

SAFETY MANAGEMENT IN THE EXPLOSIVES INDUSTRY

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SUMMARY

1. Studies show that generally across industry human error is the cause in some 90% of incidents and that 70% of incidents could have been prevented by management action. They point to the crucial significance of a systematic approach to the management of health and safety, the need to be aware of the human factor as a distinct element in that framework.
2. Reference is made to the fundamental causes of the explosion at Peterborough UK in March 1989 to illustrate the way those pointers could equally well apply in the explosives industry, the way management failings may leave individual action or inaction as the last link in a chain leading to disaster.
3. Explosives incidents are relatively infrequent. There is the need for greater pooling of information. A new data-base 'EIDAS' offers one way forward.

SAFETY MANAGEMENT

4. A principle embodied in UK safety legislation is that the primary responsibility for doing something about accidents lies with those who create the risks and those who work with them. The first purpose of HM Explosives

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Inspectorate is to ensure that systems exist that are likely to lead to the identification and prevention by management of significant faults, and that the attitude of management is conducive to this. One problem, by no means unique to the explosives industry, is that although the hazards may be appreciated, the low probability of an event and a history then of nothing appearing to go seriously wrong may engender complacency. An important goal is to secure much fuller recognition and understanding of effective safety management.

5. There is nothing new in the idea that safety requires to be managed. It is clearly demonstrable that close attention to the management of safety is effective in preventing accidents and that it is compatible with and indeed promotes first rate commercial performance.
6. There is a considerable body of literature on the subject, good guidance, even rules. But success in managing safety can only be achieved by having a clear corporate commitment, the establishment by positive action of a 'safety culture' which permeates the whole of an organisation. It is a matter for leadership, the acceptance of responsibility at the top and exercised through a clear chain of command, seen to be real and felt throughout the organisation. It is a matter for conviction that high standards are achievable, that set objectives and targets can be met, that hazards can be identified and preventative measures devised then audited and reviewed. It is an approach that does not allow error to go by default but that requires investigation and the immediate rectification of deficiencies. It is then an approach that requires all rules and standards to be observed by all staff. Effective communication is vital.
7. Brief mention might be made of some of the key elements in the safety management framework:

EFFECTIVE SAFETY POLICY

8. A legal duty in the UK but a matter of good practice if not a requirement elsewhere is the written statement - the 'safety policy' - which is the reference document for the management of health and safety within the concern. This specifies objectives, the organisation required to achieve them and the arrangements made for carrying out the policy. It covers the monitoring of the effectiveness of the organisation and arrangements and the results they achieve, and the revision of the policy as and when appropriate.

9. The policy statement should ensure there is no confusion about responsibility within the organisation, say between line managers and safety specialists, and should specify lines of communication.

SET OBJECTIVES

10. The setting and monitoring of relevant objectives and targets need to be based on satisfactory internal information systems. Line managers should be held accountable and there should be a systematic evaluation of their performance in this aspect of their job.

EXPERTISE

11. Training is an essential ingredient of any successful safety policy. Lack of training is a major contributory cause if not the main source of human error. Managers need to have knowledge of the health and safety legislation applicable to their area of responsibility, of the general principles of occupational health and safety and of the elements of safety management.
12. There is the need to learn from past mistakes and accidents and in particular to learn from experience at other places where the same hazard may exist.

SET STANDARDS

13. Having established the nature and extent of the hazards, they should be eliminated where possible. Where they cannot be eliminated, measures need to be taken and standards set to control them. Standards are the prerequisite for monitoring and review. Parallels can be drawn with the standards and procedures which control quality; demands imposed by documented systems subject to audit produce a climate where similar systems concerned with health and safety can be more easily introduced.
14. A realistic approach is required, one which takes account of the way that people actually work. Procedures must be clear, unambiguous and capable of being understood by everyone concerned. But they should not be overwhelmed by paperwork.

MONITOR

15. Monitoring by the organisation is an essential function which covers not only hazards and risks but compliance with procedures, systems of work, the adequacy of information, instructions, training and supervision.
16. In the control of high hazard, low probability situations particular attention should be paid to the identification and analysis of near misses rather than to statistics of accidents. It has been established that in industry generally for every serious injury incident there were 10 minor injury incidents, 30 property damage only incidents and 600 near miss accidents.
17. Audits play a vital part but care is required to ensure they do not dominate policy. It is recognised that management systems can come to structure themselves to gain high scores and to overcome the value of the audit as a tool towards effective control.

COMMITMENT

18. It is important to promote commitment by individual responsibility and accountability, by proper recognition of success, by promotion and reward of enthusiasm and good results. This again underlines the need for proactive monitoring based on success not failure.

