

**IMPERIAL CHEMICAL INDUSTRIES LIMITED**  
**PETROCHEMICALS DIVISION**

**SAFETY NEWSLETTER No 73**

**73/1 SOME QUESTIONS I AM OFTEN ASKED**

**8 - HOW WILL THE NEW HEALTH AND SAFETY AT WORK ACT AFFECT US?**

The short answer is Immediately, not a great deal; in the long run, quite a bit. The Act is not a revolutionary one which will change things overnight, but an evolutionary one which provides the means for gradual change what lawyers call an Enabling Act.

The Factory Inspectorate have already acquired a number of new powers, in particular the power to issue improvement and prohibition notices and the power to seize or destroy any dangerous substance or article that is in imminent danger of causing serious injury. An improvement notice tells someone (employer, employee or manufacturer) that he has to put something right; a prohibition notice tells him that he cannot operate the plant or piece of equipment until it is made safe. However, we do not expect that Factory Inspectors will deal out these notices like parking tickets. They will continue to work, as in the past, mainly by persuasion, keeping their new powers as a last resort. The Inspectorate are not dictators who can do as they please. They are responsible to the Health and Safety Commission, a body of part-time people chosen from industry, the Trades Unions and the Local Authorities.

In the long run, however, the new Act will introduce many fundamental changes, and the following are some of the most important:-

1. The detailed regulations which cover certain operations will gradually be replaced by Codes of Practice drawn up by industry itself in co-operation with the Factory Inspectorate. Codes of Practice will also be required for those operations which are at present not covered by regulations. These Codes can be given the force of law, and the Factory Inspectorate will then be able to compel companies to follow them.

We are fully in favour of these new powers. We would like to see other people being made to do some of the things we do already. Many of our activities are already covered by our own Codes, such as the ICI Engineering Codes and Regulations. The new Act will give us a stimulus to get on with the preparation of Codes for those activities which are not already covered.

2. Under the new Act the Factory Inspectorate can be given power to license factories. The chemical industry may be one of the first to be licensed in this way. Some of the plants we are now designing may have to be licensed before they can operate and we have already started to discuss with the Factory Inspectorate the way this licensing will work.
3. In the future the Factory Inspectorate will be concerned with the safety of the public as well as employees. In the past they were mainly concerned with employees.
4. Under the Act the Factory Inspectorate can be given powers not only to license factories, but to license individuals. In the words of the schedule to the Act, regulations can be made "restricting the purpose of specified functions to persons possessing specified qualifications or experience".
5. Regulations can be made under the new Act requiring employers to set up safety committees and appoint safety representatives. These regulations will probably not make a great deal of difference to companies like ICI which have safety committees already.
6. The old Factories Act was prohibitive. Like the Ten Commandments it listed a lot of things that people must not do. The new Act requires employers to actually do things, to provide safe plant, safe systems of work and adequate instruction, training and supervision. These are difficult

things to define and I doubt if many firms will be prosecuted for not providing adequate training. But it does mean that in the future the Factory Inspectorate will take a lot of interest in the software. In the past they have been mainly concerned with hardware, such as machinery guards.

