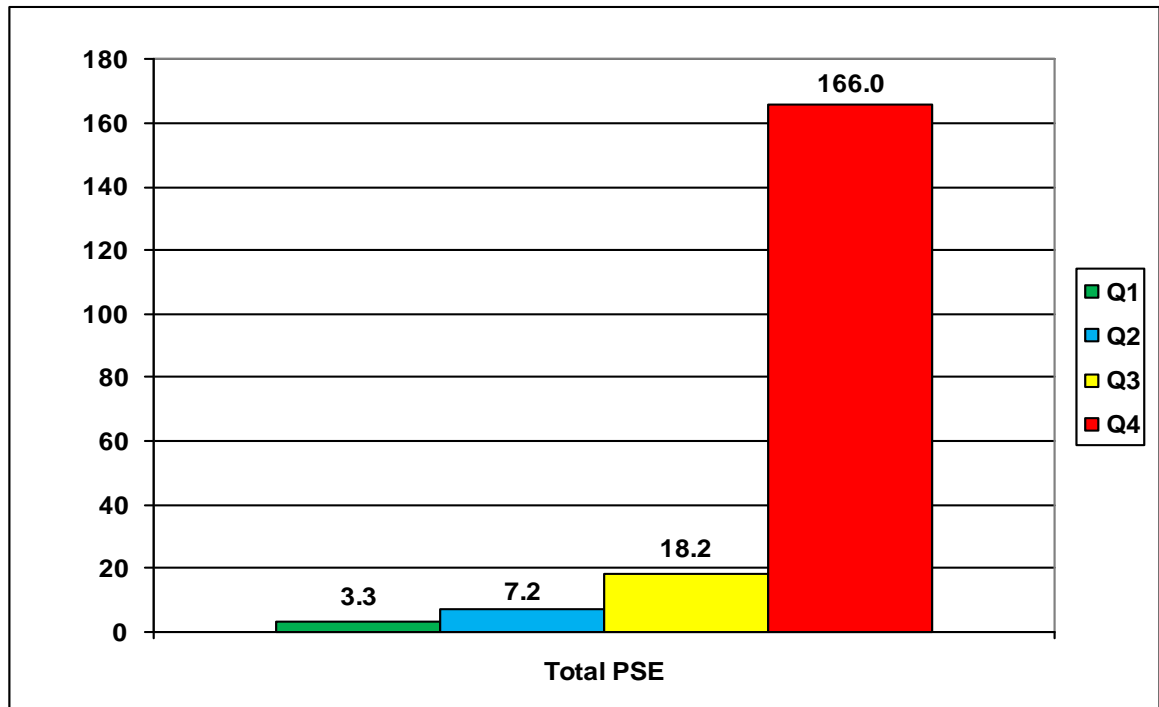


Figure 5c Total PSER – Average value per quartile

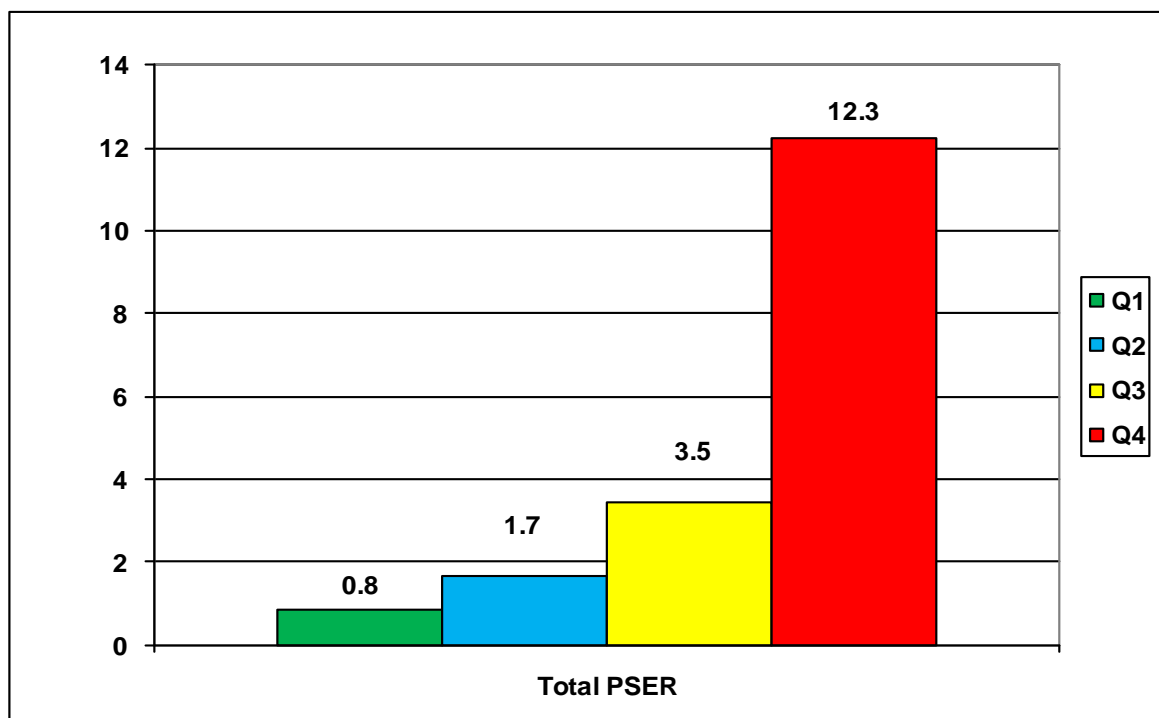


Figure 6a Cumulative frequency charts for all manufacturing PSER

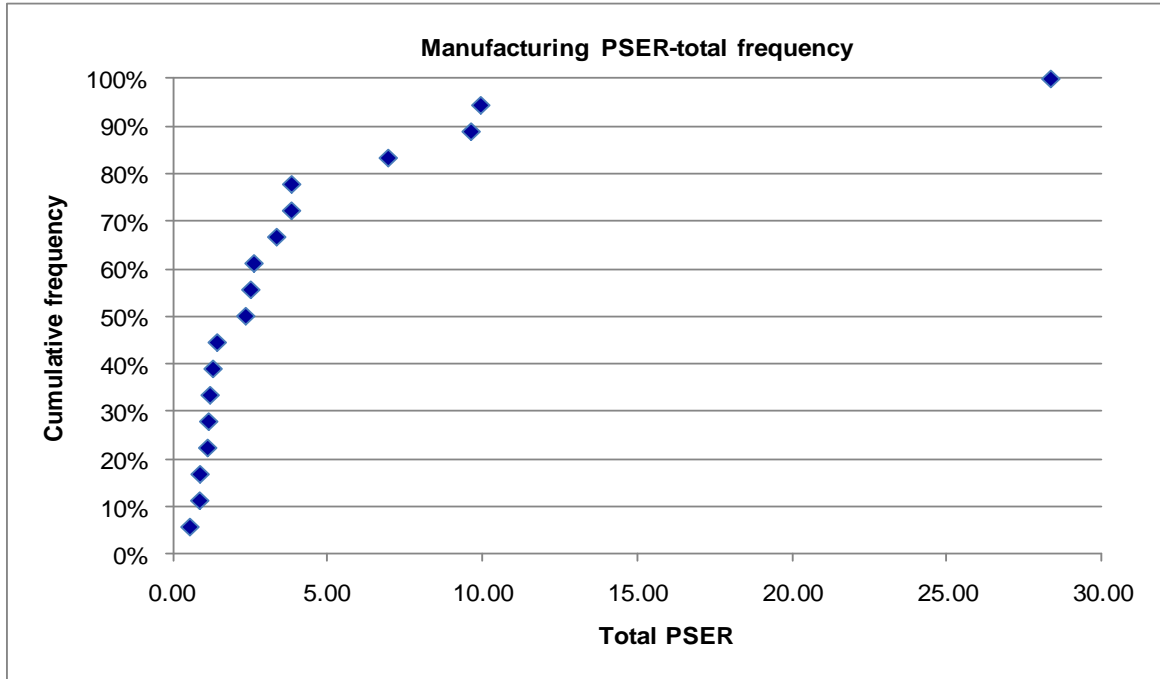


Figure 6b Cumulative frequency charts for Tier 1 manufacturing PSER

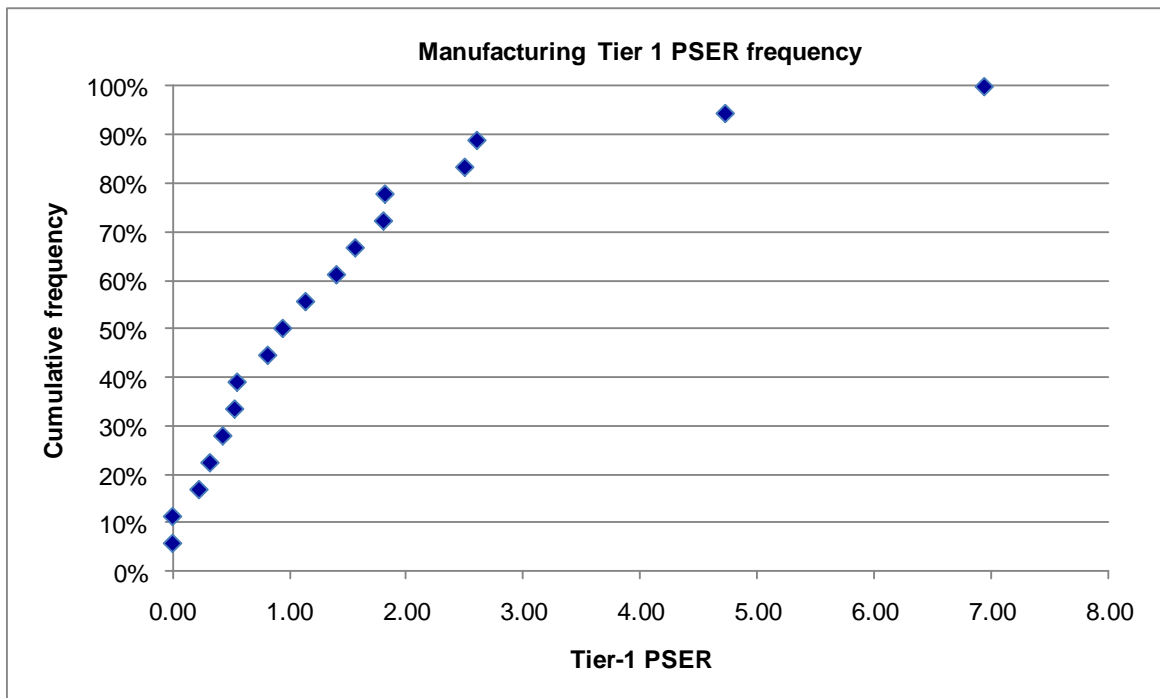
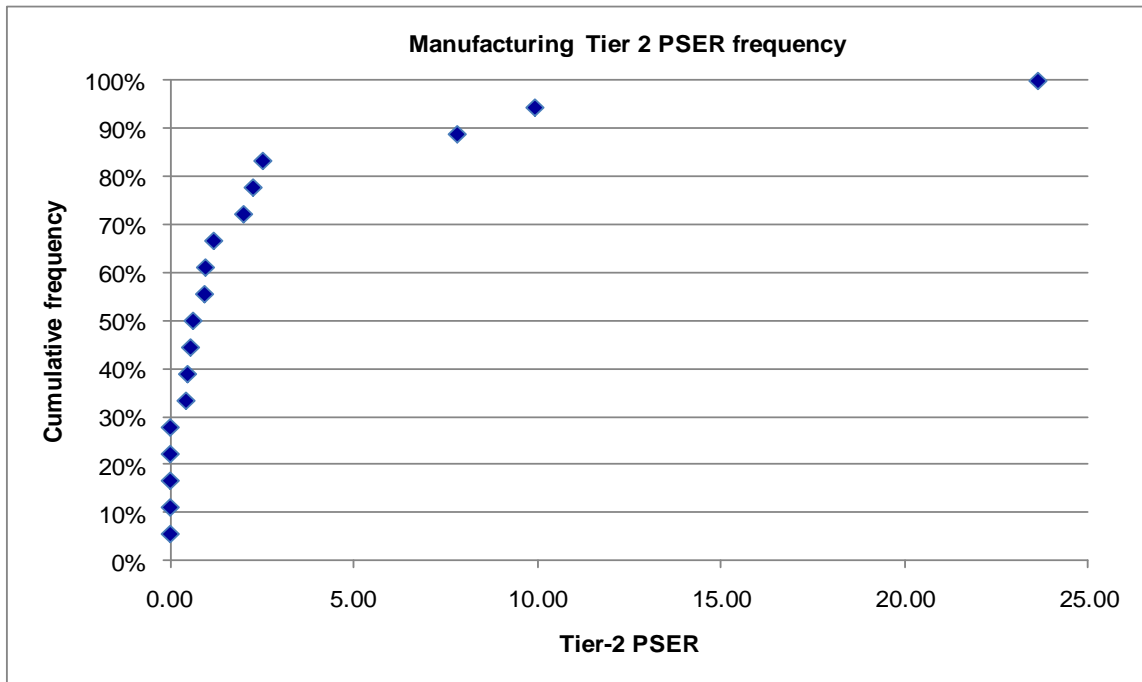


Figure 6c Cumulative frequency charts for Tier 2 manufacturing PSER



As these data are new, performing a trend analysis or drawing conclusions regarding the meaning of the data received is difficult. Therefore, the data are presented as received and no further conclusions or attempts to interpret these are presented in this report.

From the data provided, it became evident that none of the Tier 1 PSEs resulted in a fatality. The number of LWIs resulting from the PSEs is not established, as the information to do this is not available.

