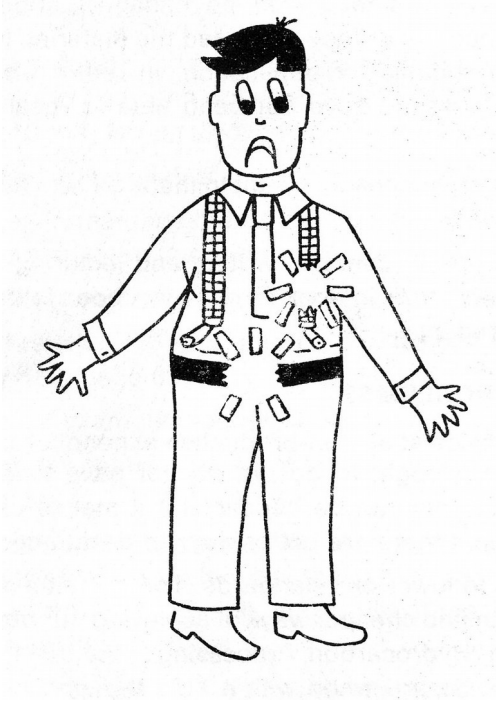
SAFETY NEWSLETTER

No. 157
SAFETY WORK IS NEVER DONE



IMPERIAL CHEMICAL INDUSTRIES LIMITED

PETROCHEMICALS DIVISION

157/1 WOMAN'S WORK IS NEVER DONE – A PERSONAL NOTE

With this Newsletter I lay down my pen after nearly 14 years, during which time I must have described over 1500 incidents. I retire from ICI at the end of March.

When a builder of bridges completes his last bridge and retires, he can do so in the knowledge that his work is complete. I cannot. Safety, like a woman's work, is never done. There is still as much to do as in 1968. This does not mean there has been no progress; there has been progress; our record is better and everyone is more safety conscious than in 1968. But new problems arise and, more important, people forget about the old ones. One of my tasks has been to help to solve new problems; a more important task has been to remind you of old ones. Later in this Newsletter (157/2) I list some new problems and say again why old ones are important.

The real authors of the Safety Newsletters have been the managers, supervisors and operators on the plants where the incidents occurred. They produced the material, told me the stories and helped me put them into a form suitable for publication. In return I have developed a bad memory and once a Newsletter is issued have not been able to recall where each incident occurred.

I have enjoyed writing the Newsletter immensely. I want to thank all who have sent me comments and all readers for their support.

As safety work is never done, I hope to continue writing and lecturing and perhaps write up some of the incidents from old Newsletters in book form. I have been told that I am a workaholic and if so I must dry myself out gradually.

157/2 WHAT ARE THE NEW PROBLEMS?

1 The recession makes us look twice at all non-productive expenditure. We are less willing to spend money on the things we ought to do but do not have to do. There has been a "hardening of the oughteries". This can be beneficial if it makes us look critically at our expenditure and makes us see if there are better ways of designing safe plants.

One way of reducing costs is to lower our standards. This is neither desirable morally nor possible in practice. But we can find cheaper ways of achieving our objectives. I have argued many times, most recently in 'Hydrocarbon Processing', Dec 1981, p 171, that we often waste money on controlling a hazard when with a little thought, in the early stages of a project, we might avoid the hazard.

For example, water is a safer heat transfer medium than oil, but if water is to be used instead of oil the decision must be made early in the life of the project and time must be allowed for all the side-effects of the change to be examined. We cannot just replace oil by water in a plant designed for oil, as amongst other things, the operating pressure is different.

Our plants are undoubtedly too complex and too expensive and some of that complexity is due to the added-on safety features. Achieving simpler and cheaper designs is one of the major tasks facing the chemical industry in the coming years. Are we giving it as much attention as we should?

2 The increasing use of computers and microprocessors will bring some new problems — or make some old ones more important. See Newsletter 152.

