

# **European downstream oil industry safety performance**

## **Statistical summary of reported incidents – 2008**

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## ABSTRACT

The fifteenth 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 2008. Data was received from 31 companies representing 97% of the European refining capacity. Trends over the last fifteen years are highlighted and the data is also compared to similar statistics from related industries.

## KEYWORDS

Accidents, AIF, CONCAWE, FAR, fatality, incidents, injury, LWI, LWIF, marketing, oil industry, refining, RAR, RWI, safety, statistics.

## INTERNET

This report is available as an Adobe pdf file on the CONCAWE website ([www.concaawe.org](http://www.concaawe.org)).

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## SUMMARY

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 fifteenth report on this topic. This report covers data collected for 2008 and includes a full historical perspective from 1993. It also includes comparative figures from other related industry sectors. Data for 2008 was submitted by 31 companies, together accounting 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 Western Europe as well as by other branches of industry.

Accident frequencies in the downstream oil industry in Europe are at low levels, which have been maintained throughout the period of reporting. Overall, the 2008 performance appears slightly improved, in several areas, compared to previous years, confirming the trend observed previously. Standing at 1.7, the Lost Work Incident Frequency (LWIF) for 2008 is down from 3.9 in 2002 and the lowest recorded so far. 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. The fatal accident rate (2.0 per hundred million hours worked) and the total number of fatalities (11) decreased in 2008. Road accidents account for 27% of the fatalities. Falls from height account for one fatality in 2008, compared with 5 reported fatalities in 2007.

## 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 fifteenth report on this topic (see references of past reports in the reference list [1-14]). This report covers data collected for 2008 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 dichotomy has also been applied in the CONCAWE data. Additionally, the data is split between 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 action;
- 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, the majority of CONCAWE member companies participated so that the sample 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 and so did the percentage of the refining capacity represented. For 2008, 31 companies responded although not all companies could supply all the requested data.

The area of coverage is primarily the EU-27 plus Norway, Switzerland and, in some cases, 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 between companies in the precise definition or interpretation of metrics, so that 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.

It is noteworthy that the majority of participating companies are willing to share their data openly with other companies. This indicates that they feel that safety is a non-competitive issue where all can learn from the experience of others and help other companies 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.<sup>1</sup>
- 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.

A more complete set of definitions is given in **Appendix 1**.

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 the indicator to shoot up 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 are many less serious injuries. These incidents provide the opportunities to address equipment, standards, training, attitudes and practices that may cause the near-misses, relatively minor incidents and, ultimately, more serious accidents.

### ***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.

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<sup>1</sup> AIF is often referred to as TRCF – Total Recordable Case Frequency. Refer appendix 1.

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 are less likely to change significantly year-to-year 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 LWIs. Although it is still less widely used than LWIF, reporting improves year by year with more companies turning to this indicator. 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 AIF 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 road accidents remain a major cause of both fatalities and lost time injuries, so a number of companies have taken to monitoring these separately. The data is 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 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. 2008 RESULTS

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

**Table 1** Completeness of submissions for 2008

No of companies	Manufacturing		Marketing	
	Own staff	Contractors	Own staff	Contractors
Submission Including	31	25	24	15
Road accidents	9	3	10	9
Distance travelled	12	5	12	8

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 is generally less complete.

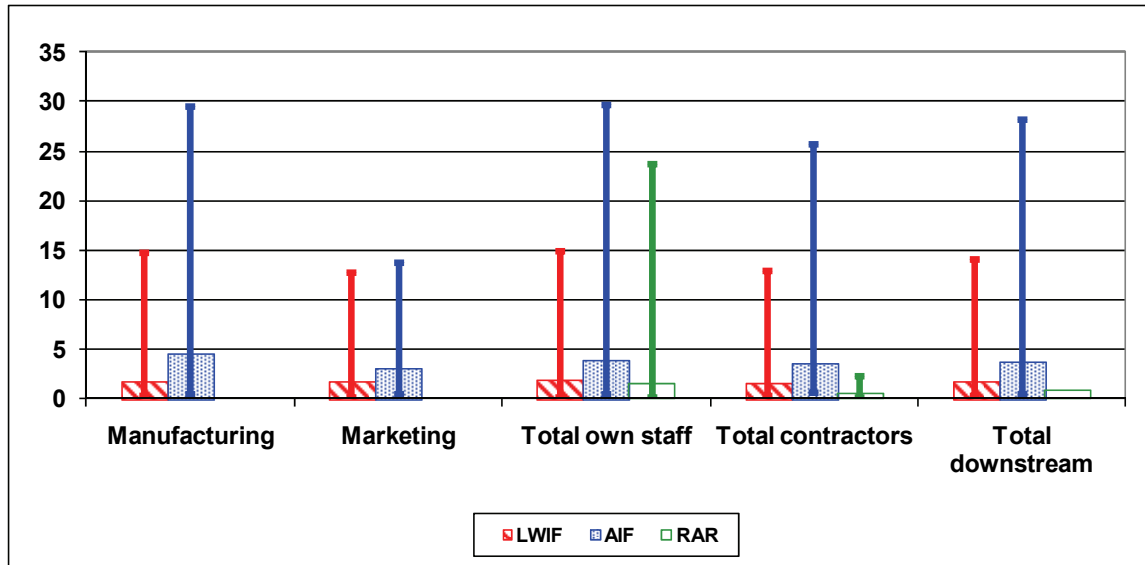
The aggregated 2008 results per sector and for the whole of the European downstream oil industry are shown in **Table 2**. **Figure 1a** shows the average performance indicators and their range of variability amongst reporting companies. **Figures 1b** and **1c** show the results for all injuries and AIF and lost time injuries and LWIF on a cumulative frequency basis which allows individual companies to benchmark their own results against the group. For AIF and LWIF, which are the most universally used indicators; we also show the distribution per quartile for the different sectors (**Figure 2a/b**).

