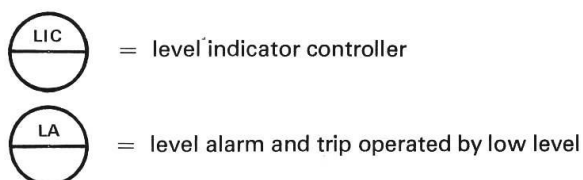
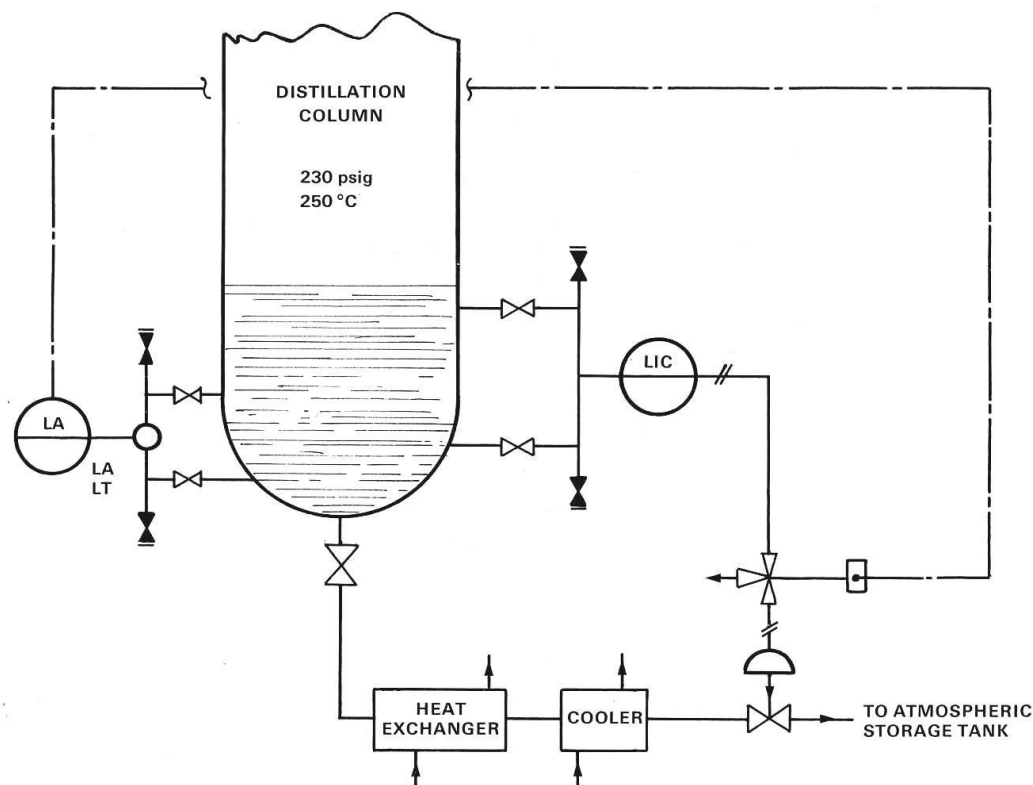


IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No.78

78/1 WHAT IS WRONG WITH THE ARRANGEMENT SHOWN ON THIS LINE DIAGRAM?



If, despite the protective equipment, the level in the distillation column is lost, then vapour will blow through to the atmospheric pressure storage tank and the roof will be blown off.

Safety Note 75/5 "Some Examples of Inadequate Protection on Existing Plant which was not Spotted when the Projects were Operability Studied at the Design Stage", describes what we think is wrong and the changes we think should be made. We can let you have a copy.

78/2 COMPRESSED AIR ESCAPE SETS

On plants which handle toxic gases and vapours the Operators are supplied with ten-minute compressed air escape sets so that they can make their way to safety if a leak of gas or vapour occurs. (On some plants the old fashioned canister respirators are used instead, but these are gradually being replaced by the ten-minute escape sets).

There was a gas leak recently in another Division. Two operators who were in the control room held

their breath and ran through the gas cloud. They were affected by the gas. They said afterwards that this was an instinctive reaction and they forgot all about the compressed air sets when the gas leak occurred.

What would happen on your plant? Do people know why the sets are there? Do they practice wearing them? What would they do in an emergency?

