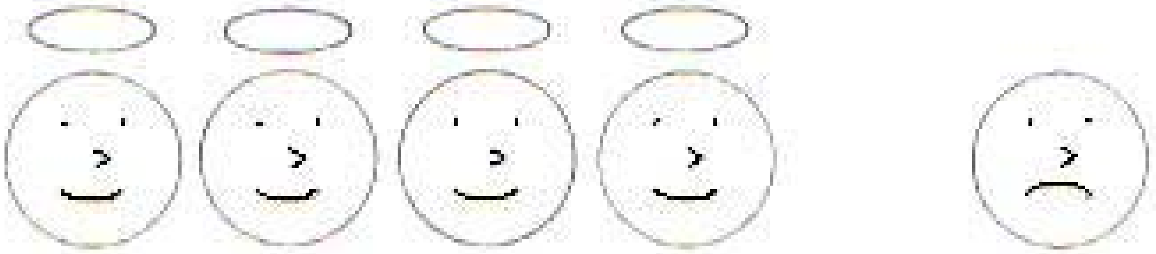
# SAFETY NEWSLETTER

# No. 121
# E SHIFT JOBS



**A B C D E**

These are jobs which, apparently, A, B, C and D shifts never did and are therefore presumed to have been done by a mythical E shift, who work only nights and weekends so that we never see them.
A, B, C and D shifts are not being dishonest when they say that they cannot remember doing the jobs. They have been forgotten because there was no proper system for authorising, controlling and recording what was done.

This Newsletter describes some E shift jobs which have caused accidents in the Division. Some occurred recently, others a few years ago.

**121/1 Reducing the size of a vent.**

**121/2 Fitting the wrong valve.**

**121/3 Fitting a low pressure hose to a higher pressure plant.**

**121/4 Closing the drain valve on a pump prepared for maintenance.**

**121/5 Disarming a trip.**

**121/6 Changing a valve trim; removing a restriction plate.**

**Also in this issue:**

**121/7 What should I do if a Factory Inspector asks me to do something which I think is unnecessary or even unsafe?**

**121/8 Nitrogen blanketing — a simple design error.**

**An Engineer’s Casebook — Manholes and entry**

**IMPERIAL CHEMICAL INDUSTRIES LIMITED**

**PETROCHEMICALS DIVISION**

**121/1 E SHIFT JOB No 1 — WHO CHANGED THE SIZE OF THE VENT?**

A small tank was used for storing as liquid a substance that melts at about 1000 C. It was kept hot by a steam coil. When the inlet line to the tank was being blown with compressed air to prove that it was clear — the usual procedure before filling the tank — the end of the tank was blown off, killing two men who were working nearby. The vent on the tank— a hole 3 inches in diameter—was choked and the air pressure (80 psig) was much greater than the design pressure of the tank (5 psig).

The tank had originally been supplied with a 6 inch vent but several years before the accident E shift had blanked the 6 inch hole and used a 3 inch hole as the vent. The 6 inch hole would not have choked with solid.

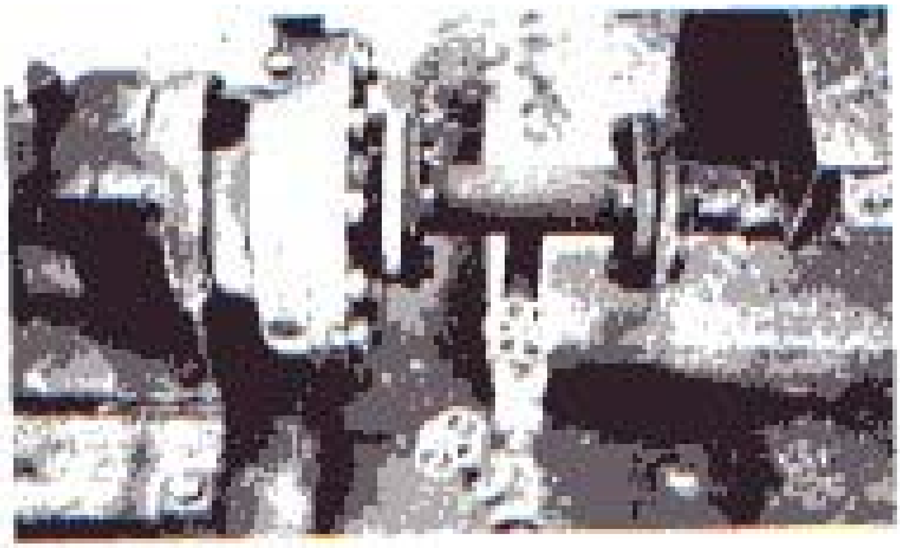
We do not know why the size of the vent was changed. Perhaps the large hole allowed dirt or rain to enter the tank.

