IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICAL DIVISION

SAFETY NEWSLETTER *No. 55*

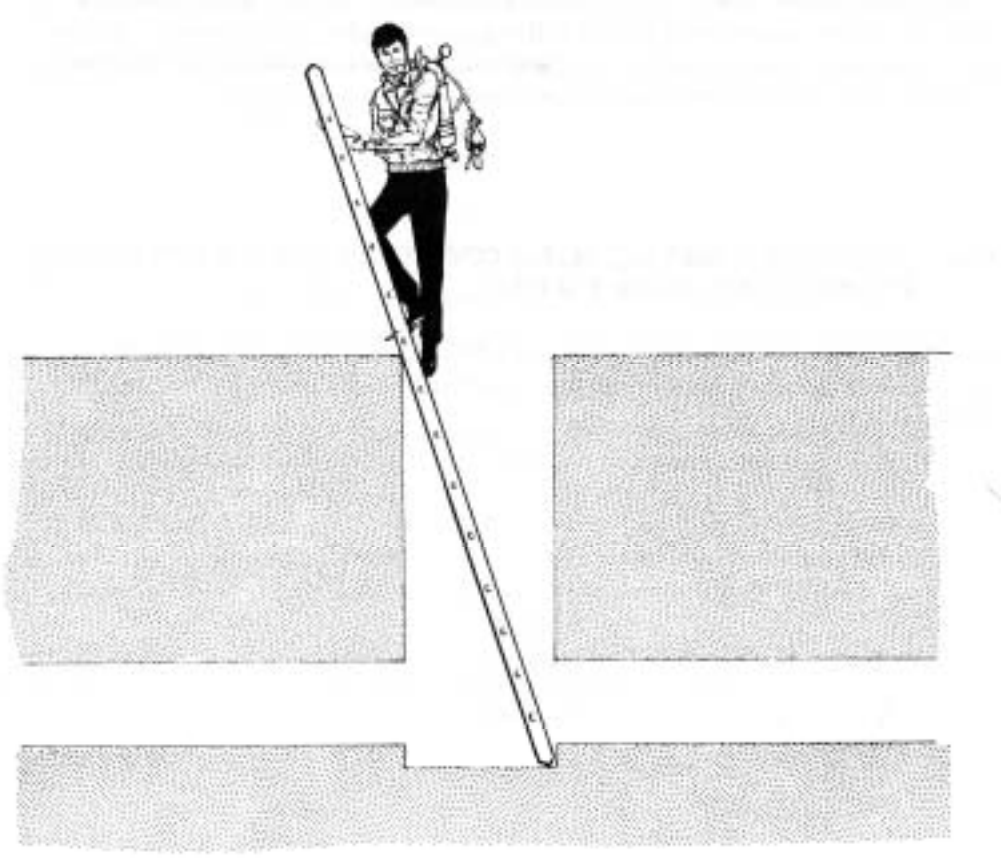
55/1 IF A CONFINED SPACE CONTAINS POISONOUS GAS OR NITROGEN, MEN CAN BE AFFECTED SEVERAL FEET AWAY FROM AN OPEN MAN-HOLE

If a vessel contains a poisonous gas or vapour or nitrogen and a man-hole is open, then people several feet away from the man-hole can be affected.

Three years ago a man knelt down near an open man-hole to recover a rope which was half inside and was caught on something inside. The vessel contained nitrogen and he was overcome (Newsletter 22, Item 1).

About the same time another man was working near the open man-hole of a vessel containing nitrogen (he was about to replace the man-hole cover) when he fell in and died before he could be rescued (Newsletter 25, Item 3).

Now another Division has reported a fatal accident. A man was standing on a ladder ready to go down into a drain man-hole to plug one of the inlet lines. The drain contained some hydrogen sulphide so he had breathing apparatus ready but he had not yet put on the face-piece as he was well outside the man-hole. His feet were at ground level.