HUMAN FACTORS

19. The term embraces a range of issues but resolves into the question as to how to harness the individuals capacity to operate skillfully and make correct judgements in unprecedented situations without being vulnerable to the same persons possible mistakes and errors. It is now widely accepted that the majority of accidents in chemical and other high hazard industries have their primary cause in human failings rather than in purely technical failures. People will make mistakes but by thought, pre-design and proper motivation this tendency can be reduced and consequences mitigated.
20. To take that last point further, it is rarely, if ever, sufficient to ascribe an accident merely to individual human error. Most accidents have multiple causes and in looking beyond the most immediate it will invariably be found that the incident was but the culmination of a

number of failures in management control - say lack of pre-consideration, lack of adequate monitoring or supervision or _ _ _ _ _.

THE PETERBOROUGH INCIDENT

21. This incident and in particular the blast damage and injuries are more fully described in the paper to be presented by Dr R Merrifield. The purpose now is to look at some of the more fundamental causes. They involve human error but relate more particularly to basic management failings - a view later endorsed by the Courts in setting a record fine. At the root was the consignment of an explosive in unauthorised and unsafe packaging.
22. The relevant law in the UK as elsewhere is quite specific. Before any explosive is consigned it must be authorised and classified by the National Competent Authority. Classification as in accord with the UN scheme relates to the packaging method, but there is also a longer standing requirement in the UK that the packaging of the explosive concerned, a type of cerium fusehead comb, must be specially authorised by a Government Inspector.
23. There is no doubt that the law was understood by the company. Systems were in place to ensure compliance at least with respect to the mainstream output of its factories. The company had developed and proved safe a packaging method for the cerium fuseheads as supplied cut from the comb. The packaging had been authorised and the whole item classified as 1.4G by the Competent Authority; any ignition was confined to one tin of 500 fuseheads, further effects limited to slight displacement of the lid of the wooden outer transport case holding up to 50 tins in all.
24. But around 1980, a fireworks company required cerium fuseheads on the comb. These were too big to pack according to the authorised method but the order appears to have by-passed the normal controls. Deliveries were initially packed in wooden boxes, and those replaced by tinned boxes in October 1985. The people responsible on the plant cannot have understood the basic requirements of any packaging methods for such fuseheads. The boxes, made outside, were of very poor quality with rust and weld spatter on inner surfaces, holes at corners. The packing of combs then ad hoc leaving too much freedom of movement for an excessive number, equivalent to 8000 as opposed to 500 fuseheads. Two such boxes were placed in a more normal wooden transit case, then handled as if 1.4G also incorrectly assumed.

25. The company organisation and systems of work were examined in an attempt to discover how the failures described above had come about. The joint Managing Directors and members of senior and middle management were interviewed. There had been several changes in systems of control and personnel since October 1985 when the fuseheads combs were first packaged and transported in tinned boxes. The management structure was a complex matrix system in which managers had both functional and business responsibilities covering separate areas of work.
26. A Design Representative and Packaging Adviser were responsible for packaging requirements. However, they checked new products and amendments to existing ones when they occurred, but did not review those introduced in previous years such as fusehead combs. No clear explanation was given for the use of unapproved packages for fusehead combs, the method appeared to have bypassed any assessment for compliance with requirements.
27. The safety department was primarily concerned with manufacture, ie plant and processes, and had little involvement in product development and design including correctness for transport. There was no clear managerial responsibility for safety in either of these functions.
28. No written specification for fusehead comb packages existed, nor were there any written operating instructions on the method of packing. No inspection of containers for suitability for use in transport, against laid down rules, was carried out.
29. It is necessary to add however that after the incident, a complete review of all products and packagings made within the company found nothing else untoward. Considerable work has been done to establish good working practices, many initiatives taken in the organisation to improve overall safety performance, not least in obtaining commitment to and conviction in a new safety culture. Sticking to the rules is a must and in every possible respect.
30. From a technical viewpoint, vibration of cerium combs in the unauthorised tin box as might be experienced during transport, could lead to damage of the fuseheads and accumulation of loose composition. Mixing with even a small quantity of rust would further enhance the extreme sensitiveness of fusehead composition to friction and impact. A relatively small jolt could cause ignition and, because of the excessive numbers in each tin, a fire ball well able to set any other packagings on a vehicle alight. An accident which could have been avoided just waiting to happen.

31. But can we be certain that all explosives are always transported in the packagings for which their classification is valid? And what of other departures from the rules? It is important to learn from such mistakes but vital to ensure that systems exist that lead to the identification and prevention by management of such faults.

EIDAS

32. A new Explosives Incidents Database Service (EIDAS) has been set up in the UK to promote the greater pooling and promulgation of information on explosives incidents. Modelled on the internationally recognised MHIDAS system covering the more general major hazard incidents, also developed by the Safety and Reliability Directorate on behalf of the Health and Safety Executive, the goal is to achieve an equivalent status and standing.
33. The aims of EIDAS are:
- a. To establish a management and control system for collecting and analysing explosives incident data.
 - b. To provide an efficient system for storing and distributing the data.
 - c. To provide a "follow up" service to obtain more detailed information on occurrences as requested by the customer.
 - d. To make the system readily available to a world-wide network to gain maximum utilisation.