IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No 80

80/1 TWO SERIOUS ACCIDENTS ON SMALL SCALE PLANTS

Two serious accidents have occurred in other Divisions because lower standards were adopted on small scale plants than would be adopted on large plants.

The first incident occurred in a pilot plant where a plastic is cast in a long, continuous strip and then fed into a machine which breaks it into small pieces. From time to time the operator has to lift a cover on the machine in order to remove a grid for cleaning. After the power supply is switched off the machine takes 1½ minutes to come to rest.

The operator switched off the power and then lifted the cover. It was possible to do this because the padlocks, which were originally used, had corroded and fallen into disuse. He then slipped on the floor, which was covered with water and product, and his left arm came in contact with the moving machinery, causing severe injury.

We do not have many mechanical hazards on our plants, but we must pay attention to the few that do exist. In this case the guard should have been interlocked with the power supply and there should have been a time delay so that the cover could not be lifted until the machinery had come to a stop.

The second incident occurred in a plant where a solid has to be added to a vessel containing warm solvent. The vessel is inside a building. A manhole cover is removed and the solid is added.

As a result of a change in the composition of the feedstock, not detected by the usual analytical tests, an unexpected reaction took place, the vessel got hotter than usual, substantial quantities of solvent vapour were emitted and the operator was killed. The ventilation system was badly designed and had not been properly maintained.

We do not normally carry out operations at open manholes when flammable or toxic vapours are present. There are a few cases where solids have to be added to a vessel containing solvent. In these cases adequate precautions are necessary to prevent a flammable or toxic concentration of vapour getting anywhere near the operator.

Both these incidents show that serious hazards are not restricted to large plants. High standards are necessary on all plants — though the methods we adopt for small plants may be different. Even if there is only a ton of flammable liquid on your plant compared with 100 tons on the plant next door you can still have a very nasty fire.

Reminder. Newsletter 36/5 described a fire in the Division because solid was added to a vessel containing methanol without making sure there was no oxygen in the vessel. Newsletters 35/6 and 76/9 described some fires which occurred as the result of mishandling small quantities of petrol.

80/2 IDENTIFICATION OF EQUIPMENT FOR MAINTENANCE

Earlier newsletters have described many accidents that occurred because someone broke into the wrong pipeline (or broke into the right pipeline at the wrong place) (See Newsletters 59/5, 54/5, 41/4 and 37/1). Tying a numbered tag on to the piece of equipment to be opened up at the precise point at which it is to be opened up, has been recommended.

An incident has occurred in another Division because the tags were fixed by the planner rather than by the process supervisor. The planner thought that certain valves had to be changed, but the process supervisor had different ideas. He issued a clearance certificate (permit-to-work) without first checking the tags. When a fitter removed the valves he found that the pipeline was full of liquid.

It is, of course, a process responsibility to make sure that the tags are tied on in the right place and a job must always be inspected before a clearance is issued.

80/3 CORROSION CAUSES A LARGE HOLE TO APPEAR IN A COLUMN

A Report (No A.20,573/B) from another Division describes how a large hole, 2½ m by 1½ m, appeared in an absorption tower in a nitric acid plant. As the tower operates at a low pressure, the fume that came out did not cause any serious injuries.

The failure was due to corrosion which was not detected by the regular inspection of the column. There were various reasons for this, including some doubts about the reliability of the contractor who carried out ultrasonic thickness measurements, but the incident had one feature of general interest. The vessel had been in service for six years and inspections had shown that there was no significant corrosion. It was therefore decided to put the vessel into inspection category "X". This category is used for a group of vessels on similar duty and under this system one vessel in the group is inspected every two years. If no corrosion is found the other vessels are not inspected until their turn comes round. The maximum period allowed between inspections is twelve years.

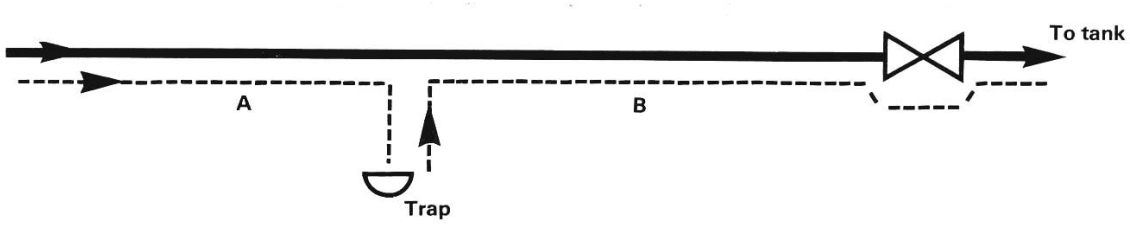
What is a "similar duty"? The tower which failed was similar in construction to the other towers, but the gas inlet temperature during the two years before failure was much higher, 100°C to 125 °C instead of 90 °C. This caused more rapid corrosion.

