IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICAL DIVISION

SAFETY NEWSLETTER No. 51

This Newsletter describes several fires and explosions which occurred because flammable liquids or gases appeared in unexpected places — in holes in the ground, in a tank which had been cleaned and in pipelines containing water or other materials.

51/1 PORTABLE ALARMS FOR COMBUSTIBLE GASES

A branch had to be welded onto a pipeline which was close to the ground. A small excavation, about two or three feet deep, provided access to the bottom of the pipeline. The excavation was tested with a combustible gas detector and as no gas was detected a fire permit was issued. About half-an-hour later, after the welder had started work, a small fire occurred in the excavation. Some hydrocarbons had soaked out of the ground into the excavation.

It is not really much good testing the atmosphere in the morning and then allowing welding to continue all day. Conditions can change. As stated in Newsletter 36/1, portable gas alarms are now available. They can be set down near the job and will sound an alarm if a leak occurs. Two instruments are recommended. The Sieger Dalek, a big noisy machine, and the Draeger Normalair which is smaller and quieter but suitable for confined spaces where it might be difficult to take a Sieger. Mr. E. Y (Ext. B.2771) can supply details.

Some Works are now well supplied with these instruments and use them on welding jobs when a leak is liable to develop. Have you got enough on your Works?

A few weeks later a similar job had to be done on the same Works. A gas detector was put on the ground near the excavation. It failed to detect hydrocarbons in the excavation and another small fire occurred. The gas detector should have been put in the excavation.

Note that if it is necessary to put a tent over an excavation into which oil may seep, then the tent must be force-ventilated to prevent vapour accumulating.

Note also that combustible gas detectors will not detect liquids which are flammable only when hot. See next item and Newsletters 56/1, 24/6 and 18/7(e).]

51/2 EXPLOSION IN A STORAGE TANK

Newsletter 24, Item 6 described two explosions in storage tanks which contained small quantities of high boiling material stuck to the sides - in one case phenol and in the other a gummy deposit. In both cases welders were working on the tanks. The heat from the welding torches vaporised some of the deposits and then ignited the vapour. Another incident was described in Newsletter 18, Item 7e.

Now another company has described a similar incident. Repairs had to be carried out on the roof of a storage tank which had contained heavy oil. The tank was cleaned out as far as possible and two welders; started work. They noticed smoke coming out of the vent and flames coming out of the hole which they had cut. They started to leave but before they could do so the tank erupted with a whoosh and a flame 80 feet long came out. One of the men was killed and the other was badly burned. The residue in the tank continued to burn for 10 to 15 minutes.

It is almost impossible to completely clean a tank which has contained heavy oils or materials which are solid at ordinary temperature, particularly if the tank, as in this case, is badly corroded so that oil can get behind the rust. A combustible gas detector cannot be used to detect heavy oils which are not flammable at ordinary temperatures. Tanks which have contained heavy oils or solids must be filled with nitrogen or other inert gas before welding is allowed. The gas should be at a slight positive pressure and tests must be carried out to make sure that the oxygen content is below 5%. As stated in Newsletter 35, Item 7b, it is possible to fill storage tanks, before welding, with fire-fighting foam gasified with nitrogen instead of air. With this technique it is much easier to maintain a nitrogen atmosphere in a tank which has holes in it. The technique should be used only after taking expert advice.

51/3 A REMOTELY OPERATED ISOLATION VALVE FAILS TO WORK WHEN NEEDED AS IT HAS NOT BEEN TESTED

Earlier Newsletters have stressed the need for remotely operated isolation valves on equipment which is liable to leak in service (see for example, Newsletter 39, Item 2 and Newsletter 27, Item 3). Many of these valves have been installed on our plants.

Recently a bad leak occurred on a pump gland. The remotely operated isolation valve did not work. Reason: It was never tested. Result: Six tonnes of hot, flammable liquid leaked out over a period of four hours.