**Table 2** Aggregated 2008 results for all reporting companies

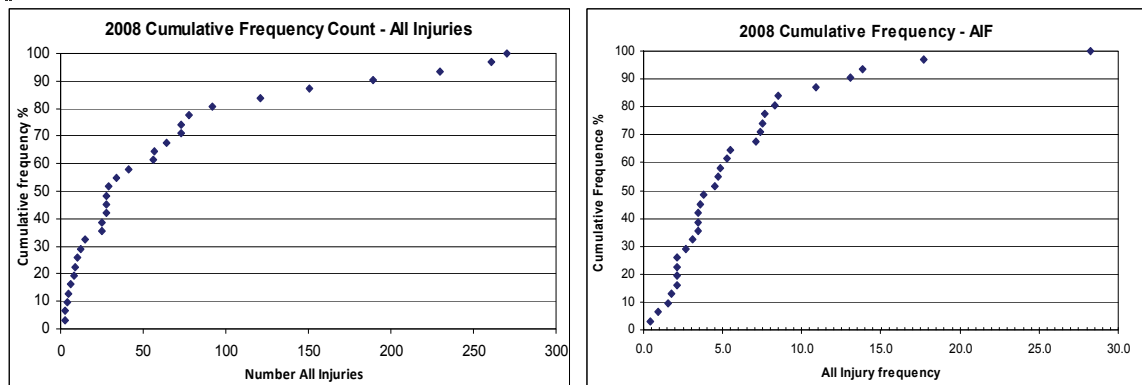
Sector		Manufacturing			Marketing			Both Sectors		
		OS	CT	AW	OS	CT	AW	OS	CT	AW
Work Force	Mh	121	130	250	160	145	305	281	274	555
Fatalities		1	4	5	1	5	6	2	9	11
Fatal Accident Rate	F/100 Mh	0.8	3.1	2.0	0.6	3.5	2.0	0.7	3.3	2.0
Lost work incidents	LWI	181	235	416	342	189	531	523	424	947
Lost time through LWI	days	5,537	6,074	11,611	8,385	1,768	10,153	13,922	7,842	21,764
LWI frequency	LWI/Mh	1.5	1.8	1.7	2.1	1.3	1.7	1.9	1.5	1.7
LWI severity	lost days/LWI	30.6	25.8	27.9	24.5	9.4	19.1	26.6	18.5	23.0
All recordable incidents	AI	442	682	1,124	648	272	920	1,090	954	2,044
All incidents frequency	AI/Mh	3.7	5.3	4.5	4.0	1.9	3.0	3.9	3.5	3.7
Distance travelled	million km							326	678	1004
Road Accidents	RA							484	400	884
Road Accident Rate	RA/million km							1.5	0.6	0.88

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

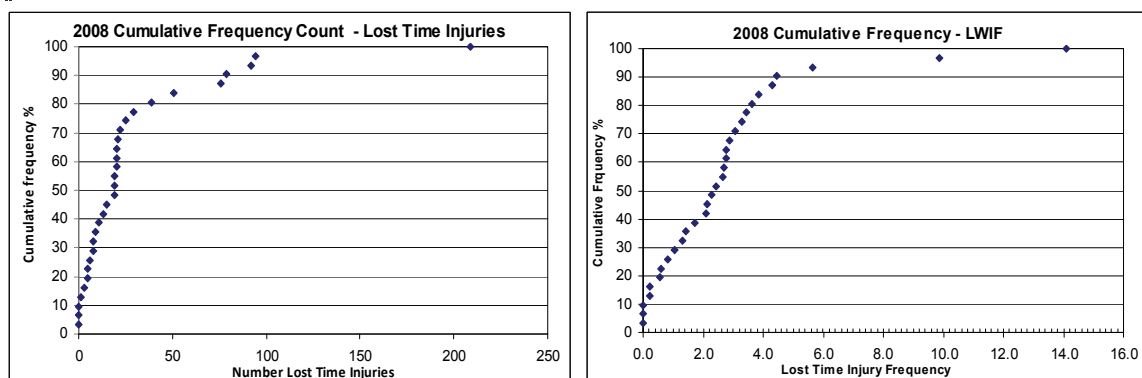
**Figure 1a** Average 2008 performance indicators with range of variability