Once the CONCAWE PSPI database is sufficiently robust to perform further analyses and report trend analyses, this will be included into these annual reports. This, however, is expected to take several years of data collection.

5. HISTORICAL TRENDS

The performance indicators are of particular interest when considering their evolution over the years. The historical trends for the European downstream oil industry as a whole are shown in **Figures 7a/b** and **Table 4**.

Figure 7a Historical evolution of main performance indicators
Yearly data for the whole European downstream industry

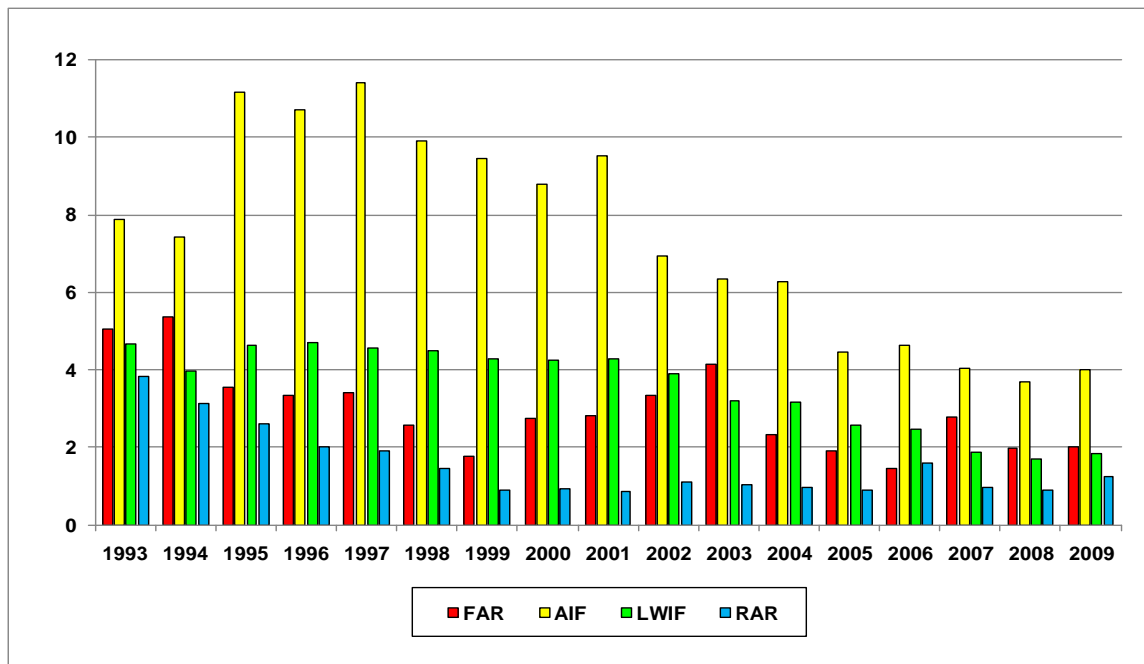


Figure 7b Historical evolution of main performance indicators
3-year rolling average for the whole European downstream industry