He was about to put on a safety harness when his two companions heard a shout and saw him sliding into the man-hole. They were unable to catch him and his body was recovered from the outfall. He had been overcome by hydrogen sulphide coming from the drains though his face was more than five feet above ground level.

There is a fuller account of the incident in Report No. D.78,891/C, available from Division Reports

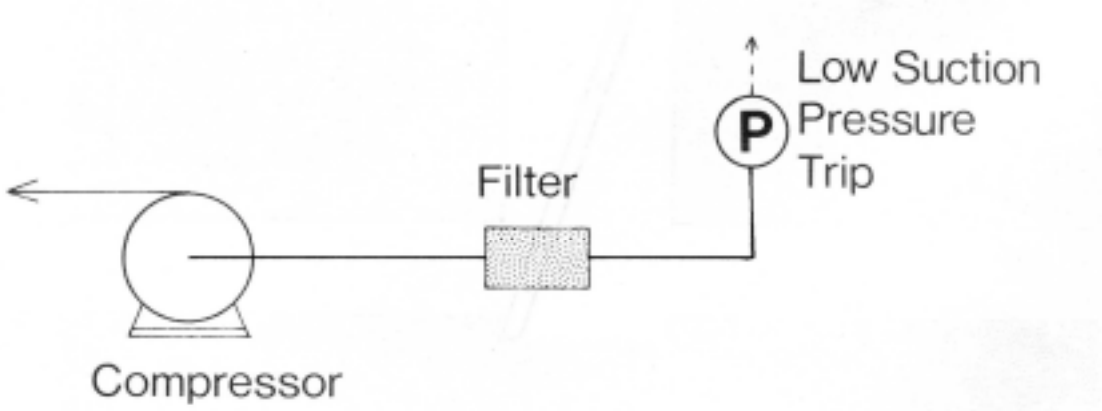
Centres.

We often require men to wear breathing apparatus before entering a vessel because the atmosphere inside is unpleasant or smelly. If the atmosphere is liable to contain poisonous gases or excess nitrogen the amount of these materials present must be measured. If the atmosphere is found to be poisonous or irrespirable then additional precautions are necessary. See Loss Prevention Guide No 4.

"Only on very rare occasions should it be necessary for a person to enter a vessel or confined space where the atmosphere is toxic or into an atmosphere where the concentration of inert gas makes it irrespirable. The precautions listed for a category 2 entry certificate will be taken and no less than three men will be directly involved in the operation, two of them positioned outside the confined space. One of these two men should be trained in methods of rescue and resuscitation. They should have a method, preferably radio contact with a control centre, for instantly alerting the rescue and medical services required as effective support to the rescue plan. The man or men at work inside the confined space should be under constant observation and in contact with the men outside. In some cases, this may mean positioning an additional man inside the space except, when two men are doing the work inside, one may be regarded as keeping the other under observation. Each should have independent air supplies and it is the responsibility of one man outside the vessel to see that these are maintained. Since it is not normally possible for one man to make a vertical lift of another from a vessel, where there is a lifting beam available above the entry suitable mechanical aid to lifting should be made available. If there is no permanent lifting beam or davit a temporary one should be erected wherever this is practicable".

55/2 A FILTER IS PLACED BETWEEN A COMPRESSOR AND THE LOW SUCTION PRESSURE TRIP - RESULT, A FIRE

Before the start up of a new plant a temporary filter was put in the suction line of a compressor to catch any dirt that had been missed by the very thorough cleaning of the equipment.



The fitter was located between the compressor and the low suction pressure trip. The fitter became choked and air was sucked into the compressor, either through leaking glands or leaking joints.

The air caused an explosion in the compressed gas. This caused several joints to leak and leaking gas caught fire, causing considerable damage and several weeks delay in the start up of the plant.