All remotely operated isolation valves should be tested regularly. If fully closing the valve will interfere with the process, the valve should be part-closed and a full test carried out during a shut-down. Experience on some plants has shown that valves can be quickly closed and re-opened without interfering with the process.

REMINDER: Newsletter 39, Item 2 described a fire which would have been over quickly if a remotely operated isolation valve had worked. It did not work because the operating button was too close to the leak and by the time someone took a chance and dashed in to operate it the cables had been damaged. The button should have been further away and the cable should have been provided with 15 minutes fire protection.

51/4 DIESEL ENGINES

If a diesel engine is operating near a leak of flammable gas or vapour, the leaking material may be sucked into this engine and ignited. A number of fires have started in this way, including a serious fire on Teesside in 1969 (see Safety Newsletter 23, Item 1). The engine cannot be stopped by isolating the fuel supply as it will continue to run on gas or vapour sucked in through the air inlet.

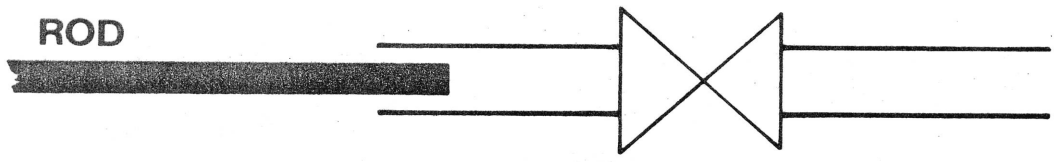
Newsletter 32, Item 2 described the 'Pyroban' device, marketed by Engineering Services (Wilton) Ltd., which will stop a diesel engine running on gas or vapour sucked in through the air inlet. It consists of a disc valve operated by carbon dioxide from a cylinder and a flame trap.

'Pyroban' has to be operated manually and ways of providing automatic operation are being considered. One possible method would be to use engine overspeed to operate the device. However, experiments have now shown that a diesel engine can ignite a leak of flammable gas or vapour without overspeed.

An alternative device to 'Pyroban', the Chalwyn valve, is operated by engine overspeed, and, therefore, does not give complete protection. Its use in the Division is not recommended.

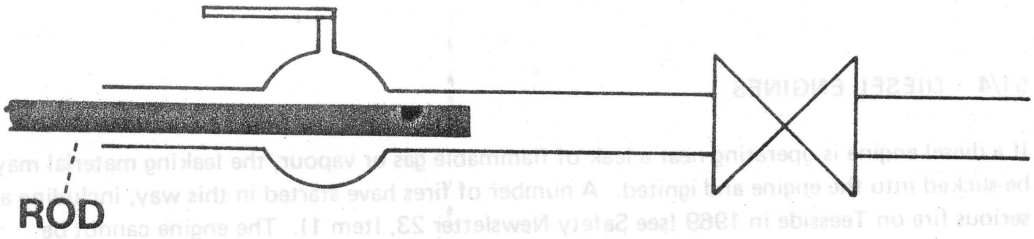
51/5 AN ACCIDENT WHILE CLEARING A CHOKED IMPULSE LINE

An artificer was rodding out a choked impulse line.



When he cleared the choke he found the valve would not close and he could not stop the flow of flammable liquid. A pump had to be shut down.

Rodding out narrow bore lines is sometimes necessary but before doing so a ball valve or cock should be fitted on the end of the line.



It is then always possible to isolate the flow when the choke has been cleared.