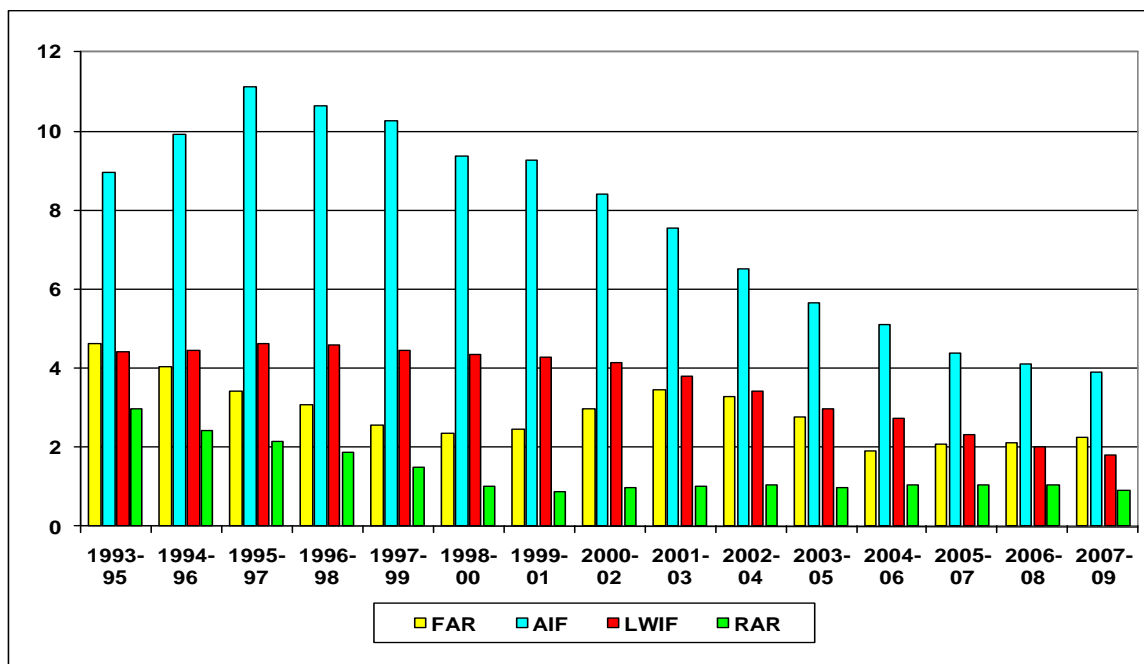


Table 4 Historical evolution of performance indicators

Year	Fatalities	FAR	AIF	LWIF	LWIS	RAR	Million hours reported ²
1993	18	5.0	7.9	4.7	27	3.8	357.0
1994	19	5.4	7.4	4.0	25	3.1	354.8
1995	13	3.5	11.2	4.6	24	2.6	366.4
1996	14	3.3	10.7	4.7	19	2.0	420.6
1997	15	3.4	11.4	4.6	23	1.9	442.0
1998	12	2.6	9.9	4.5	22	1.5	357.0
1999	8	1.8	9.4	4.3	21	0.9	469.7
2000	13	2.7	8.8	4.3	25	0.9	448.5
2001	14	2.8	9.5	4.3	24	0.8	475.1
2002	16	3.3	6.9	3.9	23	1.1	495.5
2003	22	4.1	6.3	3.2	30	1.0	480.0
2004	12	2.3	6.3	3.2	33	1.0	531.6
2005	11	1.9	4.5	2.6	35	0.9	513.3
2006	7	1.5	4.6	2.5	25	1.6	581.7
2007	15	2.8	4.1	1.9	28	0.9	477.5
2008	11	2.0	3.7	1.7	23	0.9	538.2
2009	11	2.0	4.0	1.8	26	1.2	555.5
Average							
1993-2009	14	2.9	7.1	3.5	25	1.2	473.7
3-year rolling average							
Year	Fatalities	FAR	AIF	LWIF	LWIS	RAR	Million hours reported ²
1993-95	17	4.6	8.9	4.4	25	3.0	359.4
1994-96	15	4.0	9.9	4.5	22	2.4	380.6
1995-97	14	3.4	11.1	4.6	22	2.2	409.7
1996-98	14	3.1	10.7	4.6	21	1.9	444.1
1997-99	12	2.6	10.3	4.4	22	1.5	453.4
1998-00	11	2.4	9.4	4.3	23	1.0	464.4
1999-01	12	2.5	9.3	4.3	23	0.9	473.0
2000-02	14	3.0	8.4	4.1	24	1.0	483.5
2001-03	17	3.5	7.6	3.8	25	1.0	502.3
2002-04	17	3.3	6.5	3.4	28	1.0	508.3
2003-05	15	2.8	5.7	3.0	32	1.0	542.2
2004-06	10	1.9	5.1	2.7	31	1.1	524.2
2005-07	11	2.1	4.4	2.3	29	1.0	532.5
2006-08	11	2.1	4.1	2.0	25	1.1	523.7
2007-09	12	2.3	3.9	1.8	26	0.9	546.4

² The number of hours reported are the total number of working hours reported including own staff and contractor, as provided. For the calculation of the frequencies only those working hours reported by Companies that are relevant for the estimation are used.

Figures 8a-c show the 3-year rolling average for FAR, AIF and LWIF segmented into the Manufacturing and Marketing activities, each split between own staff and contractors.

Figure 8a Historical evolution of Fatality Accident Rate (FAR) segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)

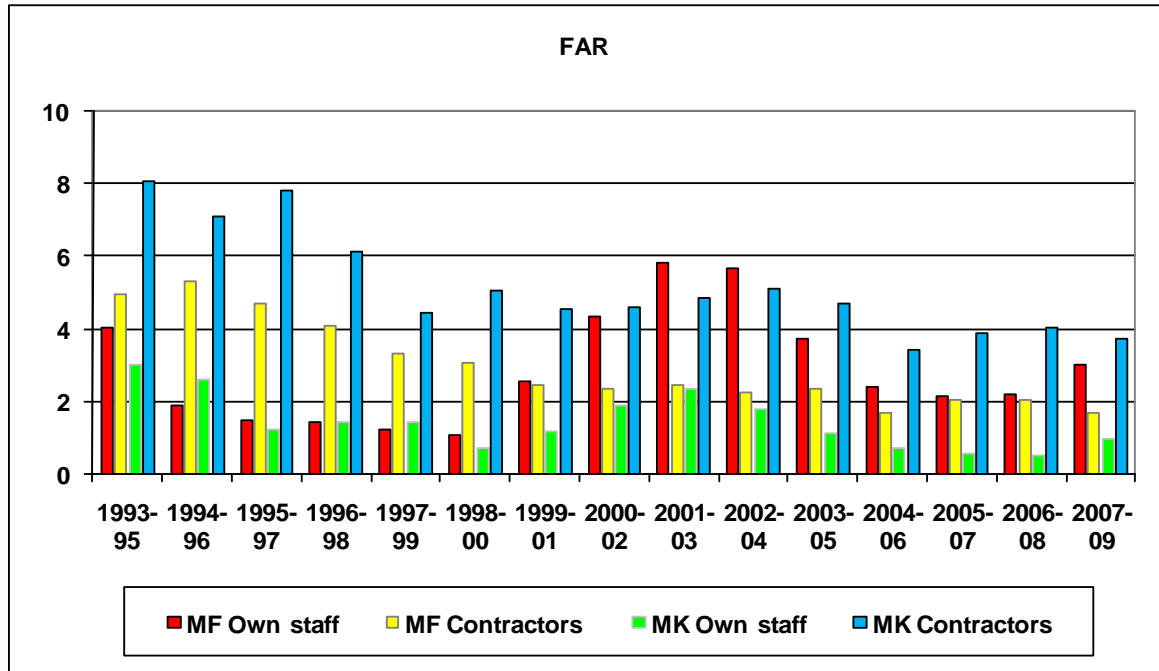


Figure 8b Historical evolution of Lost Work Injury Frequency (LWIF) segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)