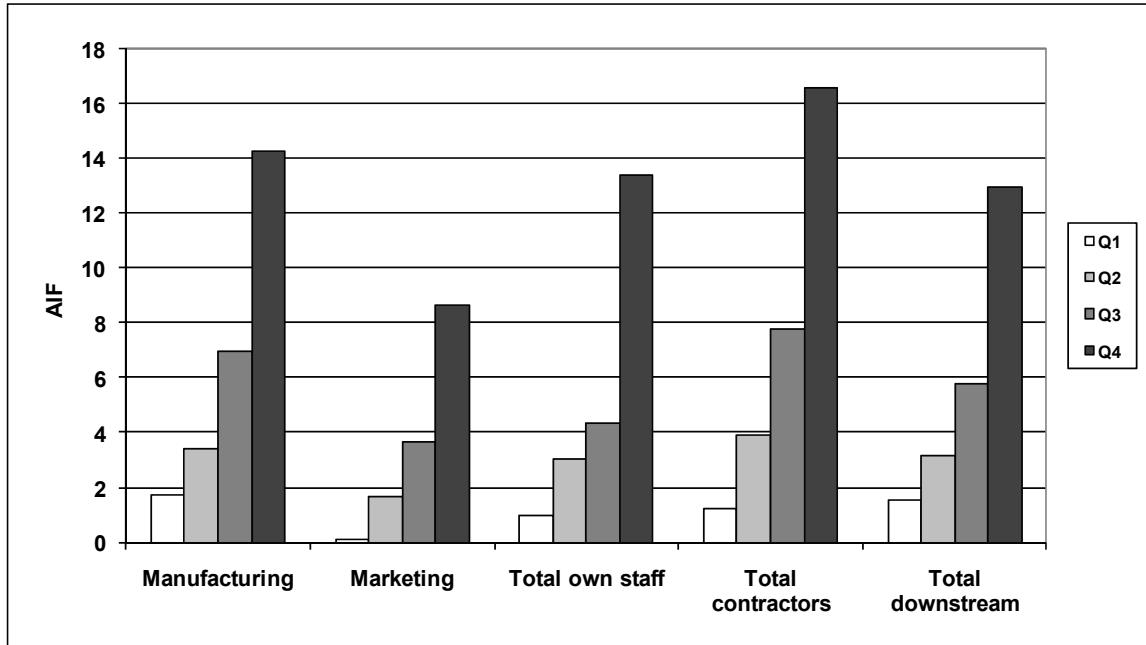
**Figure 1b** Cumulative Frequency Analysis All Injuries and All Injury Frequency



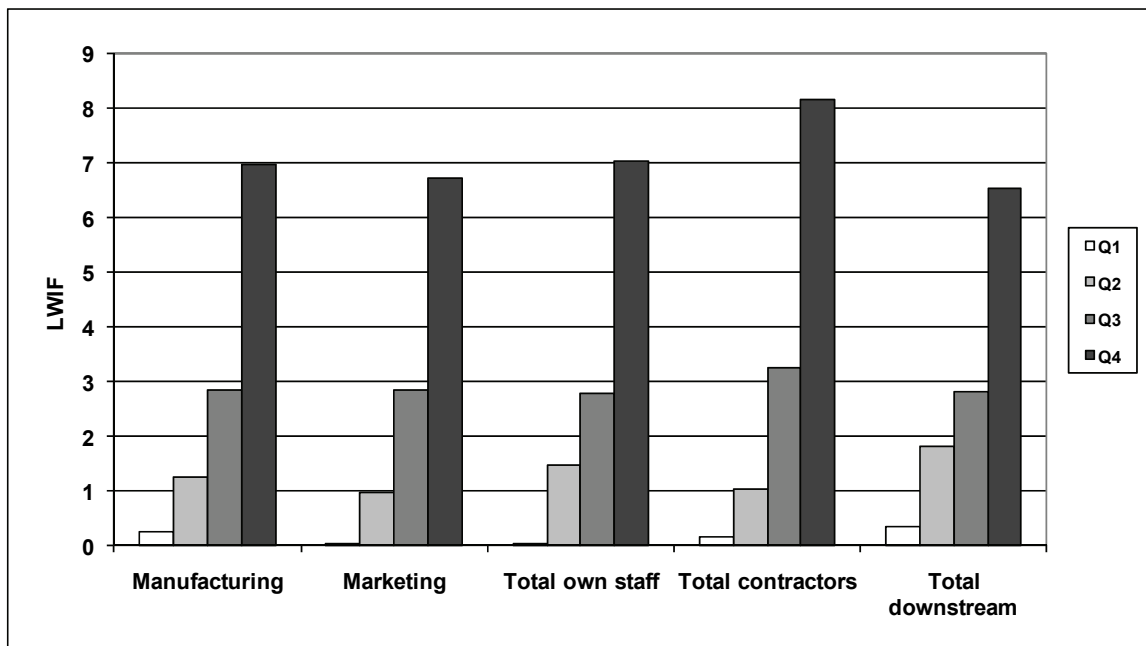
**Figure 1c** Cumulative Frequency Analysis Lost Work Injuries and Lost Work Injury Frequency