An interesting feature of the fire was that two compressed air lines (2 inches and 1½ inches diameter) were melted by the fire. The escaping air caused a very fierce fire in the immediate locality, sufficient to melt the outside of some ordinary calcium silicate insulation protected with cement. However, the insulation stayed in position and protected the pipe underneath.

Another interesting feature was severe damage to a concrete wall which had been made from pebbles. Limestone or blast furnace slag would have been better. (Engineering Specification

0406).

For further details see Report No. PLR/24/C, available from Division Reports Centres.

55/3 FURNACE TUBES HAVE A LONG MEMORY

Furnace tubes are usually designed to last for about ten years. If they are kept at or below design temperature they will last ten years but if they are allowed to get too hot they will not last as long and will burst before ten years have gone.

Suppose a furnace tube is designed to operate at 500 ^{o}C.

If it is operated at 506°C it will last 6 years.

If it is operated at 550°C it will last 3 months.

If it is operated at 635°C it will last 20 hours.

Suppose we have allowed a tube to get too hot. Then, however carefully we treat it afterwards, it will never be the same again. An elephant has a good memory but a furnace tube a better one. It will never forget that we have ill-treated it and in the end it will let us down.

Suppose a furnace tube has been designed to operate at 500°C but has been heated to 550 ^{o}C for six weeks; then we have used up half its life, and though we keep it at 500°C thereafter, it will burst after a total life of five years.

Suppose we have heated the tube to 506 ^{o}C for three years, then we will have used half its life and through we keep it at 500 ^{o}C afterwards, it will burst after a total of 3+5= 8 years.

For more details ring B.E. (W.459) or see his report No. EDN 1328, “Effect of over heating on furnace tube lives”, available from Division Reports Centre.

If you have any problems discuss them with B.E.. Deciding what a furnace tube will stand is not a subject for do-it-yourself enthusiasts.

55/4 THE VENTING OF BATCH REACTORS

The sizing of relief valves for batch reactors presents special problems. Sometimes it is difficult to know what reactions might occur or how quickly they might take place, but let us assume that we understand the chemistry and we’ know the rate at which heat will be produced.

We can calculate the amount of vapour that will be produced and it is easy to design a valve to pass this rate.

Unfortunately experience shows that usually a mixture of liquid or vapour passes through the relief valve and the entire liquid contents are ejected in this way. If the relief valve has been designed to pass vapour it will be too small for a vapour/liquid mixture, the reactor may be over-pressured and may burst.

The relief valve should therefore be designed so that the entire liquid contents can leave the vessel before the pressure rises above the design pressure or before the vessel gets too hot.

For further details see a paper by A. C. of Plastics Division, “The Venting of Batch Reactors” which was presented at the 4th Inter-divisional meeting on fire and explosion hazards. We can let you have a copy.

55/5 DIFFERENT SORTS OF “ICE”

A recent incident shows how accidents can occur because the same word means different things to different people. A nurse wanted some ice to dress a burn. She asked an ambulance driver to fetch some ice from the laboratory. The ambulance driver went to the laboratory and asked an assistant for some ice. Dry ice is used in the laboratory and so the laboratory assistant assumed that dry ice was wanted and gave some to the ambulance driver who took it back to the nurse. The nurse put it in an ice pack and applied it to the patients arm with the result that his injury was made worse.

Dry ice is another word for solid carbon dioxide or “DRIKOLD”; it is much colder than ordinary water ice and is certainly not the stuff to use on burns.

55/6 FIRE PROTECTION OF STRUCTURES

If part of the fire protection on a structure is missing the whole structure is no longer protected and may collapse in a fire. If any of the protection has to be removed it should be replaced without delay. A recent survey of a number of plants in the Division showed that on many structures a foot or two of the fire protection had been removed and not replaced. Sometimes it had been removed for earthing wires to be fitted: sometimes so that equipment could be taken in or out of a structure: sometimes new equipment had been added but the supports had not been protected. What is the position on your plant?

From Engineering News, June 1973.