*Open vents are, in effect, relief valves and should be treated like relief valves. Their size should not be changed without the written authority of an engineer.*

Other aspects of this accident were discussed in Newsletters 93 and 78/3.

**121/2 E SHIFT JOB No 2 — WHO FITTED THE VALVE?**

The photograph shows a drain point on a line carrying liquefied petroleum gas.



.The valves are made from brass and are of a type stocked for use on domestic water lines. No one knows who fitted them.

Screw fittings should not be used on process lines.

The two valves should be 3 feet apart.

The second valve should not be larger than ¾ inch.

*All modifications should be authorised at managerial level, specified in detail, and inspected on completion.*

*Maintenance organisations should refuse to carry out modifications which are not specified in detail* (see Newsletter 83).

**121/3 E SHIFT JOB No 3—WHO FITTED THE HOSE?**

While a plant was being brought up to pressure with hydrogen after a shut-down, a loud bang was heard and it was found that a low pressure nitrogen hose had burst.

No-one knows who connected the hose or when or why, but it is possible that E shift did so about six weeks earlier, before the shut-down, in readiness for a possible catalyst change which did not actually take place. Fitting the hose was not on the list of jobs to be done in readiness for the shutdown and the fact that it had been fitted was not logged anywhere.

The nitrogen hose was designed for use at 150 psig but burst at a pressure of 250 psig.

*All temporary connections should be registered and, if required for a shut-down, removed before process materials are brought back into the plant.*

*When hoses are not in use they should be isolated at both ends.*

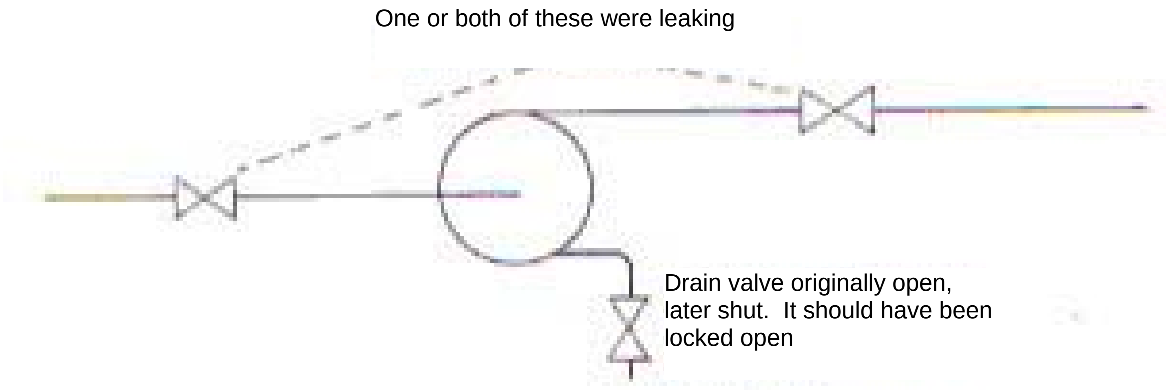
After the hose burst, hydrogen escaped, some of it got into the gap between a reactor and its insula~ tion and a few minutes later it exploded, blowing off some of the insulation.