**Figure 2a** AIF distribution  
Average value for each quartile

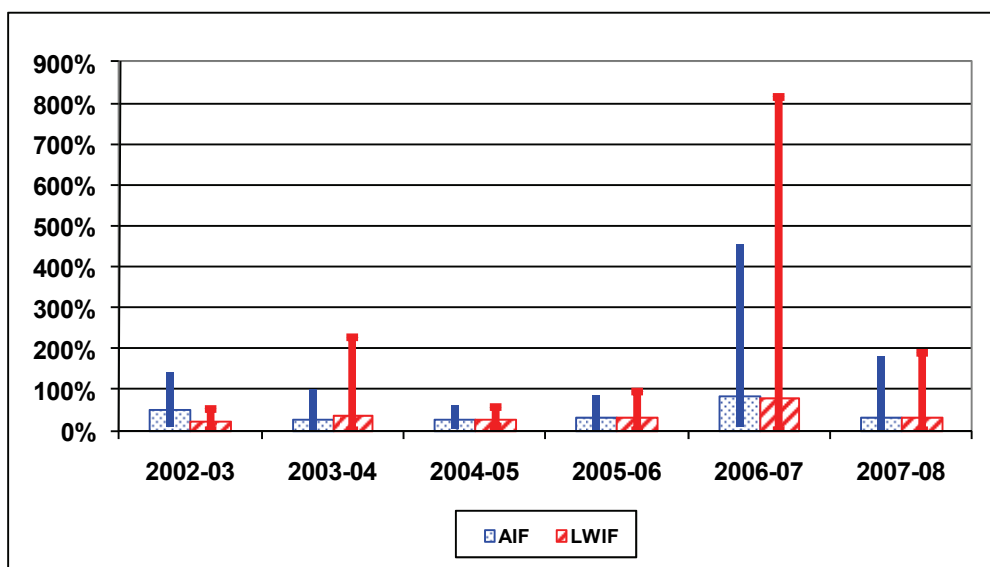


**Figure 2b** LWIF distribution  
Average value for each quartile



The average performance indicator figures clearly hide a wide range of individual values, with a factor of up to 70 between reporting companies. **Figure 3** shows that the variability is significantly less when looking at year-on-year figures for each company individually. The variance shown by several companies in 2007 seems to have been eliminated and the variability returned to previous levels.

**Figure 3** Year-on-year performance indicator variations  
Average for all reporting companies

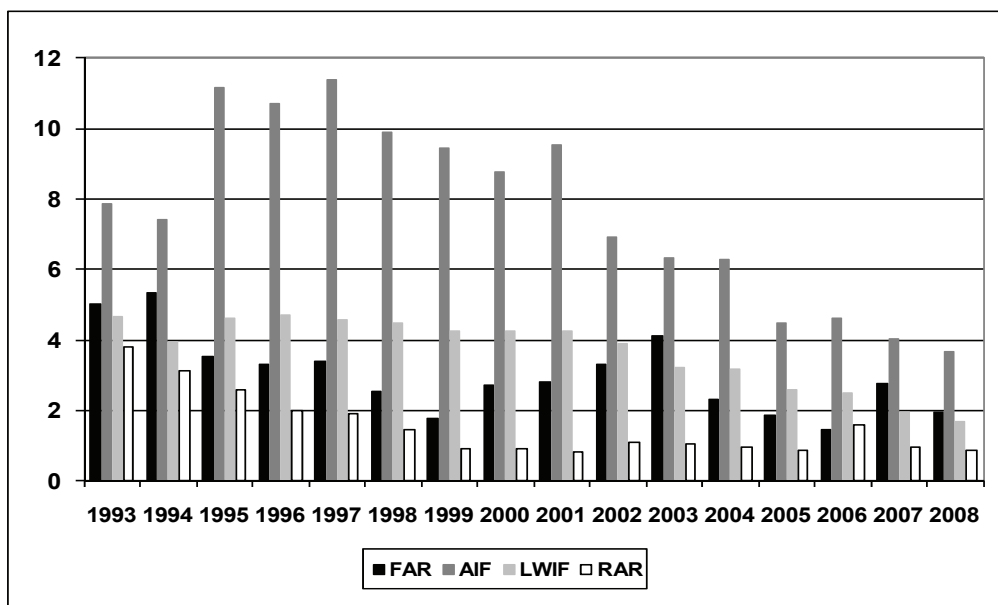


In summary there are large differences in reported figures between companies and for most companies these differences do not change much over the years. This reflects genuine levels of performance achieved by different organisations but also differences in the way they monitor and classify incidents and collect their data.

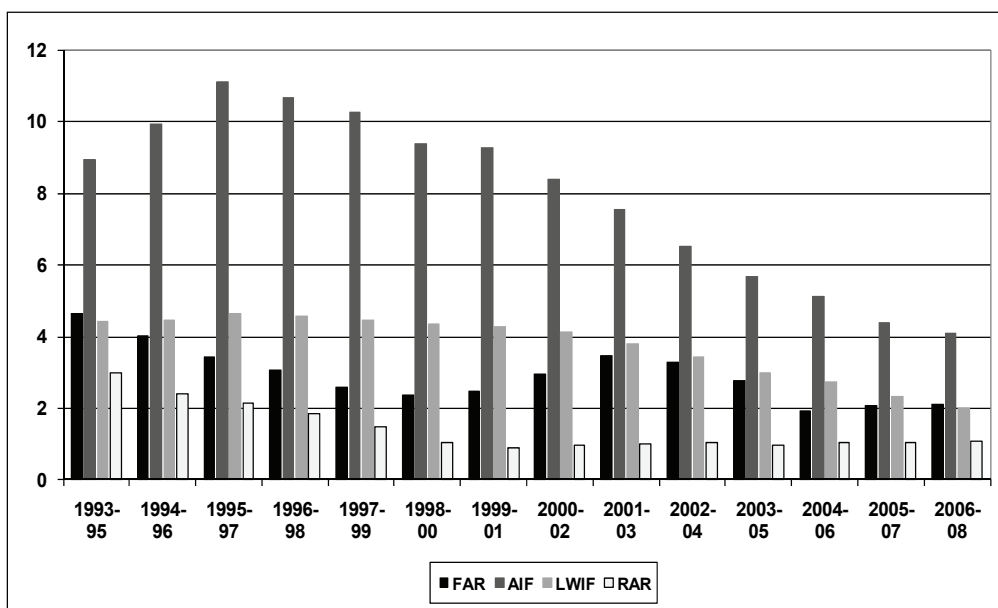
#### 4. HISTORICAL TRENDS

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 4a/b** and **Table 3**.