Incidentally, these are called ten-minute sets to distinguish them from the half-hour sets which are used when someone enters a gas cloud to rescue another person or to make an emergency isolation. As the name implies, the ten-minute sets contain only a small bottle of compressed air, enough to let someone run to safety, but not enough to enter a gas cloud to rescue someone else. Newsletter 67/2 described the different sorts of compressed air sets.

78/3 TWO ACCIDENTS COMPARED

ICI 1968	Another Company 1975
WHAT HAPPENED?	
A product of melting point 100°C was stored in a 20 m ³ tank	A product of melting point 20°C was stored in a 25 m ³ tank.
The tank was originally installed with a 6 inch diameter vent	The tank was originally installed with an 8 inch diameter vent.
The vent size was reduced to 3 inches diameter - the reason is not known, perhaps it was to prevent contamination.	The vent size was reduced to 2 inches diameter - to prevent loss of nitrogen.
There was a flow of compressed air into the tank (to prove that the inlet line was clear),	There was a flow of nitrogen into the tank (to keep out air which would make the product change colour).
The vent choked.	The vent choked.
The end of the tank was blown off, killing two men.	The bottom of the tank was bulged and raised off its foundation. Fortunately this was discovered before the tank burst.

WHAT SHOULD WE DO?

An open vent is a sort of relief valve. It must be treated like a relief valve. Its size must not be changed until we have gone through the same procedure as we would go through before changing the size of a relief valve.

Vents on tanks containing high melting point materials must be steam-traced (or electrically heated) and checked frequently to make sure that they are clear.

WHAT ELSE DO THE INCIDENTS SHOW?

Many people do not realise that the compressed air or nitrogen pressure is sufficient to burst a tank.

78/4 A VALVE IS NON-MAGNETIC BUT STILL CORRODES

A valve had to be changed on a plant which handles a mixture of acids. The shift fitter could not find a suitable valve in the workshop, but after looking round he found one on another plant. He tested it with a magnet and, finding it to be non-magnetic, he assumed it was one of the 821Ti or 845B valves normally used on the plant. He therefore installed it.

Four days later the valve was badly corroded and there was a spillage of acids.

The valve was made of Hastalloy, an alloy that is suitable for use on the plant where it was found, but was not suitable for use with the mixture of acids used on the plant in which it was installed.

Reminder: Newsletter 71/6 described some other incidents which occurred because the wrong material of construction was used.

78/5 MONNEX DRY POWDER

On the Wilton Site a large number of volunteer plant firemen have been going through a training programme. As part of their training they have to put out a fire in a tray of petrol 800 square feet in area using Total extinguishers containing 750 kg of Monnex dry powder. The fires are put out in about 10 seconds using an application rate of 35 kg per second; over thirty fires can be extinguished with each extinguisher before it has to be refilled.

800 square feet is quite a big area, about four times the size of a typical living room. The firemen gain considerable confidence from being able to extinguish these large fires in such a short time and this is apparent from their expressions of satisfaction.

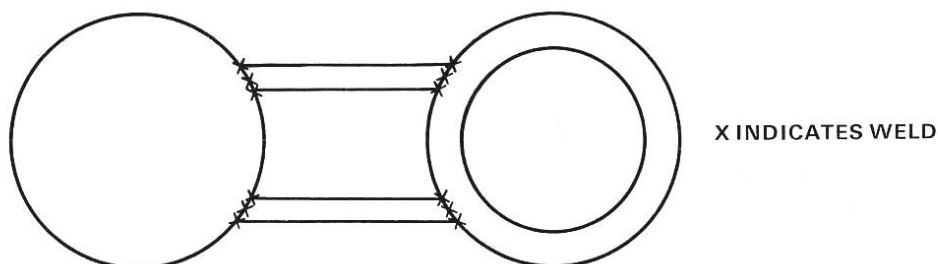
The Monnex dry powder had been in the extinguishers for over four years.

Similar extinguishers have been used in anger on the site on two occasions and also operated efficiently then.

78/6 DESIGN OF LARGE SPECTACLE PLATES

A man leant against the blank of a large spectacle plate and to his surprise it fell off.

The plate was constructed as shown below, using two 5/8 inch diameter bars to join the ring and blank.