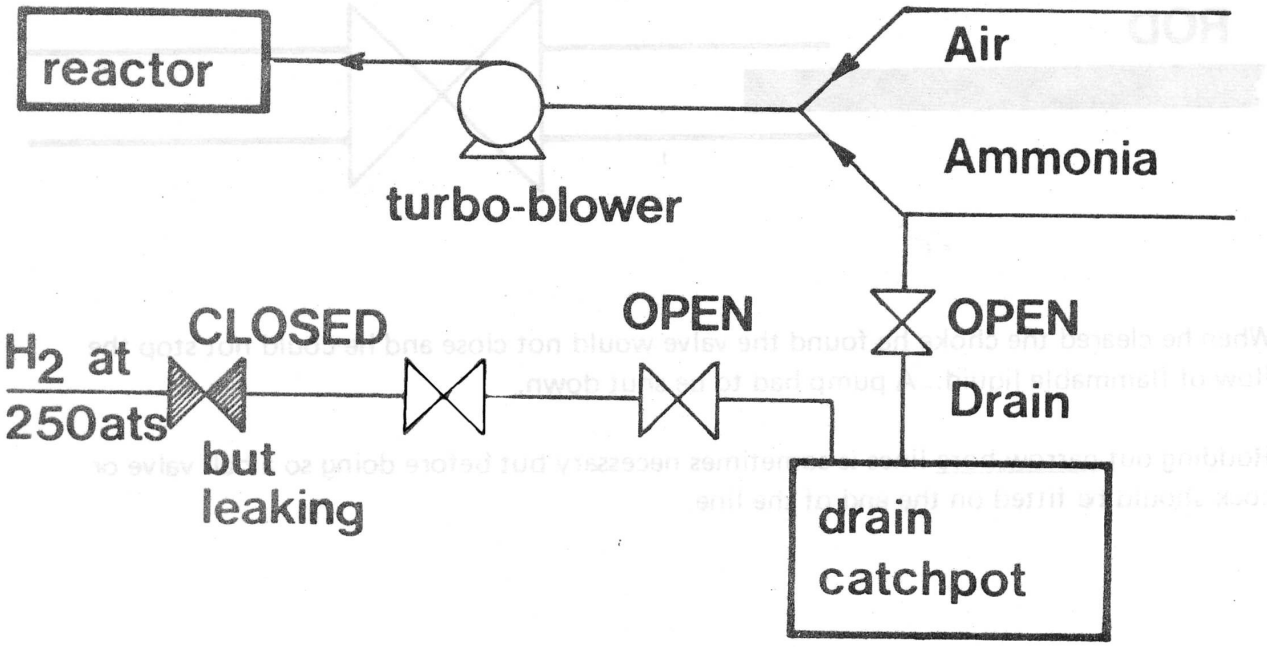
Rodding should be attempted only on narrow bore lines at low pressures and suitable protective clothing should be worn.

51/6 INCIDENTS FROM THE PAST

No. 2 in a series describing some accidents which occurred during the early years of the Billingham Factory. (No.1 appeared in Newsletter 48).

On 6 March 1928 a turbo-blower on the nitric acid plant burst its casing and a process worker was hit on the head and killed. The casing was wrecked.

The explosion was caused by a leakage of hydrogen into the ammonia via a drain catchpot which was shared with another plant, as shown below.



Normally the small leak of hydrogen was diluted by the large flow of ammonia. However, when the nitric acid plant was shut down the hydrogen concentration rose to 55%. When the nitric acid plant was started up, the hydrogen exploded. The source of ignition was probably the hot catalyst in the reactor.

The report recommended removing the connection between the hydrogen line and the catchpot and installing a katharometer on the ammonia line to detect dangerous levels of hydrogen.

The explosion is a very good example of the way in which process streams can be contaminated by back flow through minor lines. A drain, a vent line, a by-pass or a cross-connection, is put in for very good reasons but no-one realises what might occur. On new plants an operability study should pick up unwanted flows of this sort. On existing plants modifications must be carefully vetted to make sure that contamination cannot occur.

For further details see Report No. A.102,145, page 21 and Report No. A.102,132.

51/7 FOUR YEARS AGO

The following has been taken, with slight alteration, from Safety Newsletter No. 9 April, 1969.

