Safety

A constant challenge

Producing and handling petroleum products that are primarily designed to burn is a fundamentally hazardous pursuit. It is no surprise, therefore, that the oil industry has been at the forefront of safety management for many years and in all parts of the world. The industry has long recognised that 'good safety is good business' and safety has become an integral part of running the business, with safety objectives and targets being set at all levels of the organisations. Europe is no exception and safety of operating personnel and assets, but also of the public at large, is the object of ever-increasing attention from both industry and the legislator.

The word 'safety' covers a wide range of issues. The most obvious is the provision of a safe working environment for employees and contractors. This includes monitoring working conditions and practices, and preventing accidents and injuries. Related to this, but focused more on equipment, is 'plant integrity and safeguarding' i.e. a combination of hardware, software and procedures designed to prevent operating accidents. The actual or potential impact of plants on the environment within which they operate is increasingly under scrutiny the world over, as the risk thresholds that governments and the public alike are prepared to tolerate are on a steady downward trend. Finally the safety of the products manufactured by the industry, from the point of view of the customer and of the public at large (e.g. in connection with transportation) is also key to the sustainability of the business.

These various aspects of safety are addressed through a combination of investment in equipment ('hardware' measures) and of integrated safety management systems. These systems ensure coordination of efforts, as well as monitoring performance and degree of attainment of objectives.

In this article, we discuss some of the more recent developments in the field of safety in the European refining industry.

Facility design and operating practices

Refinery facilities have a long life, typically fifteen years at the project stage but often much longer in practice; many plants are still operating after thirty years or more. If a lot of the equipment is renewed during the life of a plant, the basic design concept remains and retrofitting a new safeguarding philosophy can be difficult. Integrating safety into the original design of plants and facilities is therefore essential. Two such aspects that have recently received attention in Europe are described below.

Blast resistant/blast proof constructions

In the wake of some spectacular incidents, most European refiners have, in the past ten years, reassessed the design of on-site buildings and their resistance to shock waves from process explosions. These studies, conducted by qualified consultants, have led the major operators to plan, over several years, either the reinforcement or the rebuilding of the most critical refinery buildings.

This is particularly applicable to control rooms which must not only be able to protect those inside but also remain operational in order to shutdown the plant in a quick and safe fashion in case of incident. There are, however, many other buildings that house equipment critical to normal and shutdown operations and must also be protected (e.g. control and emergency shutdown systems, power supply etc).

A typical blastproof control room

Large hydrocarbon storage facilities

Worldwide industry records of the past 40 years show that a number of accidents and fires occurred on large hydrocarbon storage tanks, with a large proportion of these involving crude oil. In the 80s most European refiners participated in the 'Last Fire' project conducted by Resource Protection International, a specialised consulting company (www.resprotint.co.uk). The objectives of this exercise were to establish a database of fires/accidents involving large atmospheric crude oil storage facilities (mainly floating roof tanks), to determine current levels of risk and to develop guidelines for best design and operational practices and make them available throughout the industry. As a further step it was proposed to establish techniques to determine site-specific levels of risk and identify appropriate and cost-effective risk reduction measures.

This exercise was completed in 1995, providing valuable insight into the main types and causes of tank fires and into the most critical aspect of design, inspection, maintenance and operation of large crude oil tanks. A second project (Last Fire Project II), involving the same consultant, is now being started. The main objective is to update the database while some additional issues will also receive attention such as definition of best practices in fire protection and new design and engineering features (e.g. the geodesic roof).

Safety of industrial sites: protecting the neighbourhood

The potential risk that industrial installations impose on their neighbourhood has been a major issue for operators, legislators and the public alike for many years. The Seveso accident in Northern Italy in 1976, involving a major release of dioxins in the environment, acted as a catalyst for the development of European legislation aiming to enhance public protection, improve the transparency of industrial operations and increase the level of control exercised by the competent authorities for delivery of operating permits and monitoring of activities at the sites. The new legislation is embodied into two European Directives on 'Control of Major Accident Hazards' commonly known as the 'Seveso' Directives. The second Directive was finally adopted in 2003 and reinforces the dispositions of the first one particularly in terms of public information. One particular aspect considered in the Directives is the siting of industrial plants and the use of the land immediately surrounding them, known as the 'land-use planning' or LUP issue.