Before classifying vessels as "similar" we must make quite sure that there is no significant difference in operating conditions. Temperatures should be recorded on pressure vessel report forms.

Reminder: Newsletter 47/4 gives some advice on choosing the places on a distillation column at which thickness measurements should be carried out. [See also Newsletter 84/5(a)].

80/4 A BLOCK IN A STEAM-HEATED LINE CAUSES A PIPE BURST

A 2 inch stainless steel pipeline carrying a solid of melting point 40°C was heated by two separate supplies of steam tracing.



The valve shown was closed when the line was not in use, but the other end of the pipeline was always kept open to the plant.

The steam supply to the first section of tracing A was isolated. The contents went solid. For some reason the liquid in section B got a little hotter and the increase in pressure was sufficient to produce a 2 inch split in the pipe.

A few degrees rise in temperature could be sufficient to burst the pipe.

In a case like that illustrated, all the steam tracing should come from a single supply. Steam tracing should not be left in operation if a line is isolated at both ends.

Reminder: Hydraulic expansion relief valves are fitted to isolatable sections of line when:

(a) The line is outside battery limits and more than 1000 feet long or

(b) The line is outside battery limits and more than 2 gallons of liquid would have to leak out to depressure it

or

(c) The line contains more than 10 to 50 kg of liquefied petroleum gas, the actual figure depending on plant layout.

For details see Loss Prevention Guide No. 1, Section 1.3.15.

80/5 STEAM HEATING OF LPG TANKS

On one of our Works there is a storage vessel for liquefied petroleum gas which includes an internal low pressure steam heating coil. This heater is used to raise the vapour pressure in the vessel to the required value, which is several times greater than the steam pressure. If the steam coil should develop a leak LPG will be forced into the steam system and may be carried to any part of that system. The presence of a non-condensable gas (at steam temperature and pressure) will materially reduce the heat transfer efficiency of heaters and when it is purged from the system through a steam trap or air vent, it may introduce a fire hazard. If flammable gases are not normally expected in the area, there may be sources of ignition nearby.

The usual solution is to install a non-return valve in the steam line, but these are notoriously unreliable unless they can be maintained to the same high standards as relief valves and trips. A better solution is to fit an external steam coil to the vessel. Then the steam and LPG are separated by two walls.

80/6 LESSONS FROM THE RAILWAYS

The Supplement to Newsletter 76 described the early history of the Stockton and Darlington Railway to show that technical change can have unforeseen consequences. The railways can provide many other examples to illustrate points made in these Newsletters.

During the early days of the Stockton and Darlington Railway the relief valves on the engines blew off so much steam that the drivers could not see where they were going. They were, therefore, allowed to raise the set points on the relief valves by hanging weights on them while the engines were in motion. As long as the engine was moving steam was being used up and a higher setting on the relief valve was quite safe. When the engine stopped at a signal or in the station the drivers had to remove the weights and were told that they would be fined and dismissed if they failed to do so.

This is a good example of a method of working which places too much reliance on people. It is inevitable in the end that somebody will forget to remove the weight or not bother to do so because he is only stopping for a minute.

In the early days of the railways boiler explosions were quite common. On one of the American railways, after a serious boiler explosion, bales of cotton were always carried between the engine and the first passenger coach in order to protect the passengers from the results of a boiler explosion. On another railway the drivers and firemen objected to the provision of cabs to protect them from the weather because they said it made it harder to jump off when the boiler exploded.

In industry we often have the choice of trying to prevent something happening or accepting that it may happen occasionally and protecting people against the consequences. Whenever we can it is always better to spend our money and effort on preventing things blowing up than in installing bales of cotton (or walls of concrete) to protect people from the consequences.

80/7 IN BRIEF

(a) Newsletter 75/7 described how a fifteen year old boy survived alone for four days and nights on the Yorkshire Moors in February because he had the right protective equipment and used it intelligently.

Several readers have suggested that instead of staying on the moor he should have walked steadily on a compass bearing until he reached a road.

He knew that other people were in the area looking for him and therefore he decided to stay put. If he had not known this then it would have been better to have walked in a fixed direction.