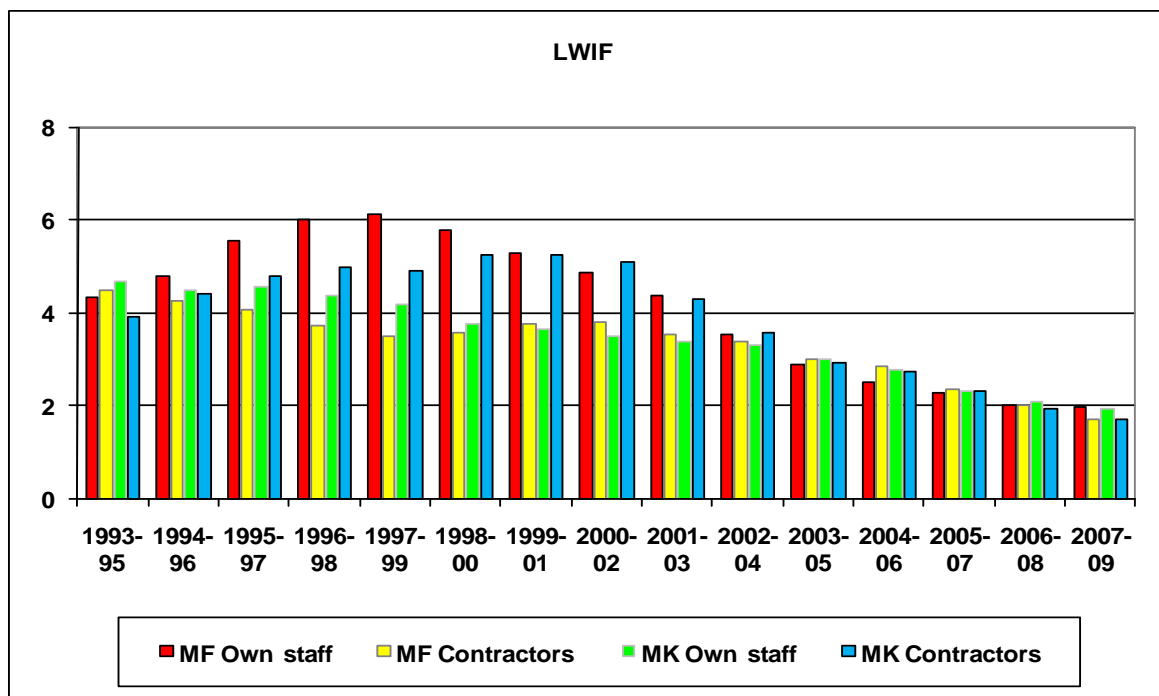
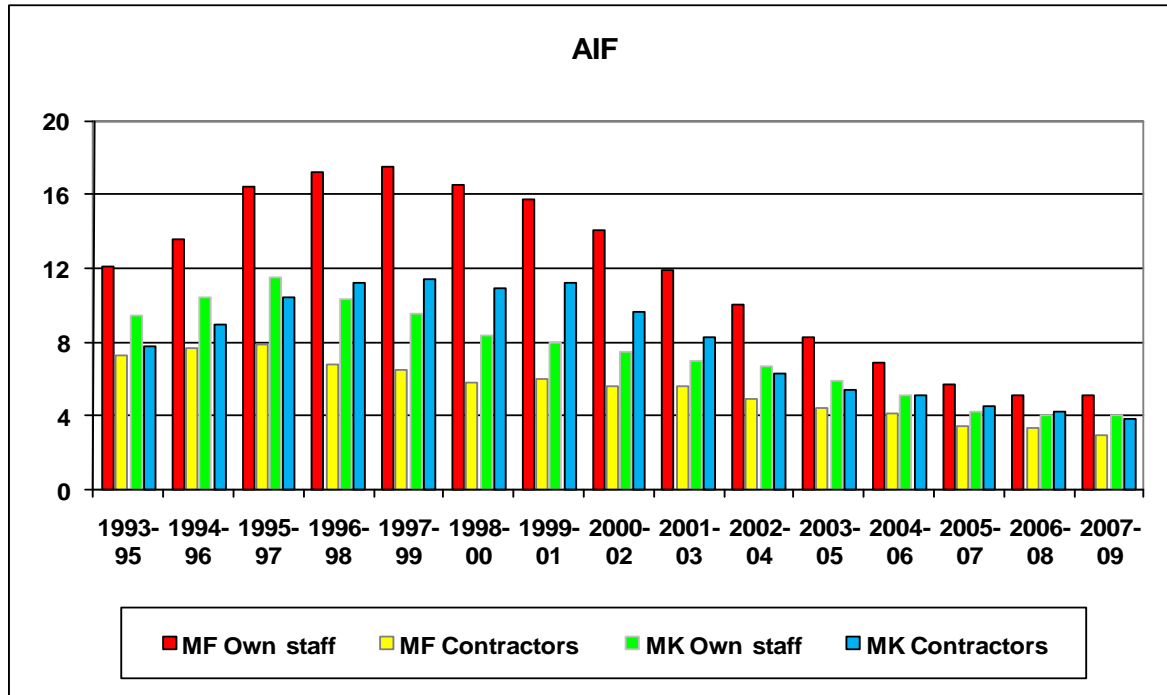


Figure 8c Historical evolution of All Injury Frequency (AIF) segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)



Unfortunately, a total of 11 fatalities were reported for 2009. Following a steady downward trend during the 1990s, fatality numbers began to increase in the first year of this decade. The 2004-06 figures showed a reversing of this unfavourable trend and the fatality numbers have shown little variation since this time. Marketing contractors continues to be the most vulnerable work group. The FAR (2.02) continue to be at a level similar to that observed in the late 1990-ties. As discussed in chapter 2, it should be kept in mind that the FAR is notoriously prone to large variations.

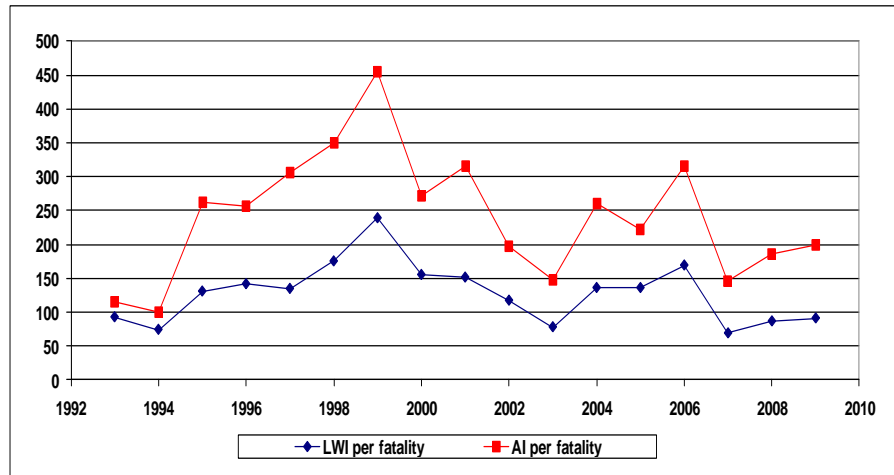
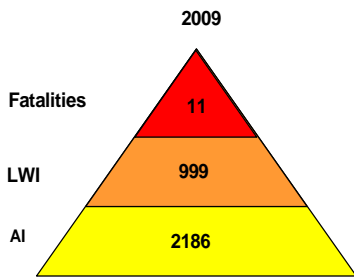
Overall the other indicators maintain the performance of 2008 with a LWIF of 1.8 in 2009, less than 2.0 for the second consecutive year, since CONCAWE started to collect these data. This indicator initially had greater reductions in Manufacturing than in Marketing, however, since 2006 figures for the 4 reporting categories continue to remain very close.