One of the bars had been broken for some time and the other was held by only a small weld.

All plates of this type above 10 inches bore should be replaced or, at the very least, checked to make sure that the welds are sound.

According to the Division standard, a piece of plate should be used to join the ring and blank of a spectacle plate.

78/7 A HEAT TRANSFER OIL CATCHES FIRE

Another company has reported that a fire occurred as a result of the rupture of a pipeline carrying heat transfer oil. The rupture was probably a fatigue failure, caused by the repeated expansion and contraction of the pipeline as the temperature varied. The heat transfer oil fell on to some electric cables. It attacked the insulation and a short circuit set fire to the oil.

The report on the incident recommends that the heat transfer pipelines should be checked to make sure they are adequately provided with expansion bends and that they should be installed, as far as possible, away from electric cables and other process equipment. In particular flanges should be placed so that leaks do not fall on lagging or electric cables.

78/8 IF A TANK IS EMPTIED WITH THE VENT BLOCKED IT WILL COLLAPSE

This has been pointed out several times in these Newsletters. For example, in Newsletter 77/2 and in the series of cartoons "How Strong is a Storage Tank?" circulated with Newsletter 56.

Another example is quoted in a letter in the AA magazine, Drive.

"Motorists buying locking petrol caps should ensure that they purchase the correct type. Some petrol tanks do not have a separate breather pipe, and the locking cap must therefore have a breather valve fitted. Failure to fit the correct cap creates a vacuum in the petrol tank, resulting in its complete collapse—as I found to my cost when installing the wrong cap on a Consul L Estate."

78/9 UNUSUAL ACCIDENTS No 48

A flex was choked with solid product. To clear it an operator put it in a drum of water and heated it up with a steam gun. The flex was then removed but the drum was left standing at the foot of a cat ladder. The operator went up the cat ladder and a few minutes later came down, stepped into the drum of hot water and scalded his leg.

78/10 SIX YEARS AGO

From Safety Newsletter No 11, July 1969:

"When a Permit-to-Work is issued to excavate the ground it is normal practice for the electrician to certify first that there are no buried electric cables. What, however, is an "Excavation"? Another Division have reported that at one of their factories a contractor asked for and received a Permit-to-Work to 'level and scrape the ground' As no excavation was requested the process supervisor did not consult the electricians. The contractor used a mechanical shovel, removed several feet from the ground and cut through a live electric cable. It is clear that the word "excavation" needs careful definition in our Works instructions"

78/11 THE USE OF FINELY DIVIDED WATER TO REDUCE THE HAZARD POTENTIAL OF VAPOUR CLOUDS

A few years ago ICI clubbed together with a group of American companies to sponsor a research programme on this subject. Experiments were carried out on ethylene and vinyl chloride and the full report has now been issued. It shows that:-

1. There was no appreciable absorption or adsorption of the gas by the water droplets.
2. The water spray can cause movement of the air and thus assist in the dilution of the gas. The sprinklers and water spray nozzles tested varied widely in their efficiency as air movers. This air pumping action can be used to set up a barrier to the horizontal flow of vapours

Unfortunately the report does not contain sufficient information to enable one to design water spray barriers.

3. The water spray did not prevent ignition and it slightly increased the rate of flame travel, probably because of the increased turbulence.

The full report can be borrowed from Petrochemicals Division Reports File.

Experiments at the Safety in Mines Research Establishment have shown that water can quench an ignition in a coal mine but the quantities of water used are very much greater than in the recent experiments a large quantity of water is injected into the flame when ignition occurs. For details see "The Design and Development of a Triggered Barrier System at SMRE" by H T Ramsay, R S Hinsley and D Waterhouse, *The Mining Engineer*, March 1971, p.381 and "The Design of Triggered Barriers for Arresting Mine Explosions" by R S Hinsley, presented at the 14th International Conference of Mine-Safety Research Establishments.

78/12 SOME QUESTIONS I AM SOMETIMES ASKED

13—CAN YOU RECOMMEND SOME BOOKS WHICH WILL GIVE ME SOME BACKGROUND INFORMATION ON LOSS PREVENTION?