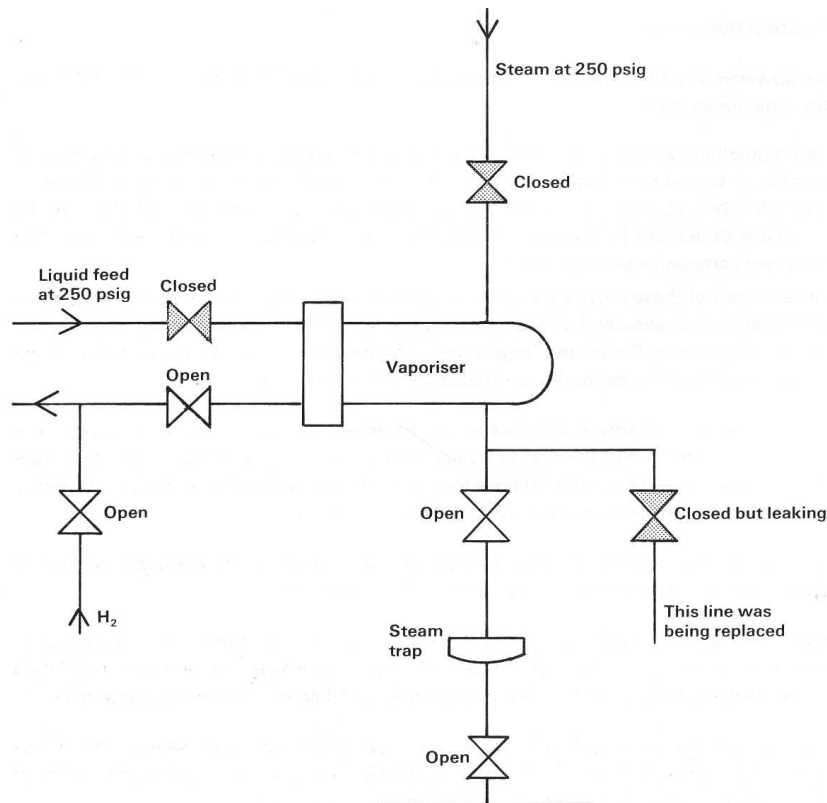
I have spoken about the Factory Inspectorate, but this name is now out of date. The Factory Inspectorate, the Alkali Inspectorate, the Mines and Quarries Inspectorate, the Nuclear Inspectorate and so on — all these separate Government departments are being welded into a single new Inspectorate. But for a long time the people we are dealing with will be mainly former members of the Factory Inspectorate.

There is a good account of the new Act in “Health and Safety — The New Law”, by James Jackson, available from the Commercial Publishing Co., 1076 Harrow Road, London, NW10 5NL, price £4.

### 73/2 A STEAM LINE CATCHES FIRE

Newsletter 51/7 described how a water line caught fire. Last year we went one better and set a steam line on fire.

The diagram shows how it occurred.



There were two leaking tubes in the vaporiser. Hydrogen entered the shell and passed through the closed steam trap by-pass valve. When a joint was broken the hydrogen escaped and caught fire. The source of ignition may have been the impact of a hammer on the bolts.

Nobody knew beforehand that a tube was leaking, as the steam and the feed are at the same pressure.

This incident shows us once again how easily service lines in a plant area can become contaminated with process materials. Before starting work on a service line, never assume that it contains only safe materials. Always test to make sure.

The incident also shows us that equipment which is given to maintenance must be properly isolated. In deciding on the method of isolation, do not take it for granted that heat exchangers are not leaking.

**Reminder:** Newsletter 58/5 described how a fitter was affected by fumes while working on a steam drum.

### 73/3 “THE BEST BUILDING HAS NO WALLS AND NO ROOF”

Earlier Newsletters (14/1, 35/2, 37/4 and 41/1) have described fires and explosions in closed buildings and have pointed out that it is much safer to build plants in the open air (or in open-sided buildings) instead of indoors. In open-air plants, better ventilation makes it less likely that an explosive mixture will be formed, and, if an explosion occurs, damage will be less.

The greater safety of open-air plants is shown by some figures published by Factory Insurance, a large United States insurance group. In a 5 year period, every £100 they paid out for fire and explosion damage was made up as follows:

Explosions inside equipment because air got in	£11
Explosions inside equipment because of run-away reactions or explosive decomposition	£23
Explosions outside equipment but inside buildings	£24
Explosions in the open	£ 3
Vessels bursting (due to corrosion, overheating or overpressure).	£ 7
Fires	£32
	<u>£100</u>

From “Loss Prevention”, Volume 3, 1 969, page 11. Despite Flixborough, explosions in the open are not common.

### 73/4 PRESSURE VESSELS EXPOSED TO FIRE MUST BE COOLED WITH WATER — OR THEY MAY BURST

Newsletter 70 discussed unconfined vapour cloud explosions. This note discusses another sort of explosion that occurs when a pressure vessel is heated by a fire so that the metal loses its strength.

As often pointed out in these Newsletters (see 65/4, 66/supplement and 72/supplement) a relief valve will not prevent a vessel bursting if the metal gets too hot. Vessels exposed to fire can be protected by:

- (1) Cooling with water
- (2) Insulation
- (3) Sloping the ground so that spillages of flammable liquid do not accumulate under the vessels
- (4) Reducing the pressure on the vessel

An article in “Fire Prevention”, May 1974, p<sup>1</sup> 7, gives details (copy on request).

When a pressure vessel bursts under the action of fire, damage occurs in four different ways:

- (1) The bits of the pressure vessel may fly apart with great force and kill or injure people 1000 feet

or more away.