The figures suggest that AIF peaked around the 1996-97 but this is likely the result of improved reporting standards. The trend is definitely on a downward slope and AIF figures have improved for all categories.

Road traffic accidents were clearly reduced compared to the early years but the rate appears to have now reached a plateau. These accidents essentially occur in the Marketing activity where the bulk of the driving takes place.

One point of particular interest is the “safety triangle” i.e. the relationship between the total number of recordable incidents or the number of LWIs and the number of fatalities. This diagram is illustrative but not to scale. This is shown in **Figure 9a**. Also shown is a graph of LWI and AI per fatality.

Figure 9a The safety triangle



The figure above illustrates the declining number of fatalities until 1999 whereas the total number of incidents remained fairly *constant*. The period from 2000 to 2003 saw a steady increase in fatalities while both AI and LWI were still on a decreasing trend, resulting in a decrease of the ratios. The lower number of fatalities from 2004 to 2009 reversed the trend resulting in relatively steady ratios with a small positive spike in 2006 when fatalities were lower at 7 people. These observations lead to the conclusion that the overall improvement in the level of less severity safety indicators is not necessarily leading to the prevention of the more severe incidents that result in fatalities.

Figure 9b Relationship between the frequencies FAR, AIF and LWIF

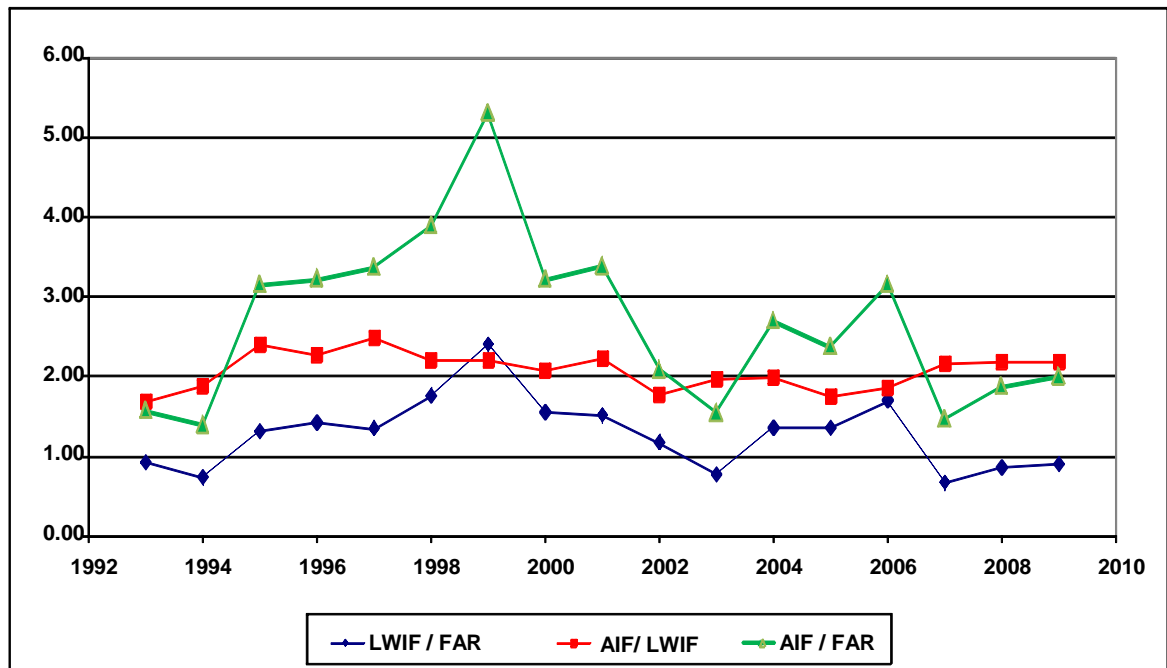


Figure 9b illustrates the relationship between the frequencies, FAR, AIF and LWIF. Since 2004 these frequencies have been relatively steady compared to each other. Fatalities remain at a disappointingly level.

Figure 10 details the causes of the 11 fatalities recorded in 2009 and **Figure 11a** shows the percentage of the main causes over the last 5 years. **Figure 11b** shows this information for all years since this information was first collected in 1998. In 2009, 3 fatalities occurred in one incident due to confined space operation, 3 were due to road accidents and 2 were as a result of falling from height. Of the remaining 3, one was a result of construction/maintenance activities, one from burning/electrocution and the last from other industrial activities.

For the last 5-year period, construction/maintenance/operations activities and road accidents remain the principal causes of fatalities.