**121/4 E SHIFT JOB No 4 — WHO SHUT THE DRAIN VALVE?**

A pump had to be dismantled. When a fitter was doing so a jet of corrosive liquid hit him in the eyes.

Fortunately prompt action by the man and his colleagues prevented serious injury and there was no lost-time.

The suction and delivery valves on the pump had been locked shut but the drain valve was also shut. It had been open originally but **someone had shut it.** The suction or delivery valve (or both) had been leaking and the pump filled with liquid.




The job was a quick one so there was no need to slip-plate the suction and delivery lines but the **drain valve should have been locked open** and then E shift could not have shut it.

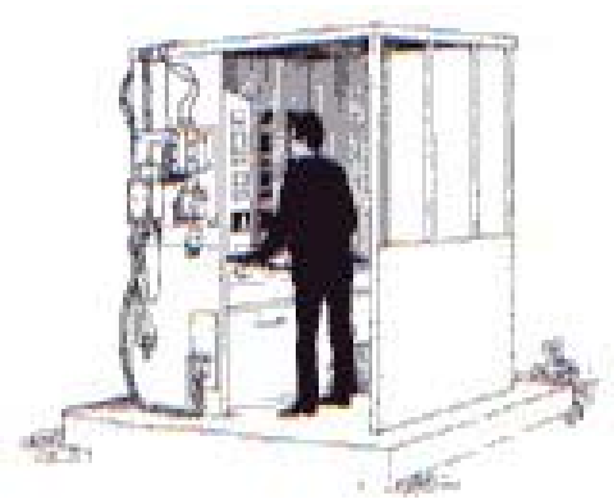
The fitter should have been wearing goggles.

Was this the first time that a drain valve had not been locked open? Was this the first time that goggles had not been worn when they should have been? Should the managers and supervisors have seen this on their regular inspections?

**121/5 E SHIFT JOB No 5 — WHO SET THE TRIP SETTING AT ZERO?**

The inside of a control unit was continuously purged with nitrogen to prevent any flammable vapour diffusing in from outside. Vapour was not normally present outside but could be present if there was a leak or spillage on the neighbouring plant. A pressure switch isolated the power supply if the nitrogen pressure fell below a pre-set level. Nevertheless, when a man, standing in the position shown, switched on the power, an explosion blew out the panels in front of his legs and injured him.

There was no leak or spillage so why did this happen?



The nitrogen had been contaminated with acetone from another section of the plant. A mixture of nitrogen and acetone will not explode but due to a failure in supply the nitrogen flow stopped, the pressure fell to zero and air diffused in, forming an explosive mixture.

Unknown to the other operators, E shift had set the pressure switch at zero, so making it ineffective. The set point was behind a flameproof cover and was not visible.

**Alterations to trip settings and the disarming of trips should be authorised in writing. Trip settings should be clearly displayed.**

It is difficult to pressurise a large cabinet and this is probably the reason why E shift had set the trip setting at zero. A flow switch would be better than a pressure switch.

Some other points also came out of the incident:

1. Dry air could be used instead of nitrogen. It is cheaper and less liable to become contaminated. The supply is more reliable and there is no danger if anyone breathes it. Air is not suitable if process materials and electrical equipment are present in the same compartment.

2. As an alternative to purging or pressurising, a combustible gas detector might be used to trip out the power supply when a gas leak occurs.

3. The control unit could be placed in a safe area and there would then be no need for purging.

4. The nitrogen was contaminated because it was permanently connected to process lines via single isolation valves. Double block and bleed valves or flexes which are disconnected when not in use should be used.

   If the pressure in the nitrogen line may fall below the pressure in the process line, there should be a low pressure alarm on the nitrogen supply and the nitrogen should be isolated before its pressure falls below the process pressure. If the nitrogen pressure does fall below the process pressure then the nitrogen must be tested for contamination.