- (2) The pressure of the escaping gas is like an explosion and can injure people who have been missed by the flying bits. Buildings and structures can be damaged.

These first two effects occur even if the material inside the vessel is not flammable. For example, they occur when a steam boiler bursts. If the material in the vessel is flammable, two other effects may occur.

- (3) The escaping gas or liquid burns and the heat may injure people or set fire to buildings.
- (4) The escaping gas or liquid may mix with the air and explode, producing a second pressure wave which does further damage.

One of the worst explosions of a pressure vessel occurred at Feyzin in France in 1966. A leak occurred on a 2000 m<sup>3</sup> sphere containing propane and caught fire at a motorway 500 feet away. The fire burnt under the vessel. The firemen were advised to use their water hoses for cooling the neighbouring vessels. The relief valve, it was thought, would look after the vessel which was on fire. After 1½ hours this vessel burst, killing 18 people and injuring 81. The fire service were wiped out and the fire continued uncontrolled.

The relief valve could not, of course, prevent the vessel bursting as the metal got so hot, thereby reducing its strength so that it burst at (or below) the set pressure of the relief valve.

Below the liquid level the liquid absorbs heat and prevents the metal getting too hot. Above the liquid level the metal can lose its strength very quickly. Some vessels have burst after exposure to fire for only ten minutes.

Road and rail tank wagons containing liquefied flammable gases (LFG) have burst on a number of occasions when exposed to fire. Looking at the four methods of protection listed above, it is hardly possible to reduce the pressure in the tank wagon; the leak may occur on level ground; insulation is not usually used because it adds to the weight. We are therefore dependent on water cooling. Sometimes the fire services may not have sufficient water available or may not realise the importance of cooling with water.

An incident which occurred in New York State in 1974 is described by the US National Transportation Safety Board in Report No. NTSB-RAR-74-4 (copy on request).

A train containing eight rail tank wagons of liquefied petroleum gas (LPG) became derailed. One of the LPG wagons was crushed by the following wagons and split open. The LPG ignited immediately. The fire service were called — they arrived in 10 minutes — and started to cool the wagons which were exposed to the fire. However, they had no idea how much water to use and not very much was available. After half-an-hour one of the tank wagons burst, injuring 54 men, mostly firemen and newspaper reporters. Three more tank wagons burst during the following 10 minutes. After that the fire was allowed to burn itself out. This took seven days.

When the tank wagons burst, half-wagons were hurled 1200 feet. The incident occurred in open country and property damage was slight. A few windows were broken.

Another incident, which occurred in Arizona in 1973, was described in "Fire Prevention", May 1974, p41. A slight leak occurred from a connection while a rail tank car of propane was being unloaded. The operators tried to tighten the connection by hitting it with a large aluminium alloy wrench. The leak caught fire and rapidly became more intense. About half-an-hour after the start of the fire, and ten minutes after the fire service had started trying to cool the tank wagon, it exploded. Thirteen men were killed, twelve of them firemen, and 95 men were injured, mostly spectators who had gathered 1,000 feet away, despite police warnings to move back.

It is fair to point out that no similar incident has occurred in this country. Standards of construction of

road and rail tank wagons are higher and they are much less likely to leak if they are involved in an accident. A few years ago an LPG tank wagon got out of control on a hill, crashed into Dewsbury Town Hall and ended up on its side, without leaking.

These incidents are quoted here to emphasise the importance of:

- (1) Cooling pressure vessels which are exposed to fire with plenty of water as soon as possible  
and
- (2) Keeping unnecessary people out of the way.

### **73/5 THE EFFECTS OF RUST**

Normally we think of the rusting of steel as causing failure because the part gets too thin and is then not strong enough to carry the load. In an article in ICI Engineering News for December 1974 (report AI 28 120/74/12), Alan Cracknell points out that rust can also cause failure in another way. Rust occupies about seven times the volume of the steel from which it was formed. When rust occurs between two plates that have been riveted together, a high pressure develops and this can force the plates apart and even break the rivets.

This effect is commoner than most people realise, and a lookout should be kept for it when inspecting pipe bridges and old riveted tanks.

### **73/6 A MISLEADING NOTICE**

We all know that road tank wagons should be earthed while they are being filled with flammable liquids.