**Figure 4a** Historical evolution of main performance indicators  
Yearly data for the whole European downstream industry



**Figure 4b** Historical evolution of main performance indicators  
3-year rolling average for the whole European downstream industry

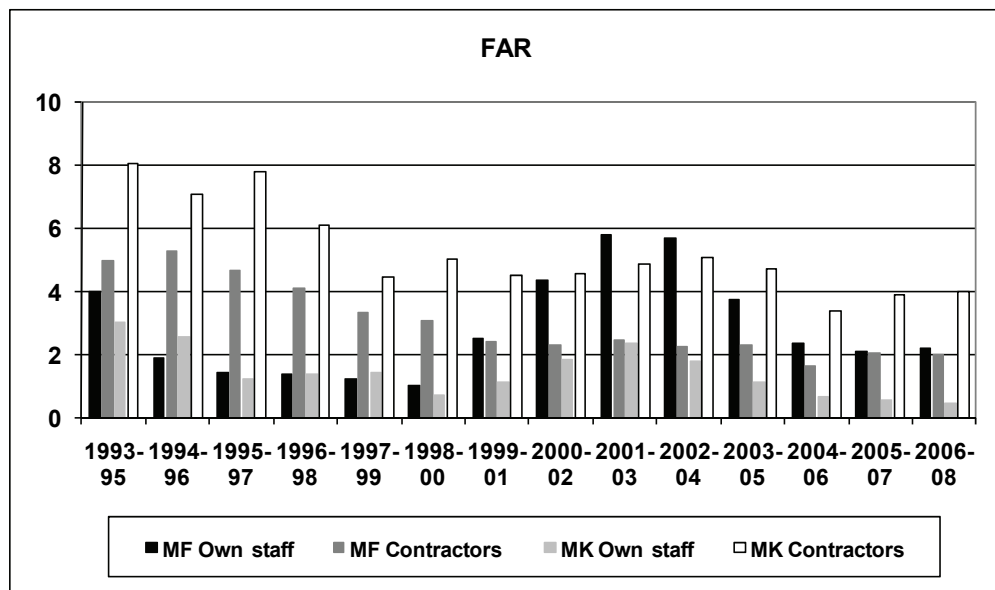


**Table 3** Historical evolution of performance indicators

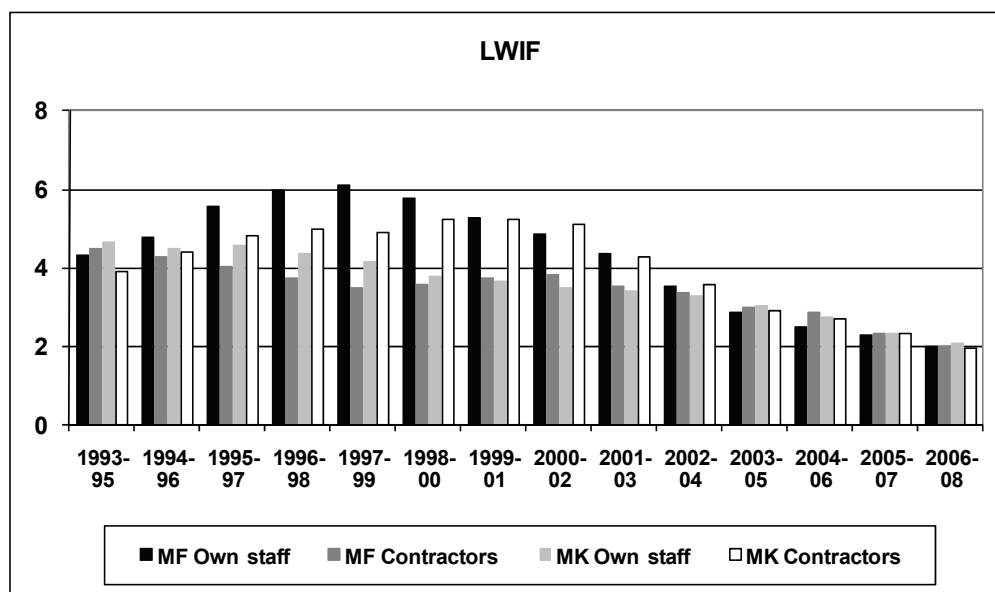
Year	Fatalities	FAR	AIF	LWIF	LWIS	RAR
1993	18	5.0	7.9	4.7	27	3.8
1994	19	5.4	7.4	4.0	25	3.1
1995	13	3.5	11.2	4.6	24	2.6
1996	14	3.3	10.7	4.7	19	2.0
1997	15	3.4	11.4	4.6	23	1.9
1998	12	2.6	9.9	4.5	22	1.5
1999	8	1.8	9.4	4.3	21	0.9
2000	13	2.7	8.8	4.3	25	0.9
2001	14	2.8	9.5	4.3	24	0.8
2002	16	3.3	6.9	3.9	23	1.1
2003	22	4.1	6.3	3.2	30	1.0
2004	12	2.3	6.3	3.2	33	1.0
2005	11	1.9	4.5	2.6	35	0.9
2006	7	1.5	4.6	2.5	25	1.6
2007	15	2.8	4.1	1.9	28	0.9
2008	11	2.0	3.7	1.7	23	0.9
<b>Averages</b>						
1993-2008	14	2.9	7.3	3.6	25	1.3
3-year rolling average						
1993-95	17	4.6	8.9	4.4	25	3.0
1994-96	15	4.0	9.9	4.5	22	2.4
1995-97	14	3.4	11.1	4.6	22	2.2
1996-98	14	3.1	10.7	4.6	21	1.9
1997-99	12	2.6	10.3	4.4	22	1.5
1998-00	11	2.4	9.4	4.3	23	1.0
1999-01	12	2.5	9.3	4.3	23	0.9
2000-02	14	3.0	8.4	4.1	24	1.0
2001-03	17	3.5	7.6	3.8	25	1.0
2002-04	17	3.3	6.5	3.4	28	1.0
2003-05	15	2.8	5.7	3.0	32	1.0
2004-06	10	1.9	5.1	2.7	31	1.1
2005-07	11	2.1	4.4	2.3	29	1.0
2006-08	11	2.1	4.1	2.0	25	1.1

**Figure 5a-c** shows the 3-year rolling average for FAR, AIF and LWIF segmented into the Manufacturing and Marketing activities, each split between own staff and contractors.