TO SUM UP

The explosion occurred because a common hazard — contamination of the nitrogen — was not foreseen and the protective equipment — the trip — had been put out of action.

## 121/6 SOME OTHER E SHIFT JOBS

The size of the trim in a control valve was increased — to give better control — without realising that a relief valve would then be too small (See Newsletter 48/1).

A restriction orifice plate was removed — without realising that a relief valve would then be too small.

## 121/7 SOME QUESTIONS I AM OFTEN ASKED No 36

### WHAT SHOULD I DO IF A FACTORY INSPECTOR ASKS ME TO DO SOMETHING WHICH I THINK IS UNNECESSARY OR EVEN UNSAFE?

First, make quite sure that you think the Factory Inspector's advice is wrong. They are not fools and most of their advice is very sensible.

Second, if the Factory Inspector is quoting a regulation and there are no 'ifs' or 'buts', we must do as he says. For example, if you have an air receiver on your plant, the safe working pressure must be marked on it so as to be plainly visible, as required by the Factories Act, 1961, Section 36(1) (a). Whether or not he or you think this is necessary is irrelevant. However, very few regulations affect us this way. Usually Factory Inspectors give advice under the Health and Safety at Work Act, under which we have a general duty to provide a safe plant and system of work, so far as is reasonably practicable.

Third, if you still feel the Factory Inspector is wrong, say so, courteously, and say why you think so. Quote any relevant Codes of Practice or relevant experience. Explain that you agree with his objective, a safer plant, but that you can achieve this in another way.

Of course, if the Factory Inspector wants to insist he can issue an Improvement Notice and then you have no choice (unless you appeal to an Industrial Tribunal) but it is very unlikely that a Factory Inspector will do so when there is a difference of opinion on technical matters. Improvement Notices are intended primarily to stop people dragging their heels on necessary changes, not as a means of settling technical arguments.

Should the Factory Inspector consider that there is immediate danger then he can issue a Prohibition Notice and you must stop the activity at once. Again, it is unlikely that this will happen when there is a difference of opinion on technical matters.

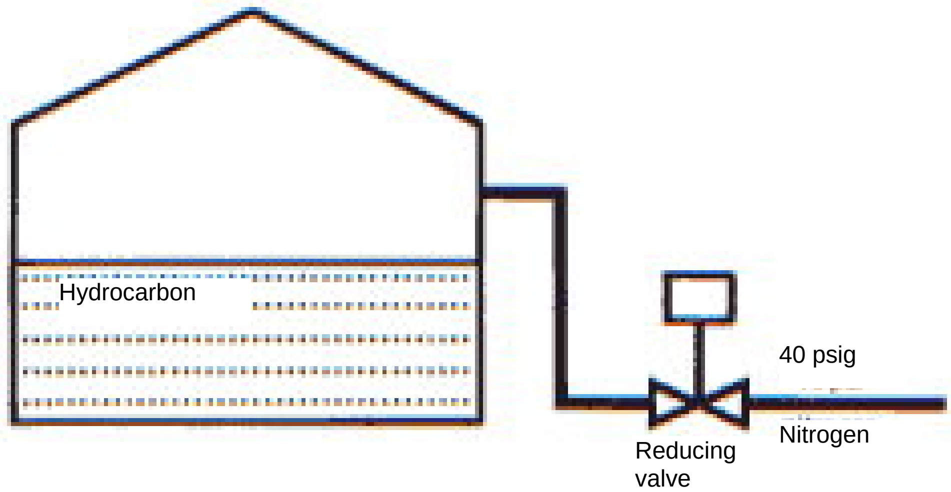
I cannot recall a case in this country where a Factory Inspector has asked us to do something unsafe — at the worst they have asked us to do something we thought unnecessary. On the Continent, however, we have had to install features which we think produced a net **decrease** in safety.