Figure 10 Causes of fatalities in 2009

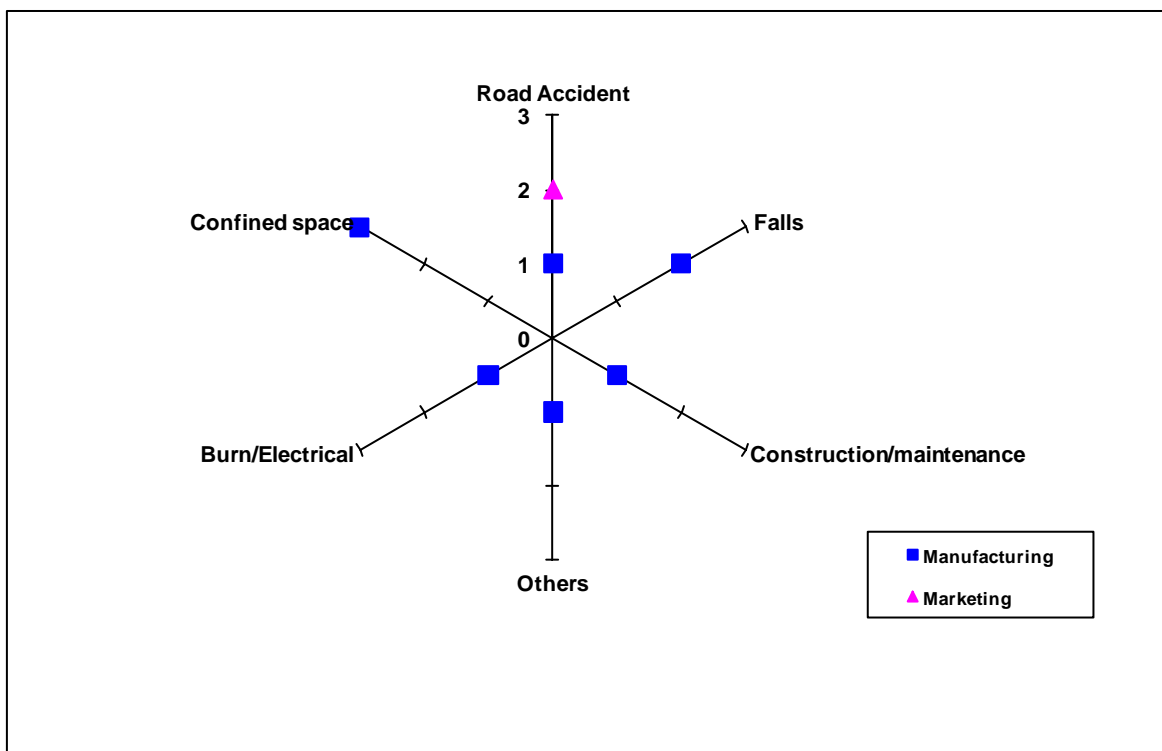


Figure 11a Causes of fatalities between 2004 and 2009

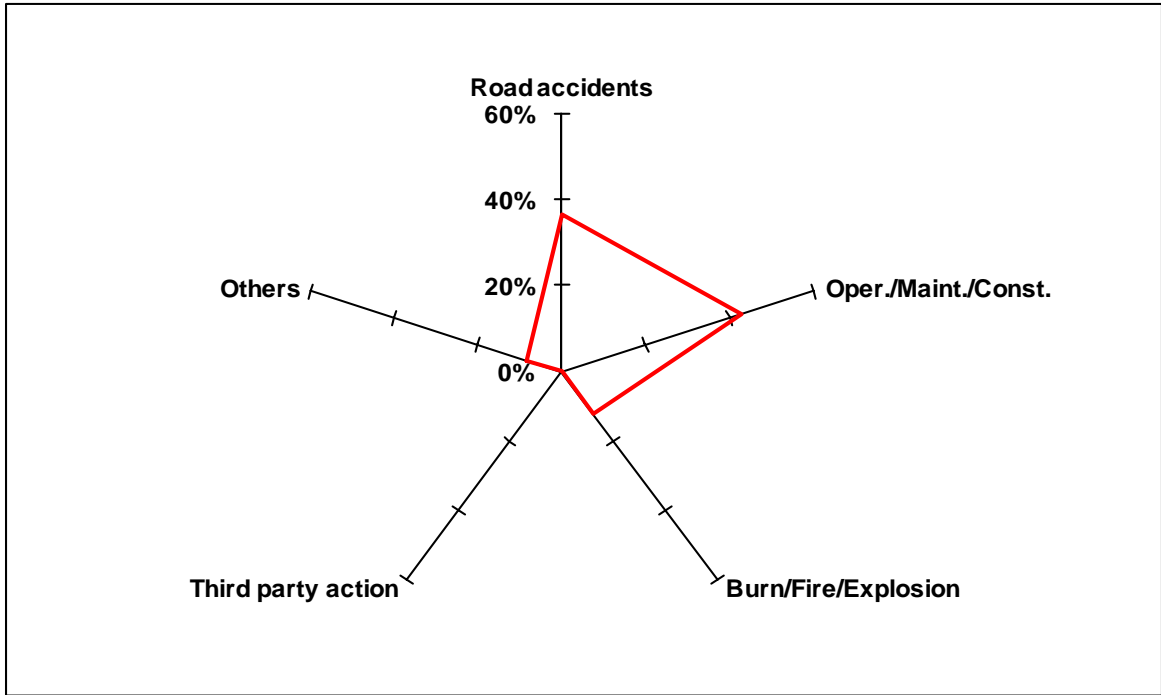
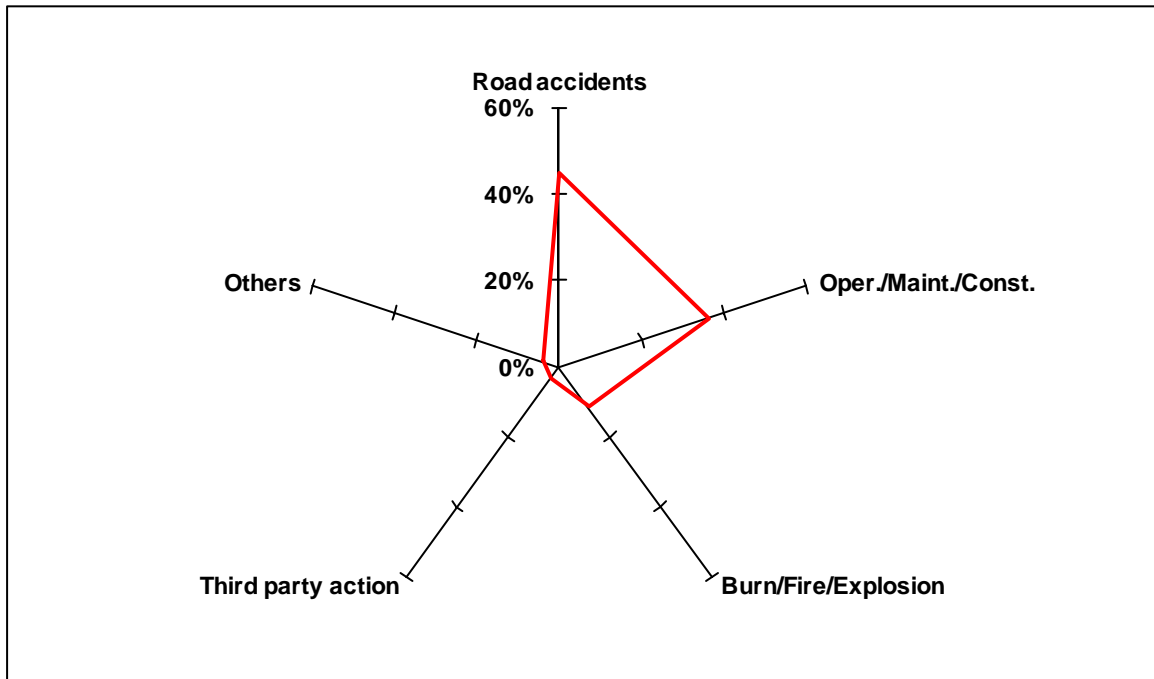


Figure 11b Causes of fatalities between 1998 and 2009



6. COMPARISON WITH OTHER SECTORS

Most of the safety performance indicators used in the oil industry, and particularly LWIF, have also been adopted in many other sectors so that meaningful comparisons are possible.

Table 4 Comparison of the safety performance of the downstream oil industry with other industry sectors

	CONCAWE This report	OGP 2009 ⁽¹⁾		CEFIC 2007	API 2008 Manufacturing
		Europe	World		
FAR	2.0	6.6	2.8	0.57 ⁽²⁾	NA
AIF	4.0	3.5	1.8	NA	5.5 ⁽³⁾
LWIF	1.8	1.3	0.5	5.7	NA

OGP Oil & Gas Producers

CEFIC Conseil Européen des Fédérations de l'Industrie Chimique

⁽¹⁾ Own staff and contractors

⁽²⁾ Estimated from the figure of 1.02 fatalities per 100,000 workers reported by CEFIC (assuming 1800 h/a worked per worker)

⁽³⁾ Estimated from reported job related non-fatal injuries and illnesses of 1.1 per 100 FT workers, API report Workplace Safety 1999-2008

The OGP statistics concern the “upstream” oil industry covering oil and gas exploration and production activities [19]. This sector shows better AIF and LWIF performances than the downstream, on a global basis, which was also the case in previous years. However the Europe and World FAR is higher than for the downstream sector.

The chemical industry data for 2008 or 2009 (CEFIC) [20], and the American Petroleum Industry data (API) [21] for 2009 are not yet available.

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APPENDIX 1 EUROPEAN REFINING AND DISTRIBUTION INDUSTRY STATISTICS DEFINITIONS AND GUIDING NOTES

AIF (TRCF)	All Injury Frequency (Total Recordable Case Frequency) which is calculated from the sum of fatalities, LWIs, RWIs and MTCs divided by number of hours worked expressed in millions of hours.
Distance travelled	This is the distance, expressed in millions of kilometres, covered by company owned delivery vehicles and company cars whether leased or owned. It should also include kilometres travelled in employee's cars when on company business.
FAR	Fatal Accident rate is calculated from the number of fatalities divided by the number of hours worked expressed in hundred millions.
Fatality	This is a death resulting from a work related injury where the injured person dies within twelve months of the injury.
Hours worked	Hours worked by employees and contractors. Estimates should be used where contractor data is not available.
LOPC	Loss of Primary Containment (LOPC) is an unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO ₂ or compressed air).
LWI	Lost Workday Injury is a work related injury that causes the injured person to be away from work for at least one normal shift because he is unfit to perform any duties.
LWIF	Lost Workday Injury Frequency is calculated from the number of LWIs divided by the number of hours worked expressed in millions.
LWIS	Lost Workday Injury Severity is the total number of days lost as a result of LWIs divided by the number of LWIs.
MTC	Medical Treatment Case is a work related injury which requires the attention of a medical practitioner. It excludes first aid treatment.
PSE	A Process Safety Event is an unplanned or uncontrolled LOPC. The severity of the PSE is defined by the consequences of the LOPC.
PSER	Process Safety Event Rate (PSER) is calculated as the number of PSE (Tier 1, Tier 2 or Total) divided by the total number of hours worked (including contractor hours) expressed in millions.
RAR	Road Accident Rate is calculated from the number of accidents divided by the kilometres travelled expressed in millions.
Road Accidents	Any accident involving company owned delivery vehicles and company cars whether leased or owned.