The point I wanted to make in the Newsletter item was that he survived because he had the right protective clothing and used it intelligently.

(b) Several incidents have occurred in the Division because split body valves came apart at the body joint. The body joint is, in effect, a joint in the pipe-work but the studs are much smaller than those that would be used on the pipework. All valves of this type are being replaced. Details on request.

(c) In Newsletter 78/2 there was a reference to 10 minute compressed air sets. These are used on plants handling toxic materials and the Newsletter stated that they contain only a small bottle of compressed air, "enough to let someone *run* to safety".

A reader points out, quite rightly, that they contain enough air to let someone *walk* to safety. If you have got a mask on it is safer to walk; you are less likely to bump into something and you use less air.

(d) Newsletters 46/6 and 49/3 describe a novel way of inspecting the interior of a sphere — by filling it with water and carrying out the inspection from a boat as the level is gradually lowered.

Another method that is now being used is to fill the vessel completely with water and then use underwater frogmen to inspect it. Specialist consultants are employed. It has not yet been demonstrated that all forms of corrosion can be detected in this way, and this method should not be used without taking expert advice from Materials Group.

80/8 SOME QUESTIONS I AM OFTEN ASKED

15 HOW LONG SHOULD A MANAGER SPEND ON THE PLANT?

The explosion at Flixborough in June 1974 stresses the need for managers at all levels, including the most senior, to spend some time walking round the plant with open eyes, looking out for anything unusual or abnormal.

Managers are under great pressures, much office work has to be done, costs and personnel matters clamour for attention and a walk around the plant with no precise objective may get left out. However, a plant cannot be managed from an office and there is no substitute for walking round with open eyes. Bill Simpson, Chairman of the Health and Safety Commission calls it "Shoe-leather management".

Walking round the site is, of course, not done just to improve the safety record; it has effects on output, efficiency and product quality.

How long should a manager spend on the plant?

It is difficult to lay down a guide, because some plants require more attention than others and there is room for a good deal of variation in management style. Ten years ago, as an assistant works manager, I used to tell new plant managers that if they were spending less than three hours per day on the plant, then they should ask themselves if this was enough. This, of course, includes time spent in the control room and talking to the supervisors.

What should managers look for when walking round the plant?

I suggest anything that looks unusual — what does not look right is usually not right — and anything that has changed since the last visit. Also look at a few things picked at random. Pick a maintenance job and check that the clearance certificate is correctly made out. Try a shower to see if it works. Look in an eyewash bottle cabinet. Above all, try to look where others do not, behind and underneath equipment.

80/9 UNUSUAL ACCIDENTS NO.50

We have had a letter from a well known manufacturer of photographic film apologising for the fact that some films were ruined by "a most unfortunate accident" — someone switched on the dark room lights while they were being developed. The company concerned have various protective devices in their dark rooms to prevent this happening. They "cannot recall any previous similar incident with such disastrous consequences". Perhaps the protective equipment is never tested.

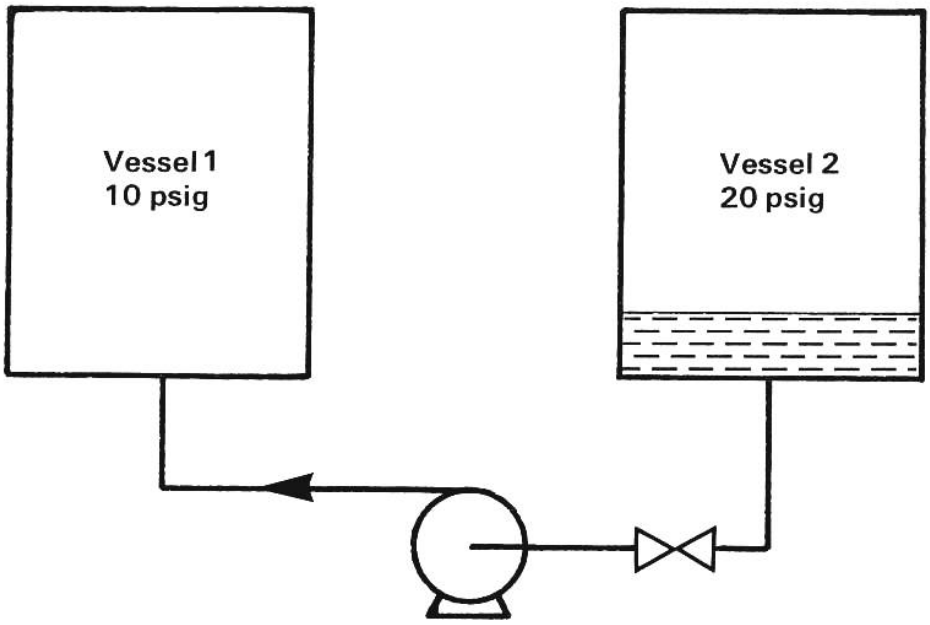
Unusual Accidents No. 45 (Newsletter 75/8) reported that eye inflammation and lung damage has been caused by the use of computer paper tape punch waste as confetti.