55/7 WHAT THE LAW SAYS NO. 12

In the Factories Act and other laws we are often told that we have to do something so far as is "reasonably practicable" or so far as is "practicable". For example, the Factories Act, Section 28 says that

"All floors, steps, passages and gangways shall, so far as is reasonably practicable, be kept free from any obstruction and from any substance likely to cause persons to slip"

Section 31 says

> *"Where, in connection with any grinding, sieving, or other process giving rise to dust, there may escape dust of such a character and to such an extent as to be liable to explode on ignition, all practicable steps should be taken to prevent such an explosion"*

What do "reasonably practicable" and "practicable" mean and what is the difference between them?

According to Redgrave's Factories Acts, 22nd Edition, page 34, "reasonably practicable" means that a comparison must be made in which the risk is placed on one scale and the sacrifice necessary for removing the risk (in money, time and trouble) is placed in the other and that if there is a gross disproportion between them the risk being insignificant in relation to the sacrifice — action to remove the risk is not required.

When the law tells us that we must do something that is "practicable", a stricter standard is required. Something may be "practicable" which is not "reasonably practicable". Nevertheless, "practicable" does not mean the same as "physically possible". It must be possible in the light of present knowledge and invention.

55/8 UNUSUAL ACCIDENTS No. 25

The following is taken from a report from one of our overseas agents, who had to off-load a ship's tank into a road tanker. The product was not flammable.

"Pumping began at 0210 hours on the 8 June and the man who was in charge of the vessel's hose at the top of the tank truck was holding a flashlight in order to watch the level of the product being filled into the tank. It happened that the flashlight or electric lantern fell apart and into the tank went two dry electric cells and the rim, glass, bulb and mirror. When this tank truck arrived at the Plant the objects which had fallen into the tank had gone in the truck's pipeline and it was not possible for us to fish these out. Fortunately the truck has three separate compartments and accordingly we unloaded the first two compartments and for the third, where the objects had fallen in, we closed the truck's gate valve as much as possible so the dry cells, specially, could not go through. But it seems that not only the objects described above had fallen into the tank but also a plastic comb and it went through the valve and into our pump making such a noise at the pump that I had to order to stop the offloading altogether.

For the next truck we switched over to the other pump at our installation and in the meantime we took apart the damaged pump in order to verify if the dry cell batteries had gone through but luckily we found only the comb and no damage was done to the pump. Afterwards, we opened the truck's gate

valve full and although we tried to recover as much product as we could, some of it did fall to the floor and lost but we recovered the two dry cells and all the parts from the flashlight.

Needless to say that I almost had a heart stroke because, if one of these batteries had gone into the pump, I believe that the product would have become contaminated".

55/9 RECENT PUBLICATIONS

(a) The Customs and Excise have issued a recommended code of practice for security at bonded oil installations. Copies can be obtained from the Customs and Excise.