LUP first came on the agenda in Europe during the 90s, resulting in a set of guidelines at European level but no harmonised legislation, EU Member States remaining free to promulgate their own rules and regulations in the matter. Two major accidents reopened this issue: the fire and subsequent explosion at a fireworks storage in Enschede in the Netherlands in May 2000 and the chemical explosion at the AZF plant in Toulouse, France in September 2001. Following these tragic events there were renewed calls for reassessment of current practices and harmonisation of legislation at the European level.

A technical working group was set up by the European Commission in 2003, with the objectives of developing the basis for such future legislation. The main topics under study are the definition of best practices for risk and hazard assessment and the development of a database of accident scenarios for each type of industrial site in order to evaluate the level of risk and recommend minimum safety distances around industrial sites and other measures. The simulation of major events such as explosions, flammable or toxic releases, is essential to the risk evaluation process and requires appropriate models. These models are complex tools that need to be used by experts.

The European oil industry has accumulated much experience in this field and, through CONCAWE, is contributing to this process by sharing information on past incidents, including frequency of similar events, to help establish a consensual list of plausible accident scenarios for its installations. CONCAWE also brings the combined expertise of its member companies in the use of simulation models.

It is hoped that this process based on a scientific and technological approach will lead to the development of realistic proposals providing a high degree of public protection without imposing undue constraints on industry.

Safety management

The introduction of a coherent safety management system is essential to a successful safety policy. Such systems can now be found in all oil companies, either developed in-house or purchased from specialised consulting firms. Increasingly, these systems are integrated into broader enterprise management systems incorporating, amongst others, environment and quality.

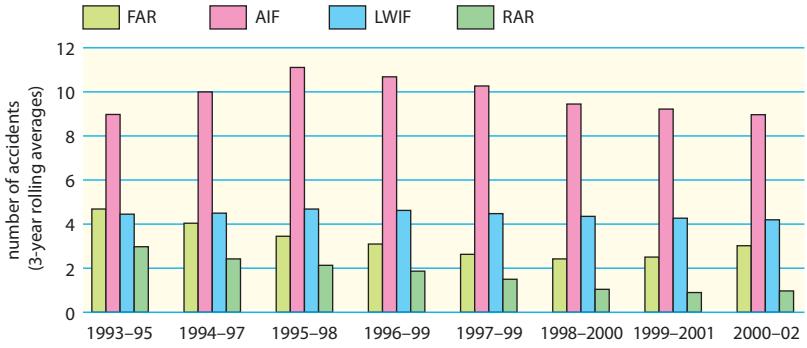
Incident prevention and monitoring: the cornerstone of safety management

How people relate to safety in general bears a strong relation to their day-to-day behaviour and, in particular, to the way they perform their professional duties. Increasing 'on-the-job' safety awareness is therefore essential to building a safety-conscious organisation. This is particularly important in an industry that deals with flammable and occasionally explosive products, and the oil industry has been putting these principles into practice for many years.

Monitoring performance is an important part of prevention. Virtually every oil company in Europe keeps statistical records of work-related incidents and injuries. At the pan-European level, CONCAWE has been collecting data from its member companies since 1993, providing a view of the industry's performance for the whole region as well as a benchmark for individual operators. The yearly report, including data for 2002, will be published shortly. Figure 1 illustrates the steady improvement of the industry performance in terms of total recordable injuries since the mid 90s. The lost work time injury rate has marginally improved. The seemingly increasing trend in the all injuries rate in the mid 90s is believed to be mainly due to gradually better and more complete reporting as more attention turned to this indicator. Fatalities, after a long period of steady decrease, have disappointingly increased again in recent years. In spite of the successful reduction of the road accident rates, the share of road accidents in the total number of injuries and, more particularly, the fatalities remain a cause for concern.

These results are put in perspective when compared to other related industrial sectors and to the general performance in the European work scene. In terms of lost work time injuries, the downstream oil industry is streets ahead of other branches, only surpassed by the impressive record of the upstream oil industry. The oil industry's fatality rate is also much lower than the European average.

Safety performance in the European downstream oil industry



FAR: Fatal Accident Rate (per 100 million hours worked)
AIF: All Injuries Frequency (per million hours worked)
LWIF: Lost Workday Injuries Frequency (per million hours worked)
RAR: Road Accident Rate (per million hours worked)

Figure 1
The industry's AIF and RAR have improved steadily since the mid-90s. LWIF has improved marginally.