## 121/8 A LOOK BACK AT NEWSLETTER 21 (August 1970)

### Nitrogen Blanketing — How it can go wrong

In Petrochemicals Division, all fixed roof storage tanks containing flammable hydrocarbons above their flash points are blanketed with nitrogen.

On one group of tanks the reducing valve on the nitrogen supply was installed at ground level.




Hydrocarbon vapour condensed in the vertical section of the line and effectively isolated the tank from the nitrogen blanketing.

The reducing valve should have been installed at roof height.

Check your tanks — there may be some more like this one.

**121/9 COMMENTS FROM READERS**

*(a) Underground Pipelines*

*Newsletter 118/6 described how underground propane and oxygen lines leaked and exploded. A reader comments:*

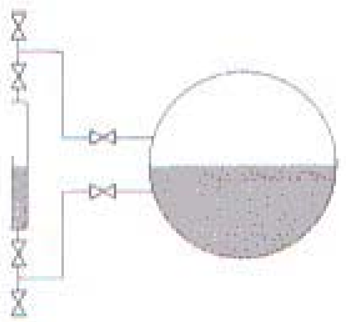
The criterion for cathodic protection of an underground pipeline should not be the length. It is frequently economic to cathodically protect short lengths of a line and uneconomic to protect any line which is buried near to other buried steel work.

Where cathodic protection is not applicable we should double wrap pipes, lay them on a bed of calcarious gravel and backfill with similar material.

If water penetrates the space between a copper pipe and its steel sheath there will of course, be a galvanic cell set up and severe corrosion will occur. However, it is only the steel that will corrode and the final result will be a copper pipe protected by a sheath of iron oxide. This is not desirable as the iron oxide has little strength.

*(b) Level glasses*

*Several readers have asked why the level glass shown in Newsletter 119/3 will give an incorrect reading when the level is below or above the branches.*



When the level is below the bottom branch the level glass is effectively isolated from the vessel and cannot give a correct reading.

When the level is above the upper branch the gas or vapour in the level glass is isolated and will be compressed as the level rises, thus producing an error in the reading.

For more information on any item in this Newsletter please ‘phone ET (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.

**An Engineer's Casebook No 21 MANHOLES AND ENTRY**

Section 30 of the Factories Act 1961 prescribes the size of manhole required by law for entry into a confined space when wearing breathing apparatus or otherwise. The Division's vessel specification VES 0101 defines the Division requirements for manholes and BS 470: 1976 'Access and inspection openings for pressure vessels' covers similar ground.

In spite of all the guidance and instruction which is available we must not assume that the designer provided every manhole of such a size as to permit whatever sort of entry may be required once the equipment forms part of a process plant. This is particularly true of some older plant and carelessness in not qualifying precisely what is meant by an 18 inches manhole. Contractors used to working to ASA Standards frequently interpret this as 18 inches outside diameter, for the American Standards are based on the nominal size referring to the pipe outside diameter where the size is 14 inches and above. An 18 inches manhole will be only 16½ inches inside diameter if the pipe is ¾ inch thick.

What does the law require? Section 30 of the Factories Act 1961 specifies that a minimum manhole size of 18 inches (or 18 inches x 16 inches) be provided for access into any confined space in which dangerous fumes are liable to be present to such an extent as to involve risk of persons being overcome thereby. Note that the origin of the dangerous fume is not stated. It may arise from residues left in the space after equipment has been on process duty, from temporary conditions such as acid washing, during start-up or shut down, from, for example, steaming out or it may arise from maintenance tasks such as welding, use of dye-penetrant crack detection techniques etc.

It is therefore illegal to enter any equipment containing dangerous fume through any opening less than 18 inches diameter unless the responsible person certifying the entry is satisfied that any deposit or other material liable to give off dangerous fumes is present in insignificant quantities only. Even if breathing apparatus is worn to combat the dangerous fumes entry through any opening less than 18 inches diameter is still illegal.