One tanker was not earthed. When this was pointed out to the driver he said "On this design of tanker an earth is not necessary". He pointed out a notice in the cab which said

This vehicle is fully insulated

Attach no earth

This notice actually referred to the vehicle's electric system. On most cars and lorries, the body is used as an earth to complete the electric circuit. On petroleum spirit tankers, all the connections are made by means of wires as accidental sparks due to bad connections are then less likely. The notice meant that the electric wiring should not be earthed. It had nothing to do with the method to be used for filling the barrel.

Do you know of any more examples of notices which meant different things to different people?

### **73/7 OUR FIRST FIRE**

We have had our first fire in the new Petrochemicals Division HQ. A cigarette was knocked against the edge of a desk and the ash fell into a wickerwork waste paper basket containing paper and plastic cups. The blaze was soon put out with a BCF extinguisher.

Do not use wickerwork wastepaper baskets. Use metal ones.

### 73/8 UNUSUAL ACCIDENTS NO.43

A man left his donkey jacket on a steam pipe for a couple of hours. When he returned only the collar was left — the rest had smouldered away.

The steam pipe was covered with temporary insulation only and the heat was sufficient to set fire to some oil on the jacket. Oily clothing or insulation can catch fire at quite low temperatures. Any insulation which gets contaminated with oil should be removed at once — or it will catch fire.

There is a good review of insulation fires in the July 1974 issue of “Fire Prevention Science and Technology”.

### 73/9 EXPLOSIONS IN REACTION VESSELS — AND THEIR INVESTIGATION

The following account of the explosions that occur while practising alchemy is taken from “The Canon’s Yeoman’s Tale” from “The Canterbury Tales” by Geoffrey Chaucer, written about 1386 and translated into modern English by Nevill Coghill.

According to the translator the details of alchemical techniques described by Chaucer are accurate and reliable in so far as they can be checked. Some writers think he had first-hand knowledge of alchemy.

*It happens, like as not,  
There’s an explosion and good-bye the pot!  
These metals are so violent when they spilt  
Our very wails can scarce stand up to it.  
Unless well-built and made of stone and lime,  
Bang go the metals through them every time  
And some are driven down into the ground  
-That way we used to lose them by the pound-  
And some are scattered all about the floor;  
Some even jump into the roof, what’s more.  
.....  
Some said the way the fire was made was wrong;  
Others said, ‘No — the bellows. Blown too strong.’  
That frightened me, I blew them as a rule  
‘Stuff!’ said a third. ‘You’re nothing but a fool,  
It wasn’t tempered as it ought to be.’  
‘No!’ said a fourth. ‘Shut up and listen to me;  
I say it should have been a beech-wood fire  
And that’s the real cause, or I’m a liar’  
I’ve no idea why the thing went wrong;  
Recriminations though were hot and strong.  
Well,’ said my lord, ‘there’s nothing more to do.  
I’ll note these dangers for another brew;  
I’m pretty certain that the pot was cracked,  
Be that as may, don’t gape! We’ve got to act.  
Don’t be alarmed, help to sweep up the floor  
Just as we always do, and try once more.*

### 73/10 RECENT PUBLICATIONS

(a) Safety Newsletters 56-70 have been re-issued as a bound volume. Copies can be obtained from Division Reports Centres by asking for Report No. PC.200,81 0/A.

Bound volumes of earlier numbers are obtainable as follows:-

Newsletters 1-12      Report No. 0.200,630/A

Newsletters 13-21    Report No 0.200,647/A

Newsletters 22-31    Report No 0.200,710/A

Newsletters 32-43    Report No 0.200,762/A

Newsletters 44-55    Report No 0.200,790/A

An index to Newsletters 56-70 can be obtained from E.T., Extension P.2845

(b) The ICI Process Safety Panel have issued a report (No HO/SD/730,009/3A, available from Division Reports Centres) on "Venting — State of the Art". This describes present knowledge on methods of calculating the vent size required:-

To pass a given rate of liquid or gas (p 2).

To cope with runaway reactions (p 4).

To cope with a dust explosion (p 5).

To cope with a gas or vapour explosion (p 27).

There is also a section on the hazards caused by discharge of vented material to atmosphere (p 10) and a section on the equipment available for venting (p 35).

For more information on any item in this Newsletter please phone E.T. (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. Please let her know if the address on your copy is incorrect.

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