A WATER LINE CATCHES FIRE

A small fire, in which a man was slightly burnt, occurred while a welder was working on the water lines leading to a waste heat boiler. Gas leaking out of a broken joint caught fire.

The atmosphere inside the water lines had not been tested with a combustible gas detector as the supervisor did not see how it was possible for gas to get into them.

How did it get in and what should be done to prevent similar incidents in the future? Turn over when you have thought of the answer.

The waste heat boiler had been taken off-line because a tube was leaking. Before the process side could be isolated and blown down, process gas leaked into the tubes.

The water side of the boiler should, if possible, have been kept full of water until the process side had been isolated and blown down. If the leak was so bad that this was impossible, then the water lines should have been tested for the presence of flammable gas and the process side sweetened so that no gas could leek through while welding was in progress.

Service lines have been contaminated with process material many times in the past. Before welding is done on water or steam lines in a process plant area, it is good practice to test the atmosphere with a combustible gas detector.

But remember (see Item 51/2 above) that these detectors will not detect high-flash point materials which become flammable when hot.

51/8 SEVEN TIMES SOMETHING BROKE — ON THE EIGHTH OCCASION SOMEONE WAS INJURED

Extract from an accident report:-

"All but one of the ¾" diameter bolts had been removed and, whilst attempting to remove the last bolt, it sheared, causing Mr ..... to jerk backwards. As a result he strained his back and was absent from work for a total of five working shifts"

What were your reactions when you read this? Just another of these back accidents? Put it down to human failing? Now read on.

"During the initial investigation on the plant, seven bolts were found near the area of work which had been similarly sheared at some previous time. The Committee concluded from this that the bolts sheared quite frequently and what is required is an investigation into the loads put on the bolts to find a more suitable material for use on this application."

This accident would not have occurred if the men doing the job had told the engineer that the bolts often sheared, instead of struggling on under difficulty. How can they be persuaded to speak up? (When they do speak up, do we always act?)

The accident would also have been avoided if the supervisor and the engineer, on their tours of the plant, had noticed the broken bolts and asked why there were so many. (Though if the job had been tidied up properly, the broken bolts would not have been left lying about).

51/9 ENTRY TO CONFINED SPACES - THE ATMOSPHERE MUST BE TESTED BEFORE AN ENTRY PERMIT IS ISSUED

The following story is taken from the magazine of St. Cuthbert's Church, Marton:-

Many years ago three men stole a piece of beef and threw it down a well until they could recover it. Later the bodies of the three men were found at the bottom of the well. The epitaph on their tombstone reads:

'Erected in memory of Robert Armstrong aged 28, James Ingledew aged 39 and Joseph Fenison aged 27 years who unfortunately lost their lives Oct 11th 1812 by venturing into a well at Marton when it was filled with carbonic acid gas or fixed air. From this unhappy accident let others take warning not to venture into wells without first trying whether a candle will burn in them; if the candle

burns to the bottom they may enter with safety,- if it goes out human life cannot be supported'

51/10 WHAT THE LAW SAYS NO. 9

What does the law say about plant tidiness?

"All floors shall be kept free from any obstruction and from any substance likely to cause persons to slip"

Factories Act 1961, Part II, Section 28(i).

51/11 UNUSUAL ACCIDENTS NO.21

Some Gas Board employees were digging a trench with a mechanical digger. They cut through a 415 volt cable. There was a big bang and smoke shot 30 feet into the air. One of the Gas Board men then tried to join the ends of the cable together. There was another bang and a flash and the man had his trousers burnt off to the knee and was burnt on the arm and leg.