RWI	Restricted Workday Injury is a work related injury which causes the injured person to be assigned to other work on a temporary basis or to work his normal job less than full time or to work at his normal job without undertaking all the normal duties.
Tier 1 PSE	<p>A Tier 1 Process Safety Event (T-1 PSE) is a loss of primary containment (LOPC) with the greatest consequence. A T-1 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO₂ or compressed air), from a process that results in one or more of the consequences listed below:</p> <ul style="list-style-type: none"> • An employee, contractor or subcontractor “days away from work” injury and/or fatality; or • Hospital admission and/or fatality of a third-party; or • Officially declared community evacuation or community shelter-in-place; or • Fires or explosions resulting in greater than or equal to €25,000 of direct cost to the Company; or • A pressure relief device (PRD) discharge to atmosphere greater than the threshold quantities described in Table 1 of appendix 2 that: <ul style="list-style-type: none"> ▪ contained liquid carryover; or ▪ was discharged to an unsafe location; or ▪ resulted in an onsite shelter-in-place; or ▪ resulted in public protective measures (e.g., road closure); or • A release of material greater than the threshold quantities described in Table 1 of Appendix 2 in any one-hour period.
Tier 2 PSE	<p>A Tier 2 Process Safety Event (T-2 PSE) is a LOPC with lesser consequence. A T-2 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO₂ or compressed air), from a process that results in one or more of the consequences listed below and is not reported in Tier 1:</p> <ul style="list-style-type: none"> • An employee, contractor or subcontractor recordable injury; or • A fire or explosion resulting in greater than or equal to €2,500 of direct cost to the Company; or • A pressure relief device (PRD) discharge to atmosphere or to a downstream destructive device greater than the threshold quantity in Table 2 of Appendix 2 that results in one or more of the following four consequences: <ul style="list-style-type: none"> ▪ liquid carryover; or ▪ discharge to a potentially unsafe location; or ▪ an onsite shelter-in-place; or ▪ public protective measures (e.g., road closure) and; • A release of material greater than the threshold quantities described in Table 2 of Appendix 2 in any one-hour period.
Total days lost	The number of calendar days lost through LWIs counting from the day after the injury occurred.

Statistics are collected under two groupings: Manufacturing (refineries) and Marketing.

Marketing includes all non-refining activities (e.g. terminals and distribution facilities) including "Head Office" personnel.

Where data are not available directly, CONCAWE members are requested to present the best possible estimates.

APPENDIX 2 CONCAWE PROCESS SAFETY PERFORMANCE INDICATORS DEFINITIONS

Within CONCAWE a decision was taken to start gathering Process Safety Performance Indicator (PSPI) data, as of 2010.

Aligning this initiative with developments globally, this decision was made to adopt the indicators of the forthcoming ANSI/API guideline “Process Safety Performance Indicators for the Refining and Petrochemical Industries” that was published as ANSI/API Guideline 754 in April 2010 [A2-1].

This short note provides an overview of the performance indicators that CONCAWE intends to collect from its members for the European Refining and Distribution Industry, which are the Tier 1 and 2 PSPI of this guideline with minor alteration to allow the alternative use of the criteria that are embedded in EU-legislation and the fact that in Europe quantities are reported in the SI-metric system (kg/m³/sec). However, the classification of Process Safety Events (PSE) preferentially should follow the scheme set in the aforementioned guideline.

The purpose of this Appendix is to inform the Member Companies on this with the aim to allow them to initiate the gathering of these requested PSEs as of 2010.

It is realised that this might be cumbersome for some members and, therefore, the reporting of these indicators will need to develop overtime. However, it is expected that within a few years the internal data gathering and reporting to CONCAWE will develop such that meaningful analyses can be performed for the European Refining and Distribution Industry that enables and allows comparing with other regions where this data is collected and reported.

In the forthcoming API guidance 4 Tiers of PSPIs are mentioned. However, the data collection and evaluation within CONCAWE will restrict itself to the Tier 1 & 2 PSPIs.

The criteria for the classification of Tier 1 and 2 PSEs are provided below, followed by a decision tree that assists in the classification of these.

Tier 1 Performance Indicator — Process Safety Event (T-1 PSE)

Tier 1 Indicator Purpose

The count of Tier 1 process safety events is the most lagging process safety performance indicator (PSPI) and represents incidents with greater consequence resulting from actual losses of containment.

Tier 1 Indicator Definition and Consequences

A Tier 1 Process Safety Event (T-1 PSE) is a loss of primary containment (LOPC) with the greatest consequence as defined by this document. A T-1 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen or other inert gases, compressed CO₂ or compressed air³), from a process that results in one or more of the consequences listed below:

³ Non-toxic and non-flammable materials (e.g., steam, hot water, nitrogen, compressed CO₂ or compressed air) have no threshold quantities and are only included in this definition as a result of their potential to result in one of the other consequences. Events involving these are only reported, if these events result in one of the indicated consequences.

- An employee, contractor or subcontractor “days away from work” injury and/or fatality; or
- A hospital admission and/or fatality of a third-party; or
- An officially declared community evacuation or community shelter-in-place; or
- A fire or explosion resulting in greater than or equal to €25,000 of direct cost to the Company; or
- A pressure relief device (PRD) discharge to atmosphere or to a downstream destructive device that results in one or more of the following four consequences:
 - liquid carryover; or
 - discharge to a potentially unsafe location; or
 - an on-site shelter-in-place; or
 - public protective measures (e.g., road closure);and a PRD discharge quantity greater than the threshold quantities in Table 1; or
- Any release of material greater than the threshold quantities described in Table 1 in any one-hour period.

Calculation of Tier 1 PSE Rate

The Tier 1 PSE Rate shall be calculated as follows:

$$\text{Tier 1 PSE Rate} = (\text{Total Tier 1 PSE Count} / \text{Total Work Hours}) \times 1,000,000^4$$

⁴ Total work hours include employees and contractors. The 1,000,000 hours is the CONCAWE denominator that is also applied in the operational safety statistics frequency estimations.

Table 1— Tier-1 Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification ^{1,3,4}	Threshold Quantity (outdoor release)	Threshold Quantity (indoor ² release)
1	Toxic Inhalation Hazard (TIH) Zone A or EU-CLP Category 1 Hazardous Materials ⁵	5 kg	2.5 kg
2	TIH Zone B or EU-CLP Category 2 Hazardous Materials ⁵	25 kg	12.5 kg
3	TIH Zone C or EU-CLP Category 3 Hazardous Materials ⁵	100 kg	50 kg
4	TIH Zone D or EU CLP Category 4 Hazardous Materials ⁵	200 kg	100 kg
5	Flammable Gases or Liquids with Boiling Point ≤ 35°C and Flash Point < 23°C or Other Packing Group I Materials	500 kg	250 kg
6	Liquids with Boiling Point > 35°C and Flash Point < 23°C or Other Packing Group II Materials	1000 kg	500 kg
7	Liquids with Flash Point ≥ 23°C and ≤ 60°C or Liquids with Flash Point > 60°C released at a temperature at or above Flash Point or strong acids/bases or Other Packing Group III Materials	2000 kg	1000 kg

¹ Many materials exhibit multiple hazards. Correct placement in Hazard Zone or Packing Group shall preferentially follow the rules of the UN Recommendations on the Transportation of Dangerous Goods, Section 2 [A2-2] or the Classifications according to DOT 49 CFR 173.2a [A2-3], as explained in the ANSI/API guideline 754 Annex B. Alternatively, the classifications of EU Regulation EC-1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 [A2-4] that implement the UN harmonised System can be used.

² A structure composed of four complete (floor to ceiling) walls, floor and roof.

³ For solutions not listed on the UNDG, the anhydrous component shall determine the TIH hazard zone or Packing Group classification. The threshold quantity of the solution shall be back calculated based on the threshold quantity of the dry component weight.

⁴ For mixtures where the UNDG classification is unknown, the fraction of threshold quantity release for each component may be calculated. If the sum of the fractions is equal to or greater than 100%, the mixture exceeds the threshold quantity. Where there are clear and independent toxic and flammable consequences associated with the mixture, the toxic and flammable hazards are calculated independently.

⁵ For vapours, the hazardous classifications only apply to inhalation toxicity. Whereas for liquids, the oral and dermal toxicity should be assessed, as well as described in the ANSI/API guideline Annex B.