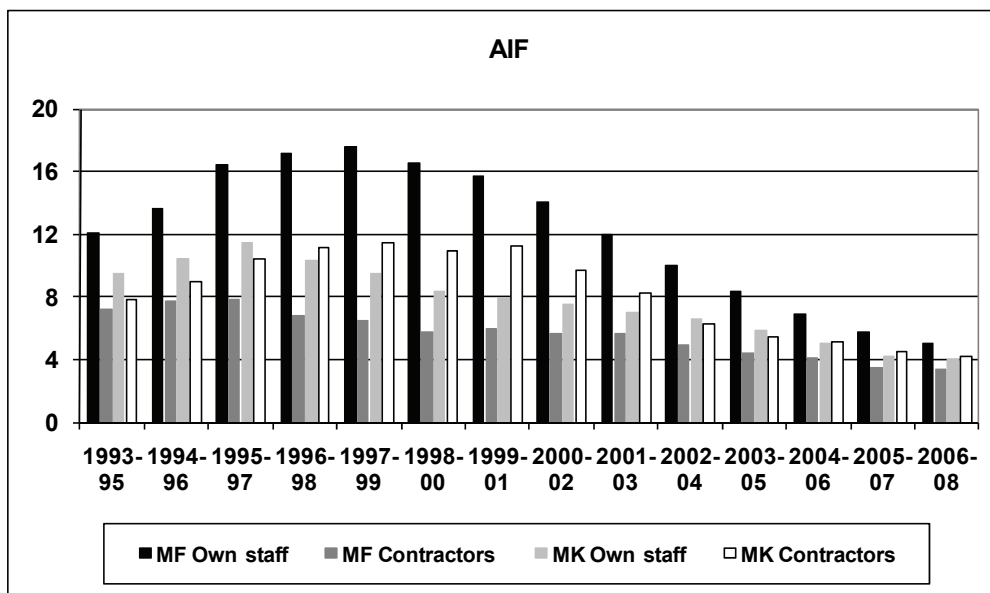
**Figure 5a** Historical evolution of Fatality Accident Rate segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)



**Figure 5b** Historical evolution of Lost Work Injury Frequency segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)



**Figure 5c** Historical evolution of All Injury Frequency segmented 3-year rolling average (MF: Manufacturing; MK: Marketing)



A total of 11 fatalities were reported for 2008. 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 (2.0) continues to be at a level similar to that observed in the late nineties. As discussed in chapter 2, it should be kept in mind that the FAR is notoriously prone to large variations.

Overall the other indicators show a steady performance improvement over the years with slow but steady reduction of LWIF to 1.7 in 2008, becoming less than 2.0 for the first time, since CONCAWE started to collect this data. This indicator initially had greater reductions in Manufacturing than in Marketing, however, since 2006 figures for the 4 categories continue to be very close.

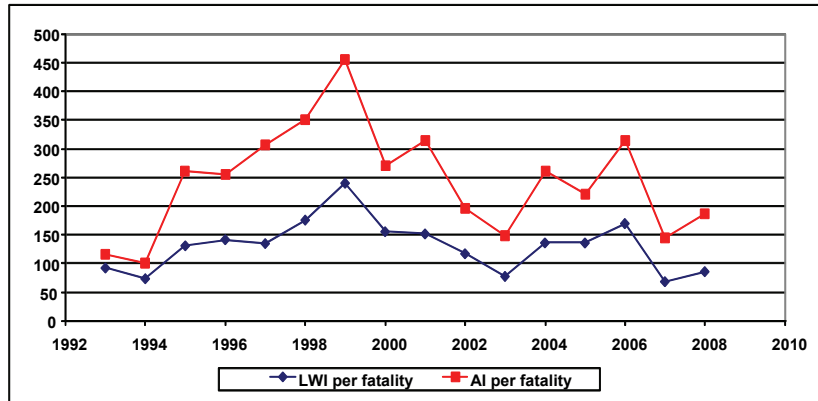
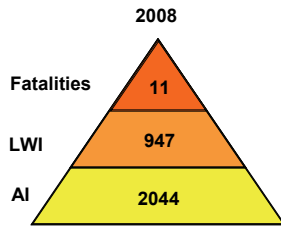
The figures suggest that AIF peaked around the 1996-97 but this is likely the result of improved reporting standards. The trend is definitely on a downward slope and AIF figures have improved for all categories.

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 6a**.