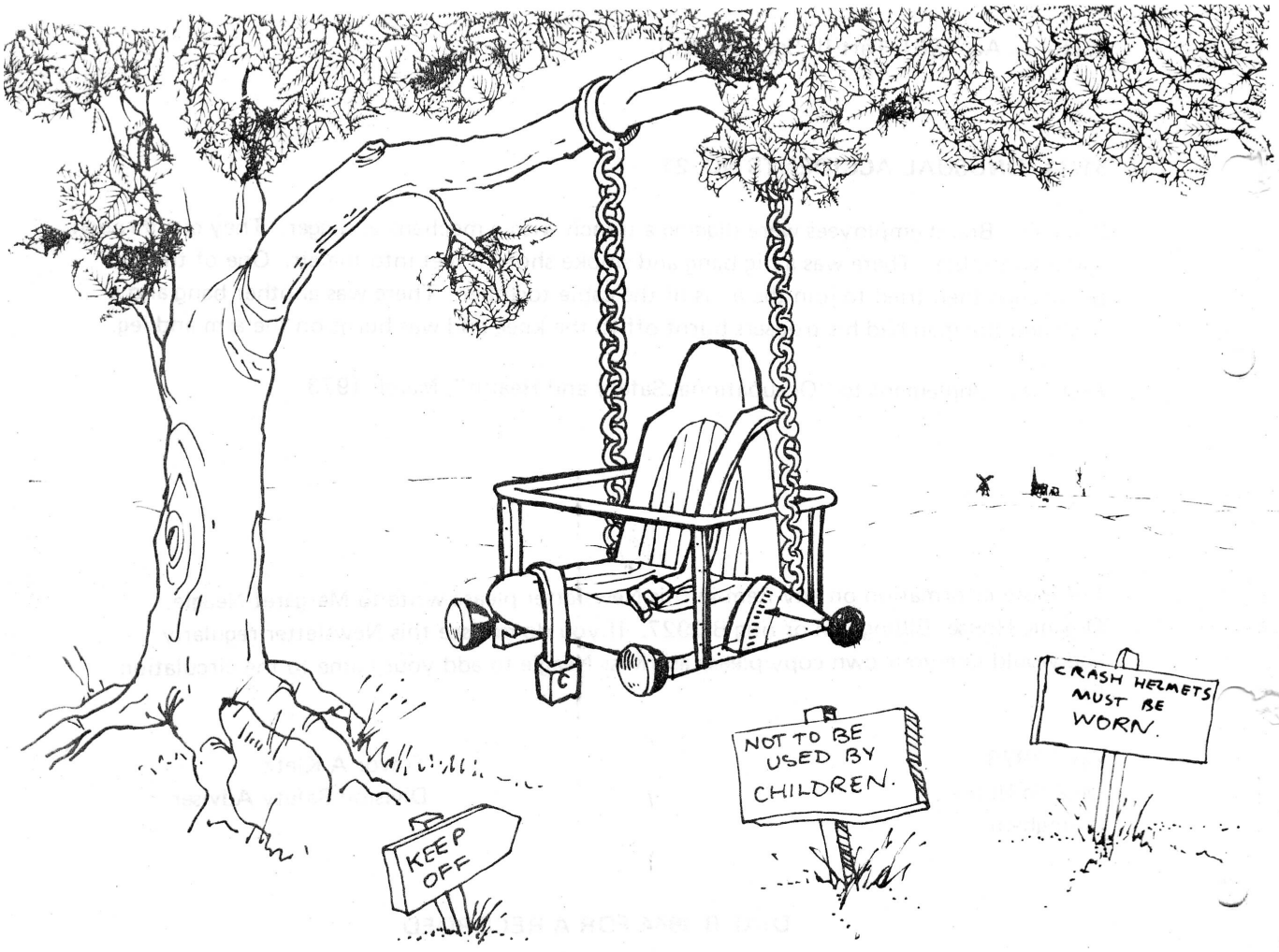
From the supplement to "Occupational Safety and Health", March 1973.

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.

April 1973

NEWSLETTER 48 SHOWED SIX WAYS IN WHICH DIFFERENT PEOPLE SAW THE SAME PROBLEM.

Readers have suggested a seventh



WHAT THE SAFETY OFFICER WANTED.