The Division has long been aware of the physical difficulty associated with entry to and egress from equipment equipped with a minimum 18 inches internal diameter manhole when breathing apparatus or bulky protective clothing has to be worn. For such cases the design requirement, stated in VES 0101, is for a 24 inches nominal size manhole, that is, about 22½ inches internal diameter if of ¾ inch wall thickness.

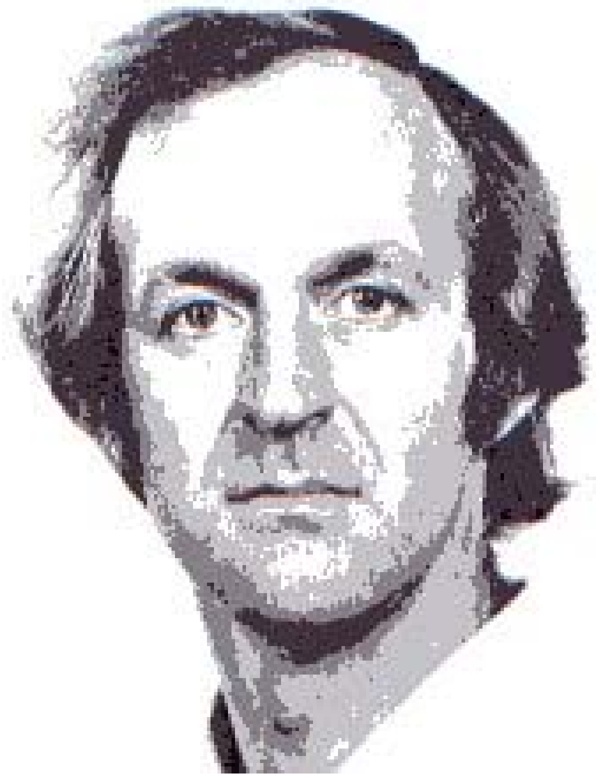
This requirement has recently been endorsed with the issue of BS 470: 1976 "Access and inspection openings for pressure vessels". This specification requires a minimum manhole of 460 mm (18.11 inches) internal diameter for any purpose with a recommended size of 575 mm (22.63 inches) internal diameter where entry wearing apparatus is necessary to afford full rescue facilities with self-contained breathing apparatus.

Many manholes on equipment in the Division's Works may be less than 18 inches internal diameter and there may be a need for regular entry, for example, into boiler drums. Care is necessary in these cases, not only to ensure that dangerous fume is not present or, if so, only in insignificant quantities, but also that it is not created inside the equipment as a result of inspection or maintenance work.

E H Frank

March 1979

# WHO'S WHO IN SAFETY



**No. 29 J M ALEXANDER**

John Alexander was born and bred in Cardiff. He studied chemical engineering at Imperial College, rowed for his College 2nd 'Eight' and was President of the College Mountaineering Club.

After graduating he joined the RAF and became officer in charge of the Kinloss Mountain Rescue Team.

John joined Dyestuffs Division in 1 959 and was responsible, among other things, for research into a novel milling technique and designing a micro-scale pilot plant for the manufacture of nylon intermediates.

In 1963 he moved to Nylon Works, Billingham and was later promoted to a new safety engineering function. This interest in safety was carried through to John's next job. From 1971 to 1975, as a member of Petrochemicals Division Safety and Loss Prevention Group, he advised project and plant managers on technical safety and on safety aspects of new plant designs. He also published a paper on the cause of internal fires in oxidation processes which proposed general rules to prevent such fires, (See I Chem E Symposium Series No 39a, 1 975, p 1 57).

In 1975 John became a Technical Adviser to I C Insurance with responsibility for inspection and reporting to Company underwriters on unsatisfactory features of plants and processes. The job involves much travelling between Head Office, the Divisions and subsidiary companies.

John is married but has no children. He is still interested in mountaineering and enjoys reading when he has the time. His interest in good music is shared by his wife, who is a trained singer.