3 The main lesson of Three Mile Island for us is the need for better training in diagnosis. See Newsletter 156.

4 We have given a lot of attention to the way gases and liquids behave when they leak out of the plant. We have given less attention to the causes of the leaks and their prevention. See the next item.

5 In addition to these technical problems, the recent reorganisation in the Company will create some new problems. I am not concerned about changes made after due consideration but about changes made unknowingly as the result of reorganisation. There are many examples of practices inadvertently discontinued after organisational change.

157/3 ASKING THE RIGHT QUESTION

Technologists are usually very good at *answering* questions. Tell them your problem and before long you will have to choose between many possible solutions.

We are less good at *asking* questions. We often ask the wrong question. Here are some examples, from various branches of technology:

1 **Question:** How can fire engines get to a fire more quickly?

Answer: By providing devices for starting engines more quickly, opening fire station doors automatically, setting traffic signals in favour of the fire engine and so on.

Comment: The problem was seen as an engineering one. But the time between a member of the public dialling 999 and the fire station getting the message can be as long as the journey to the fire. Little or no thought has been given to ways of speeding up this step. (From *Fire Prevention*, No 145, 1981, p 31).

2 **Question:** The Negev desert in Israel is irrigated with water transported great distances by pipeline. Recently water has been obtained from deep (over 500 m) wells but it contains over 500 ppm chloride. Can this be removed so that the water is suitable for irrigation?

Answer: Techniques are available.

Comment: Changes in methods of irrigation (to the drip method) and treatment of the soil have allowed the water to be used without purification.

Are there any examples in loss prevention of asking the wrong question?

One was asked in Newsletter 143 and answered in Newsletter 144, page 8 in each case, and another in Newsletter 156, page 6.

Some more fundamental examples are given below:

3 **Question:** How can we reduce the number of fires and explosions on our plants and the damage they cause?

Answer: By detecting leaks automatically, isolating them by means of remotely operated valves, dispersing the leaking material by the use of open construction and steam and water curtains, removing sources of ignition, and finally, if the leak should ignite, by installing fire protection and fire-fighting facilities.

Comment: Much less attention has been given to the question “Why do leaks occur and how can we prevent them?” The usual answer is by good design, construction, operation and maintenance. I suspect that the most effective way will be by providing better control of construction and better inspection after construction. (See “Safety Aspects of Pressurised Systems”, Proceedings of the Fourth International Pressure Vessel Conference, I Mech E, 1981, p 25).

More fundamentally can we use non-flammable or less flammable liquids or use less of the flammable ones or use the flammable ones at lower temperatures and pressures? (See Chemistry and Industry, 6 May 1978, p 28 and Hydrocarbon Processing, August 1980, p 137).

4 **Question:** How can I improve the control of this process?

Answer: By adding on lots of control instrumentation.

Comment: By redesigning the process so that it does not need to be controlled so accurately, so that variations in plant conditions produce smaller variations in performance.

5 **Question:** Many accidents have occurred because operators opened the wrong valve or forgot to open a valve. How can we prevent people making such mistake?

Answer: By telling operators to be more careful, penalising those who make mistakes etc.

Comment: Men carrying out a routine task will make occasional mistakes even though they are well-trained, well-motivated and physically and mentally capable. Once we realise this, and if the occasional mistakes cannot be accepted, then the problem becomes one of removing or reducing the opportunities for error (See Newsletter 109).

6 **Question:** What research should we do on safety?

Answer: Many suggestions have been made, some of them quite expensive, for examples, large-scale tests on gas dispersion and unconfined vapour cloud explosions.

Comment: While there are a lot of things we would like to know, on the whole, accidents are not the result of lack of knowledge. Accidents occur because the knowledge of how to prevent them, though well-known, is not known to the people concerned or they know what to do but lack the will to get on with it.

In general it is often better to avoid the need to ask a question than to provide a good answer.

Why are we so much better at answering questions than at asking the right questions? It is because we are trained at school and university to *answer questions that others have asked?* If so, should we be trained to *ask questions?* One way of doing so might be to carry out hazard and operability studies during university courses or to discuss some of the incidents described in the Institution of Chemical Engineers Hazard Workshop Notes.