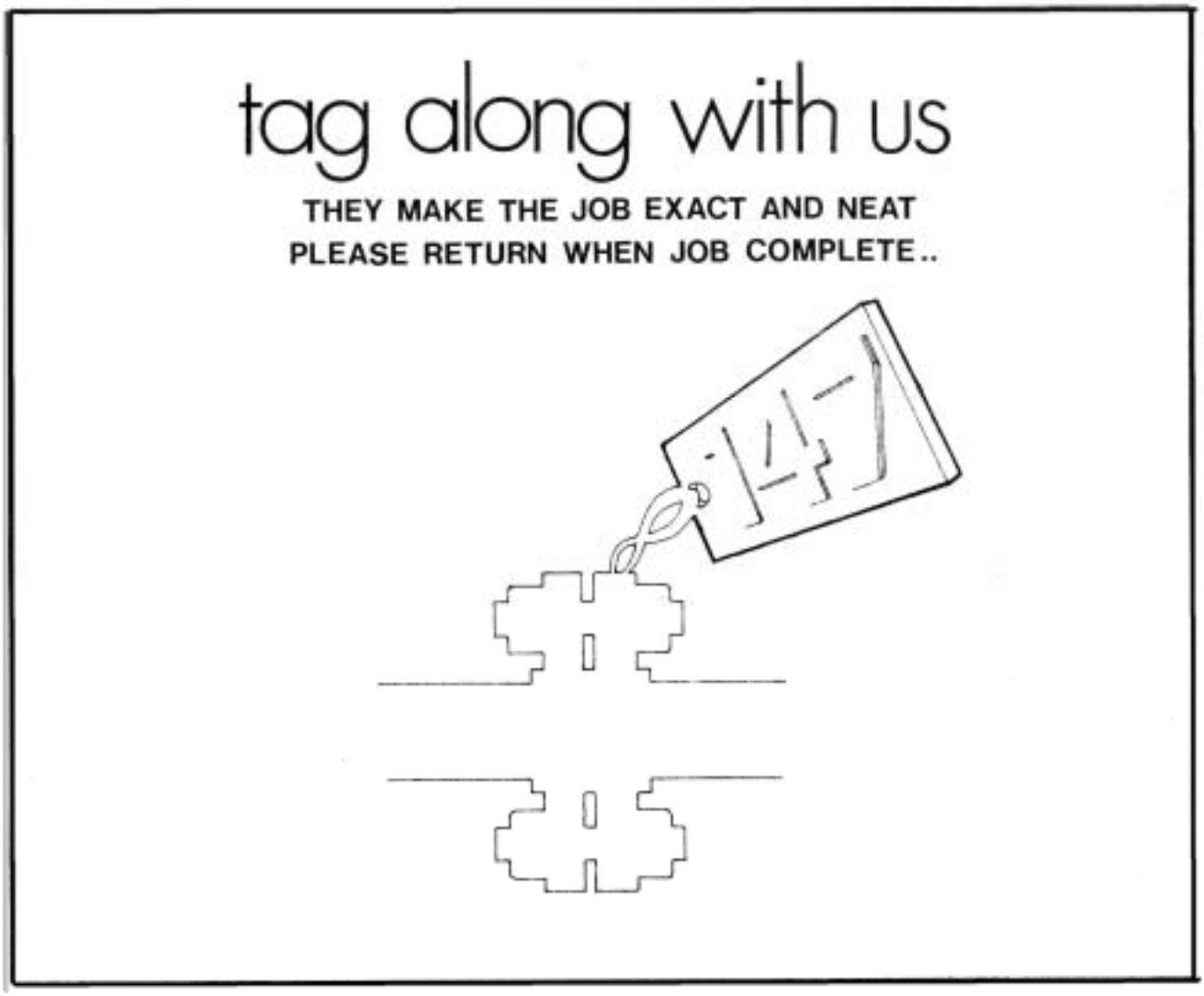
(b) ICI Engineering Codes and Regulations Group B, Vol. 1.3 "Lifting Appliances" has been revised. Copies can be obtained from Standards Section, Engineering Department (ext. B.3373).

(c) "Accident Data — The Need for a New Look at the Sort of Data that are Collected and Analysed". This paper, which was presented at a recent symposium on accident data, argues that very few useful conclusions are drawn from the usual accident data and that the effort devoted to its collection would be much better used in collecting data on the frequency with which equipment failures occur. A summary of the other papers presented at the symposium is also available.

(d) "The Uses, Availability and Pitfalls of Data on Reliability", a reprint of a paper which appeared in "Process Technology International", March 1973.

For copies of (c) - (e) or for more information on any item in this Newsletter please write to Miss M. N. Organic House, Billingham or ring B.3927. If you do not see this Newsletter regularly and would like your own copy please ask Miss N to add your name to the circulation list.

August 1973



Contributed by Fred Cubitt, Olefines Works.

If there is sufficient demand, we will have this made into a small poster, this size, for putting up in control rooms and workshops.