Tier 2 Performance Indicators – Process Safety Events (T-2-PSE)

Tier 2 Indicator Purpose

The count of Tier 2 process safety events represents LOPC events with a lesser consequence. Tier 2 PSEs, even those that have been contained by secondary systems, indicate system weaknesses that may be potential precursors of future, more significant incidents. In that sense, Tier 2 PSEs can provide a company with opportunities for learning and improvement of its process safety performance.

Tier 2 Indicator Definition and Consequences

A Tier 2 Process Safety Event (T-2 PSE) is a LOPC with lesser consequence. A T-2 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO₂ or compressed air³), from a process that results in one or more of the consequences listed below and is not reported in Tier 1:

An employee, contractor or subcontractor recordable injury; or

- A fire or explosion resulting in greater than or equal to €2,500 of direct cost to the Company; or
- A pressure relief device (PRD) discharge to atmosphere or to a downstream destructive device that results in one or more of the following four consequences:
 - liquid carryover; or
 - discharge to a potentially unsafe location; or
 - an onsite shelter-in-place; or
 - public protective measures (e.g., road closure);

and a PRD discharge quantity greater than the threshold quantity in Table 2; or

- A release of material greater than the threshold quantities described in Table 2 in any one-hour period.

Calculation of Tier 2 PSE Rate

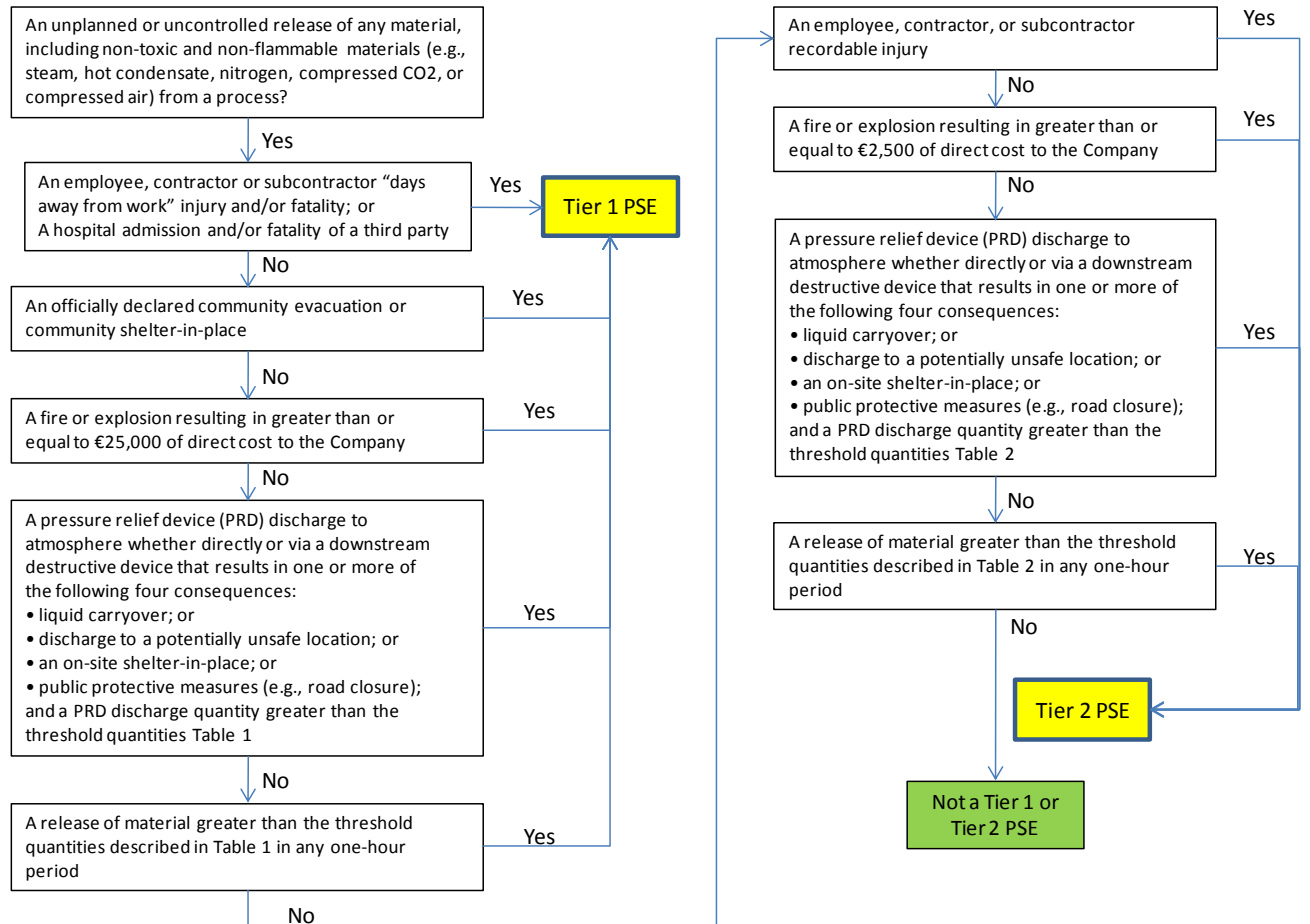
The Tier 2 PSE rate shall be calculated as follows:

$$\text{Tier 2 PSE Rate} = (\text{Total Tier 2 PSE Count} / \text{Total Work Hours}) \times 1,000,000^5$$

Table 2 — Tier-2 Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification ^{1,3,4}	Threshold Quantity (outdoor release)	Threshold Quantity (indoor ² release)
1	TIH Zone A or EU-CLP Category 1 Hazardous Materials ⁵	0.5 kg	0.25 kg
2	TIH Zone B or EU-CLP Category 2 Hazardous Materials ⁵	2.5 kg	1.25 kg
3	TIH Zone C or EU-CLP Category 3 Hazardous Materials ⁵	10 kg	5 kg
4	TIH Zone D or EU CLP Category 4 Hazardous Materials ⁵	20 kg	10 kg
5	Flammable Gases or Liquids with Boiling Point ≤ 35°C and Flash Point < 23°C or Other Packing Group I Materials	50 kg	25 kg
6	Liquids with a Boiling Point > 35°C and Flash Point < 60°C or Liquids with Flash Point > 60°C released at or above Flash Point; or Other Packing Group II and III Materials or Strong acids and bases	100 kg	50 kg
7	Liquids with Flash Point > 60°C released at a temperature below Flash Point or Moderate acids/bases	1000 kg	500 kg
<p>In order to simplify determination of reporting thresholds for Tier 2, Categories 6 and 7 in Tier 1 have been combined into one category in Tier 2 (Category 6). The simplification is intended to provide less complicated requirements for those events with lesser consequences.</p>			
<p>¹ Many materials exhibit multiple hazards. Correct placement in Hazard Zone or Packing Group shall <u>preferentially follow the rules</u> of the UN Recommendations on the Transportation of Dangerous Goods, Section 2 [A2-2] or the Classifications according to DOT 49 CFR 173.2a [A2-3], as explained in the ANSI/API guideline 754 Annex B. Alternatively, the classifications of EU Regulation EC-1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 [A2-4] that implement the UN harmonised System can be used.</p>			
<p>²A structure composed of four complete (floor to ceiling) walls, floor and roof.</p>			
<p>³ For solutions not listed on the UNDG, the anhydrous component shall determine the TIH hazard zone or Packing Group classification. The threshold quantity of the solution shall be back calculated based on the threshold quantity of the dry component weight.</p>			
<p>⁴ For mixtures where the UNDG classification is unknown, the fraction of threshold quantity release for each component may be calculated. If the sum of the fractions is equal to or greater than 100%, the mixture exceeds the threshold quantity. Where there are clear and independent toxic and flammable consequences associated with the mixture, the toxic and flammable hazards are calculated independently.</p>			
<p>⁵ For vapours, the hazardous classifications only apply to inhalation toxicity. Whereas for liquids, the oral and dermal toxicity should be assessed, as well as described in the ANSI/API guideline Annex B.</p>			

PSE Classification Decision Logic Tree



Bibliography of Appendix 2

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FURTHER READING

The following documents are not directly referenced in this Appendix but provide a useful source of relevant information.

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