157/4 OTHER MEN'S VIEWS No 28

Primitive societies often believe that if we do not honour the spirit of our departed ancestors, they will return to haunt us.

"Behind this idea lies something more than a mere fear of the poltergeist. The notion that the untended dead haunt the living in the form of spooks or spectres is simply a symbolic way of saying that if the past be forgotten or ignored and the connection with it negligently dismissed, it will nevertheless rise up of its own accord and obtrude itself upon the present. . . If the past be interred and forgotten, its grave will be unquiet; only when it is full integrated with the present will it cease to behave like a restless ghost"

Similarly, if we forget our past — the incidents that have happened and the lessons learnt from them — then they will return to torment us — the incident will happen again.

The quotation is from "The Holy and the Profane" by T H Gaster, Morrow, New York, 1980, p 191.

157/5 LEARNING THE LESSONS OF THE PAST

Some further extracts from the "Report of the Tribunal appointed to inquire into the Disaster at Aberfan on October 21st 1966" (HMSO, 1967). Other extracts appeared in Newsletter 142/5.

One of the most striking discoveries emerging from our investigations has been the degree of extent to which the views expressed by the experts in relation to the causes of the Aberfan disaster were anticipated 27 years earlier by the Powell Duffryn memorandum of 1939. If that document had remained in circulation and dispersed throughout the South Western Division — and heeded — the probability is that there would have been no disaster... there is no real room for doubt that had it been properly circulated, studied and applied, due attention to tip stability would have resulted.

(Paragraph 161)

We found that many witnesses, not excluding those who were intelligent and anxious to assist us, have been oblivious of what lay before their eyes. It did not enter their consciousness. They were like moles being asked about the habits of birds.

(Paragraph 17)

157/6 SWITCHING OFF AN ALARM LEADS TO A CRASH

Earlier Newsletters (for example 121/5) have described accidents which occurred because various types of protective equipment, mainly trips and alarms, had been disarmed, that is, switched off or made inoperative in some way. Here is an example from another industry.

The US National Transportation Safety Board has published a report (No NTSB-AAR-81-5) on the crash of a charter aircraft in May 1980. A contributory cause of the crash was the fact that an unauthorised switch had been fitted so that the overspeed warning horn could be switched off. A similar switch was found in another aircraft of the same type belonging to the same company. No reason for fitting the switch was given.

To prevent the disarming of protective equipment; except when authorised by a responsible person:

1 Everyone should know why the protective equipment is there and what would happen (and in some cases has happened) if it is disarmed.

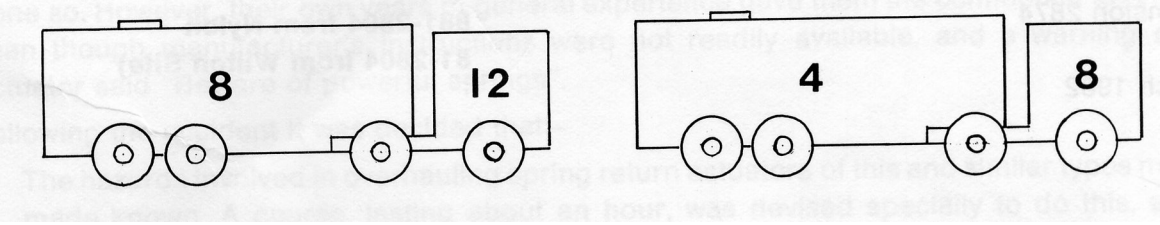
2 All protective equipment should be tested at regular intervals.

3 If protective equipment is disarmed, it may be because it operates when it should not and interferes with production. If this is the case we should find out the reasons for the unwanted or spurious operations and see if they can be stopped. Perhaps a 2-out-of-3 voting system is needed.

Newsletter 56/6 described another accident caused by disarming protective equipment.