There are plenty of books on mechanical accidents, protective clothing and things like that, but, so far as I know, there is no up-to-date book on the prevention of fires and explosions, serious leaks and so on in the chemical industry. If you would like some background reading, apart from back numbers of these Newsletters, I suggest the following:-

1. The booklets published by the American Oil Company, particularly:

No 1—Hazards of Water

No 2— Hazards of Air

No 5— Hazards of Electricity

No 6 — Hazards of Steam

No 7 — Safe Handling of Light Ends (that is, liquefied petroleum gas)

We have a few spare copies of these booklets which we will give to the first applicants.

2. Some of the papers on loss prevention published by Petrochemicals Division staff, particularly:-
 - “Hazard Analysis — A Quantitative Approach to Safety”, I Chem E Symposium Series No 34, 1971, p.75
 - “Specifying and Designing Protective Systems”, Loss Prevention, Vol 6, 1972, p.15.
 - “Some Loss Prevention Case Histories”, Chemical Engineering Progress, April 1 974, Vol 70, No 4, p.80.
 - “Some Myths of the Chemical Industry”, Proceedings of First International Symposium on Loss Prevention and Safety Promotion, Elsevier Publishing Co., 1 974, p.309.
 - “The Protection of Pressure Vessels Against Fire”, Fire Protection, May 1974, No 103, p.17.
 - “Are Safety Relief Valves ‘Old Hat’?”, Chemical Processing, September 1974, p.77.
 - “Some Questions Raised by Flixborough”, Loss Prevention, Vol 9, 1 975.
 - “Emergency Isolation of Chemical Plants”, Loss Prevention, Vol 9, 1975.
 - “Design for Loss Prevention — Plant Layout”, H G Simpson, I Chem E Symposium Series No 34, 1971, p¹05.
 - “A Means of Containing and Dispersing Leakages of Flammable Vapour”, H G Simpson, Power and Works Engineering, 8 May 1974, p.⁸.
 - “Operability Studies and Hazard Analysis”, H G Lawley, Chemical Engineering Progress, Vol 70, No 4, April 1974, p.⁴⁵.
 - “The Process Engineering of Pressure Relief and Blowdown Systems”, J S Fitt, Proceedings of the First International Symposium on Loss Prevention and Safety Promotion in the Process Industries, Elsevier Publishing Co., 1974, p.³¹⁷.
 - “The Hazard of Gas Phase Oxidation in Liquid Phase Air Oxidation Processes”, J M Alexander, I Chem E Symposium Series No 39, 1974, Paper I.
 - “High Integrity Protective Systems”, R M Stewart, I Chem E Symposium Series No 34, 1971, p.99.
 - “Dispersion of Gases Vented to Atmosphere from Relief Valves”, A L Cude, The Chemical Engineer, October 1974, p.629.
 - “Fire Engineering in Relation to Process Plant Design”, R B Robertson, Fire International, September 1 974, p.69.

Copies of these papers are available from us.

3. The *Loss Prevention Bulletins* published by The Institution of Chemical Engineers.
4. The eight volumes of *Loss Prevention*, published by the American Institute of Chemical Engineers each year since 1967, reporting the papers and discussions at the annual Loss Prevention Symposia.
5. "Major Loss Prevention in the Process Industries", Institution of Chemical Engineers Symposium Series No 34, the report on a Symposium held in Newcastle in 1971, especially the articles by P L Klaassen on p.11 and R G Pickles on p.61.
6. "Loss Prevention and Safety Promotion in the Process Industries", published by Elsevier, the report of a Symposium held in The Hague in 1974.

Finally, the following (originally quoted in Newsletter 5/10) is taken from the foreword to the American Oil Company booklets:

"It should not be necessary for each generation to rediscover principles of process safety which the generation before discovered. We must learn from the experience of others rather than learn the hard way. We must pass on to the next generation a record of what we have learned"~

The record is in these publications. It is up to us to learn from their experience.

78/13 RECENT PUBLICATION

There has been a lot of interest since Flixborough in methods of estimating the damage caused by the explosion of an unconfined vapour cloud. There is a good review of the subject in a paper by D A Decker, "An Analytical Method for Estimating Overpressure from Theoretical Atmospheric Explosions".

For a copy of this paper or 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 Turner to add your name to the circulation list.

July 1975