8 Risk reduction in operation and maintenance

...neither should he lend too ready an ear to the terrifying tales which may be told him, but should temper his mercy with prudence, in such a manner, that too much confidence may not put him off his guard...

Nicolás Maquiavelo, The Prince, Chapter XVII

8.1 Risk reduction in operation

The design of a chemical factory can never be totally safe, completely ‘human error proof’. The complexity of the work to be carried out, the wide variety of working conditions, the adaptation to the conditions of raw materials and the ever possible chance of an unforeseen failure are factors which make the correct management of a plant a factor of such importance as that of the initial design.

A well-designed, completely automated factory with the best existing technology cannot guarantee that no serious accidents will occur because of an error in communication, a start-up operation done in an incorrect sequence, insufficient control of the modifications or inadequate maintenance procedures, etc.

Equally, an originally safe factory could cease to be so if it were not managed and maintained with maximum care. The accidents which occurred at Flixborough and Bhopal are two typical cases caused by serious negligence, as described in the appendix.

To control the process we resort to ever more complex automated systems. The handling of these requires qualified and trained operators. The training and education programmes, together with dynamic simulations of the plant operation, are ever more vital elements of the management systems necessary to attain a high degree of safety in a chemical plant.

8.1.1 Safety and environmental management systems

Safety has traditionally been managed as a programme, similar to those existing in other areas of a company, based on slogans and objectives. The main problem with this is the amount of fashionable dogma that can be involved. The effectiveness of the programme could suffer, with the consequent risks, when other objectives distract attention from it.
The concept of a management system improves effectiveness through a different approach. Such a system is a form of working that secures, in a continuous and systematic way, the fulfilment of the established rules and procedures. The management system should be established by the head officer of a company who should assure that periodic revisions of its efficiency are carried out. In this way the to-and-fro movements of classical programmes can be successfully avoided.

More and more legislation is being introduced at national and international levels on safety and prevention of accidents in the chemical industry. The SEVESO EC Directive has recorded an historical milestone, demanding that those industries which handle dangerous compounds, above certain fixed quantities, must give notification to the corresponding government entity and set up internal and external emergency plans. Documents such as these have followed:

- The recommended practice API RP 750 ‘Management of process hazards’ [5].

All of these standards, to a greater or lesser degree, require or define safety management systems. Some of them are limited to activities related to certain types of product (toxic, flammable, etc.) but their philosophies are very similar.

The Centre for Chemical Process Safety (CCPS) of the AIChE proposes [6, 7] twelve basic elements which should be specifically defined by a safety management system.

1. Responsibility, policy and objectives.
2. Process knowledge and documentation.
3. Project reviews and design procedures.
5. Management of changes (modifications in the installation, in operating procedures, etc.)
7. Incident investigation.
10. Regulations, codes and legislation.
11. Audits and corrective action.
12. Improvement of knowledge on process safety.

These factors are not independent but reach maximum efficiency when carried out simultaneously. It is their inculcation to the company’s philosophy that allows the system to attain its objectives. The suitability of the management system directly influences the safety results of the company through the creation of a positive, or