Learning from experience: information exchange and 'lessons learned' management

The past 10 to 15 years saw the realisation that much was to be gained in improving the flow of information related to safety. This is particularly relevant to the identification and the dissemination of the 'lessons learned' from incidents and near-misses to avoid reoccurrence of past accidents and disasters. Nowadays, 'lessons-learned management' takes advantage of companies' intranet to broadcast relevant messages and documentation throughout the different business sectors of a company. The exchange of such information between otherwise competing companies is also well established and CONCAWE, through its Safety Management Group in which all member companies can participate, contributes to this process.

	CONCAWE 2002	OGP 2002 Europe	OGP 2002 World	CEFIC 2001	EU all branches 1999
FAR	3.3	NA	3.9[1]	NA	8.0[2]
AIF	8.5	7.0	3.6	NA	NA
LWIF	3.9	2.0	1.1	10.5	19.9[2]

OGP: International Association of Oil & Gas Producers
CEFIC: Conseil Européen de l'Industrie Chimique/European Chemical Industry Council
[1] *Own staff and contractors only*
[2] *Estimated from statistical data compiled by the European Commission (EUROSTAT)*

More traditional media such as booklets or pamphlets still have their place. In this respect the 'Process Safety Booklet Series' issued by BP is particularly interesting. Following the example of the US industry, the European refiners are also engaged in the process of setting up a common database on this issue.

Mutual assistance and equipment sharing

Mutual assistance arrangements, in case of major fire or other safety- or environment-related incidents, have been in place for many years at the local level—separate sites in the same industrial area sharing, for example, fire-fighting facilities or consumable stocks (e.g. foam). This has proven to be workable, beneficial as well as efficient. As fire-fighting equipment becomes more sophisticated and expensive to purchase and maintain, the European refiners have been considering the possibility of sharing heavy equipment at the scale of a region or in some cases a country. This of course must be integrated with fast and reliable transportation arrangements and requires extensive discussions with local and permitting authorities. At this point fire pre-plan studies and cost/benefit analyses are being carried out to demonstrate the feasibility of such projects, with a view to organising full scale trials.

Product safety: the REACH legislation

Ensuring the safe transportation and use of its products is central to the long-term sustainability of the industry and a key element is to disseminate the relevant information. CONCAWE have compiled a series of product dossiers summarising the physical and chemical properties and toxicological, health, safety and environmental information for petroleum substances. These dossiers are available for free download from the CONCAWE website.

The existing European chemicals legislation that affects petroleum substances includes, among others, the Dangerous Substances Directive, the Dangerous Preparations Directive and the Existing Substances Regulation (Additional information on the above legislation may be found on the European Chemicals Bureau website: http://ecb.jrc.it/). For many years, CONCAWE has provided recommendations for the health and environmental classification (and labelling) of petroleum substances in accordance with existing legislation. These recommendations are published as CONCAWE reports and updated as new information becomes available or the legislation is amended.

Recently the EU Commission issued a draft proposal for a far-reaching new piece of legislation for the **R**egistration, **E**valuation and **A**uthorisation of **CH**emicals (known as 'REACH'). If adopted into law, REACH will radically change the responsibilities of industry and the authorities for the control of chemicals in the years ahead. In particular, the responsibility for undertaking the health and environmental risk assessment on substances will shift from the authorities to industry. Recognising the challenges that lie ahead to perform risk assessments on petroleum substances, which have a complex and variable composition and for which risk assessment methodologies need to be developed, CONCAWE has undertaken a voluntary initiative to conduct risk assessments of petroleum substances. The current programme of risk assessments started in 2002 and will continue for most of this decade.

Conclusions

Safety in all its aspects is nowadays fully integrated into the management of the European oil business. Much has been achieved and the European downstream oil industry can be proud of its safety record. All the same, much remains to be done. Open sharing of information within organisations and between companies is essential if hazardous situations and incidents are not to be repeated. All human activities include an element of risk. Pooling of resources and experience at industry level for a common and consistent approach to problems is likely to pay dividends in the form of better and more cost-effective solutions.

Cooperation at the European level is well-established. Cooperation and information exchange between regions of the world is less developed and this may be an opportunity for the future.