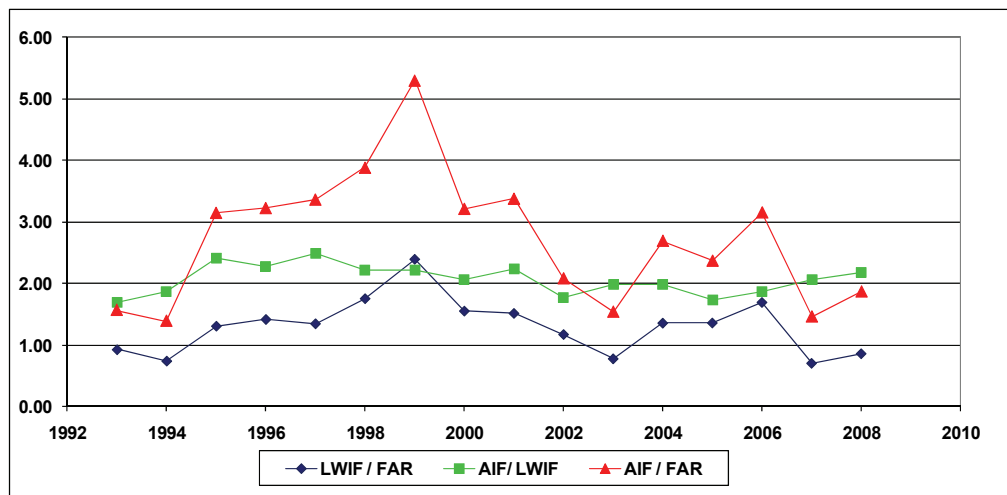
**Figure 6a** The safety triangle



The figures illustrate 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 2008 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 of the reviewed safety indicators is not necessarily leading to the prevention of the major incidents that result in fatalities.

The American Petroleum Institute (API) has recently recommended the adoption of Process Safety Performance Indicators (PSPI) in addition to operational safety performance indicators such as those contained in this report. This is intended to better address the potential causes of major process safety incidents, which normally have catastrophic effects in the petroleum industry. The Safety Management Group of CONCAWE has 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 (API, 2008). This additional focus together with the focus on personal safety factors undertaken thus far could contribute to a further reduction in serious injury rates in the industry.

**Figure 6b** Relationship between the frequencies, FAR, AIF and LWIF

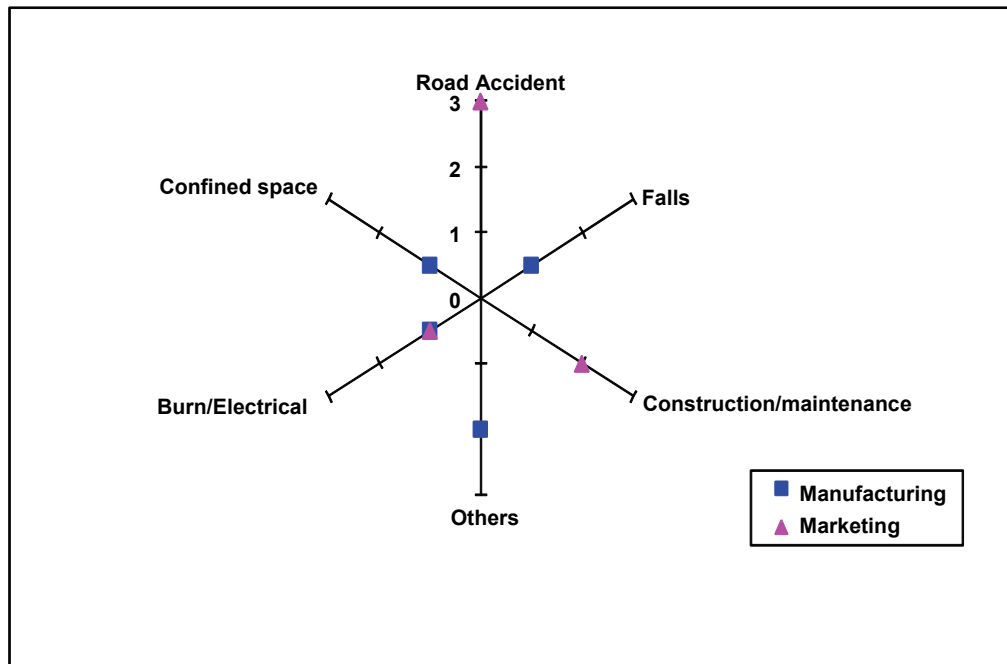


**Figure 6b** illustrates the relationship between the frequencies, FAR, AIF and LWIF. Since 2004 these frequencies have been relatively steady compared to each other. Fatalities remain at an unacceptable level.

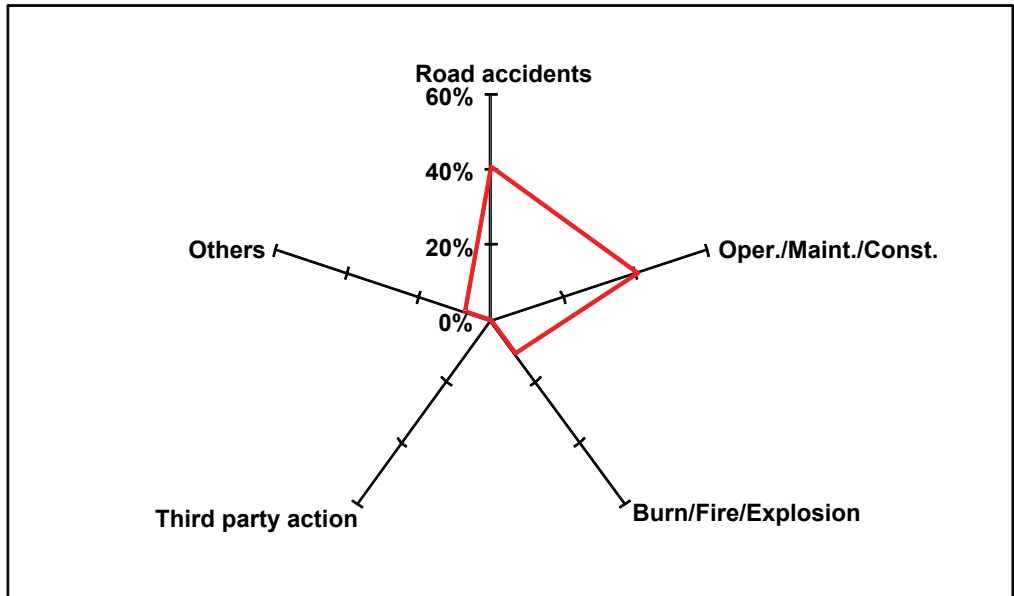
**Figure 7** details the causes of the 11 fatalities recorded in 2008 and **Figure 8a** shows the percentage of the main causes over the last 5 years while **Figure 8b** shows this information for all years since this information was first collected in 1998. In 2008 3 fatalities were due to road accidents, 2 were caused by construction/maintenance activities, 2 were caused by burning/electrocution and the remainder from other various industry activities.