Our printer read this and found several bags of paper tape punch waste that had been put aside for use as confetti.

We were pleased to learn that somebody read this item and took action.

80/10 PSI ABSOLUTE AND PSI GAUGE

Here is the answer to the problem in our last issue.



You will remember that vessel 1 contains nitrogen at 10 psig and vessel 2 contains a liquid of 20 psig vapour pressure. A small quantity of the liquid is transferred from vessel 2 into vessel 1. The reduction in the volume of the nitrogen is small and can be neglected.

What is the final pressure in vessel 1?

The answer is *not* 10 + 20 = 30 psig.

Gauge pressures are not additive.

The absolute pressure in vessel 1 at the start is 10 + 15 = 25 psia.

The absolute pressure in vessel 2 at the start is 20 + 15 = 35 psia.

After the transfer the absolute pressure in vessel 1 is 25 + 35 = 60 psia

= 45 psig.

If you find this hard to understand, consider two boxes standing on the floor, one 25 inches tall and the other 35 inches tall. On the wall a line is drawn 15 inches above the floor. Instead of measuring the height of the boxes above the floor we can measure their heights above the mark on the wall. One box would be 10 inches high and the other would be 20 inches high.

Now stand one box on top of the other.

What is the total height?

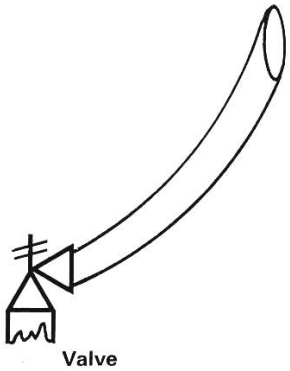
80/11 RECENT PUBLICATION

The Safety in Mines Research Establishment have published the proceedings of a symposium on the Collection, Analysis and Interpretation of Accident Data, which was held in 1973. Copies can be obtained from Mr W.D.H., SMRE, Red Hill, Sheffield S7 7HQ, price £3.

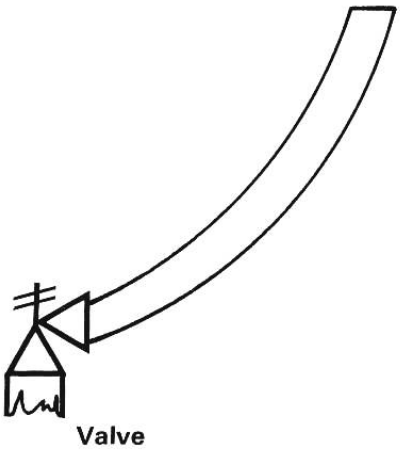
For more information on any item in this Newsletter please 'phone E.T. (Ext. P.2845) or write to her at Wilton. If you do not see this Newsletter regularly and would like your own copy, please ask Mrs T. to add your name to the circulation list.

September 1975

WHY ARE THE ENDS OF RELIEF VALVE TAIL-PIPES SHAPED LIKE THIS



AND NOT LIKE THIS



Electrical Installations in Flammable Atmospheres

ICI Engineering Codes and Regulations

The ICI Electrical Committee has recently approved the issue of an additional new clause extending the scope of the 1972 edition of this code. The new Clause 6 deals with the subject of instruments into which flammable gases, vapours and liquids are introduced as a feature of their operation, and with the associated subject of analyser houses. It makes special reference to the use of pressurizing and purging as methods of safeguarding such instruments, and amplifies basic guidance on these methods given in the 1972 edition of the code.

Electrical Installations in Flammable Atmospheres containing the new Clause 6 and other minor dependent amendments is now available from RoSPA price £5.50 per copy.

Holders of the 1972 edition of the code may obtain copies of the new Clause 6 and other amended pages from Rospa at £1.00 per copy.

Orders, with remittance, should be sent to Service Dept, RoSPA, Royal Oak Centre, Brighton Road, Purley, Surrey CR2 2UR.