157/7 ANOTHER ACCIDENT CAUSED BY CONFUSING LABELS

Two road tankers were standing near each other in a filling bay. They were labelled as follows:



The filler said to the drivers, “No 8 is ready”.

He meant that No 8 tanker was ready, but the driver assumed that the tanker attached to No 8 tractor was ready. He got into No 8 tractor and drove away. Tanker No 4 was still filling.

Fortunately the tanker was fitted with the ‘integral interlocks’ described in Newsletter 82/9 and he was able to drive only a yard or two and did not break the hose.

If possible tankers and tractors should be given entirely different sets of numbers.

Other accidents caused by similar misunderstandings were described in Newsletter 153/4, while accidents caused by poor labelling were described in Newsletters 146/4, 137/4 and 134.

157/8 COMMENTS FROM READERS

Newsletter 154/2 described some fires which were followed by explosions. A reader reminds us of another possibility: If a cloud of gas or vapour is too rich to explode it may burn at the edges and then later explode.

Newsletter 155/7 pointed out that the obvious solution to a problem may not be the best one. A reader suggests that the obvious solutions to safety problems (and other problems) usually tackle the *effects* while the best solutions tackle the *causes*. Newsletter 155/7 provides an example. Another example is provided by a recent request to recover traces of bottoms product from a distillation column overhead stream. Treating the effect — with an additional column —would have cost £1M. Treating the cause — improving the column internals — cost £100,000.

157/9 UNUSUAL ACCIDENTS No 115 – AN AVOIDABLE INDUSTRIAL FIRE

Father Christmas carried the pudding into the Works canteen ... and the flaming brandy fired his cotton-wool beard.

The Engineer, 21 May 1981, p 41.

157/10 RECENT PUBLICATIONS

(a) Safety Note 82/1 lists published papers on safety by the staff of the Division.

(b) Darchem Engineering have developed a flexible enclosure for protecting the actuators of remotely operated valves against fire. A report on a (successful) test on this enclosure can be obtained from J R Cockerill, Engineering Department, Billingham (Extn. B.2819).

For a copy of (a) or for more information on any item in this newsletter please ‘phone P.2845 or write to us at Wilton. If you do not see this Newsletter regularly and would like your own copy, please ask us to add your name to the circulation list.

March 1982

An Engineer's Casebook No 57
THE HAZARDS OF PRE-LOADED SPRING ASSEMBLIES

A recent accident on a Works, during the overhaul of a spring unit from an air-operated spring return valve actuator, has highlighted a number of points of general concern.

To maintain a large return force over the whole stroke of the valve, the unit is designed to keep the spring under compression at all times. Even when the spring unit is removed from the valve actuator the spring is kept in a state of compression, being restrained by several tie-rods. The tie rods are of insufficient length to ensure the spring force is reduced to zero before the nuts are finally removed.

The unit was being dismantled for overhaul when the spring assembly parted violently. A man standing nearby was struck on the hand and lost the end of his little finger.

During the accident investigation it became clear that a lot of people just did not appreciate the magnitude of the forces involved when actuator springs are under compression. In this case the force was estimated to be nearly one tonne. Second, the people doing the work did not appreciate fully all the difficulties and hazards involved in dismantling the spring unit. The people involved had not done this particular job before, but had been present when others had done so. However, their own years of general experience gave them the confidence to proceed, even though manufacturer's instructions were not readily available, and a warning on the actuator said "Beware of powerful springs".

Following the accident it was decided that:-

1 The hazards involved in overhauling spring return actuators of this and similar types must be made known. A course, lasting about an hour, was devised specially to do this, and all instrument personnel on the Works were put through this course.

2 In future the overhaul of spring units of this or similar types must not take place until reference has been made to the proper overhaul procedure instructions.

3 The policy of returning spring-pack actuators to the manufacturer for overhaul or disposal must continue whenever possible.

4 All actuators of this type should be clearly marked to indicate the hazards and the necessity to follow the specified overhaul procedure.

R M Luntz

The following are some of the cartoons on safety I have collected.