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

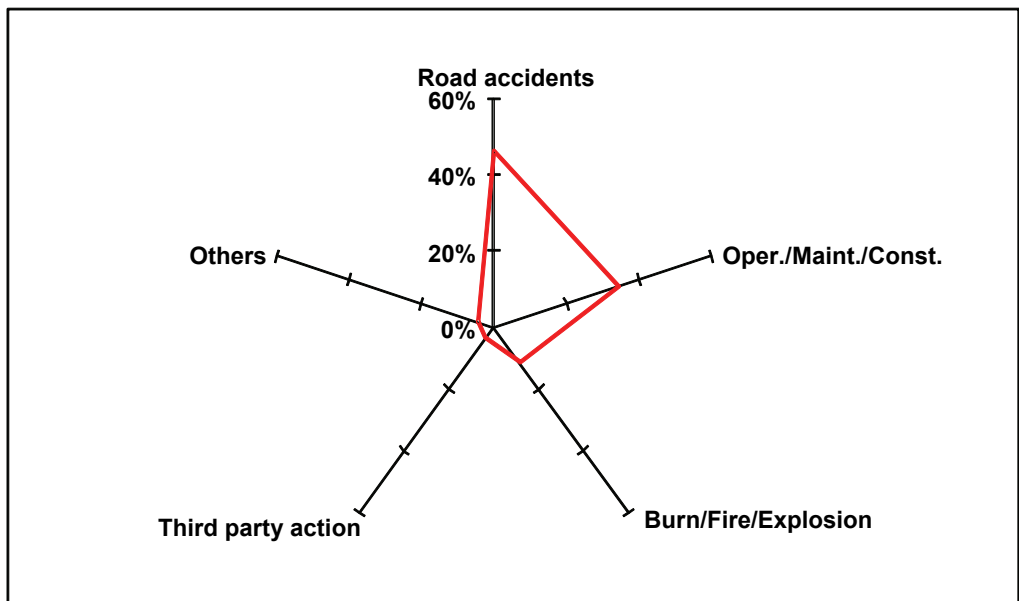
**Figure 7** Causes of fatalities in 2008



**Figure 8a** Causes of fatalities between 2003 and 2008



**Figure 8b** Causes of fatalities between 1998 and 2008



## 5. 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	OGP 2008 <sup>(1)</sup>		CEFIC
	2008	Europe	World	2007
FAR	1.9	4.2	3.1	0.93 <sup>(2)</sup>
AIF	3.9	3.9	2.1	NA
LWIF	1.8	1.4	0.6	5.7

OGP Oil & Gas Producers

CEFIC Conseil Européen des Fédérations de l'Industrie Chimique

<sup>(1)</sup> Own staff and contractors

<sup>(2)</sup> Estimated from the figure of 1.7 fatalities per 100,000 workers reported by CEFIC (assuming 1800 h/a worked per worker)

The OGP statistics concern the “upstream” oil industry covering oil and gas exploration and production activities. 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 the downstream sector.

The chemical industry data (CEFIC) and the American petroleum industry data (API) are not yet available for 2008.

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## APPENDIX 1 EUROPEAN OIL INDUSTRY STATISTICS DEFINITIONS AND GUIDING NOTES

- |                        |  |
|------------------------|--|
| 1. Hours worked        | Hours worked by employees and contractors. Estimates should be used where contractor data is not available.  |
| 2. Fatality            | This is a death resulting from a work related injury where the injured person dies within twelve months of the injury.   |
| 3. 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.  |
| 4. Total days lost     | The number of calendar days lost through LWIs counting from the day after the injury occurred.   |
| 5. 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. |
| 6. MTC                 | Medical Treatment Case is a work related injury which requires the attention of a medical practitioner. It excludes first aid treatment.   |
| 7. 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.   |
| 8. LWIF                | Lost Workday Injury Frequency is calculated from the number of LWIs divided by the number of hours worked expressed in millions.   |
| 9. LWIS                | Lost Workday Injury Severity is the total number of days lost as a result of LWIs divided by the number of LWIs.   |
| 10. 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.                   |
| 11. Road Accidents     | Any accident involving any of the vehicles described above.  |
| 12. RAR                | Road Accident Rate is calculated from the number of accidents divided by the kilometres travelled expressed in millions.   |
| 13. FAR                | Fatal Accident rate is calculated from the number of fatalities divided by the number of hours worked expressed in hundred millions.   |

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

Marketing includes all non-refining activities including "Head Office" personnel.

Where data is not available the best estimate possible should be made.