

IMPERIAL CHEMICAL INDUSTRIES PETROCHEMICALS DIVISION

SAFETY NEWSLETTER NUMBER 39

By Trevor Kletz

If an incident which happened on your plant is described in these Newsletters you may notice that one or two unimportant details have been changed.

Sometimes this has been done to make it harder for people to tell where the incident occurred.

Sometimes this has been done to make a complicated story simpler, but without affecting the essential message.

Sometimes the incident did not happen on your plant - another plant had a similar incident.

39/1 SHOULD WE REPORT SUCCESSES AS WELL AS FAILURES?

“Our failures show very clearly and our successes never show, that is one of the problems. The technique we have been trying with some success in our reporting procedures is to emphasise success aspects of the incident - in other words a fire was controlled by a few sprinklers. What might the damage have been if the sprinkler system had not been commissioned and working properly; or the fire brigade was on the job in two minutes and there was a ten thousand dollar loss. We had a loss, but without adequate control it could easily have been a two million dollar loss”.

A L Miller, Monsanto Co., Proceedings of the Symposium on Major Loss Prevention in the Process Industries, I Chem E Symposium Series No. 34, 1971, page 255.

39/2 A FIRE IN A HYDROCARBON PROCESSING PLANT - THE VALUE OF REMOTELY OPERATED ISOLATION VALVES

R L Miller's remarks are illustrated by a fire which occurred recently. The fire burned for six hours in the middle of a congested plant but the damage was localised. Seven years ago a fire of this magnitude would probably have led to the destruction of the plant.

Several lessons of general interest can be learnt from the fire which started as a leak on a large pump handling several hundred tons per hour of volatile hydrocarbons. The leak was due to a coupling failure with subsequent bearing and seal collapse. The source of ignition was sparks produced by the rotating shaft striking the main pump casing.

In the following, lessons from the fire-fighting are discussed first. This is followed by a discussion of the value of remote isolation valves for isolating leaks.

1. LESSONS FROM THE FIRE FIGHTING

1.1 Disposal of Water

Surrounding equipment was cooled and as a result damage was very slight. Cables were destroyed but structures and vessels were unharmed. About 3,000 gpm of water were used for cooling and foam making. Although this quantity is not large - 10,000 gpm might be used in a major fire - it was too much for the drains and a pool of water covered with hydrocarbon began to fill the plant. Temporary pumps were used to pump out the water and two fire appliances were also used. The water was pumped into a reservoir and into an area, of low-lying ground. The Fire Brigade have now agreed that whenever ten or more pumps are called to a fire, two extra will be called in for pumping out.

Although the drains on the plant concerned are particularly poor, nevertheless, on all our plants the capacity of the drains is being measured and plans are being made for the

disposal of fire-fighting water. These plans include provision of sufficient pumps, provision of suction facilities (eg slipper strainers which make it easier to get suction from a shallow pool) and plans for the disposal of the water which is pumped away.

1.2 Value of Dry Powder

The pool of water, covered by hydrocarbon, which filled the plant, was covered with foam. From time to time the foam was disturbed by firemen, hydrocarbon broke through and caught fire. Monnex dry powder was most effective in extinguishing these fires and altogether 4,000 lb was used. The stock available has now been increased to 6,000 lb. The 150 lb size was found to give the best compromise between size and manoeuvrability, although in other cases 250 lb or 500 lb might be more suitable.

All Works are now reviewing their stocks of Monnex dry powder extinguishers.

1.3 Confinement of Excess Water

On new plants the ground is graded so that excess water does not accumulate under the plants but runs off to the side. The fire confirmed the value of this policy.

During the fire, sandbags were used to confine the hydrocarbon leakage to the neighbourhood of the pump and were found most valuable.

On each site, a stock of at least 2,000 ready filled sandbags, made from woven plastic, is being made available.

On plants on which excess water is liable to flood all over the plant, the construction of low permanent walls to prevent unrestricted spread is being considered.

1.4. Liaison with the Fire Brigade

Fire-fighting was made easier by the friendly 'Christian-name' personal relations which existed between the officers of the Fire Brigade and the Works Manager and his staff, the result of frequent exercises and informal contacts.

1.5 Value of Vapour Depressuring

The vessels exposed to the fire were lowered in pressure through process lines, but some ingenuity had to be used to find a method that did not involve the operation of valves in the fire area. It has been agreed (before the fire) that on new plants all vessels will be provided with remotely operated facilities for vapour depressuring. It must be emphasised that if a vessel gets too hot the relief valve will not protect it; the vessel may burst below the set pressure (see Newsletter 36, Item 3).

We should consider how the vessels on all our plants will be depressured in a fire and, if necessary, should make special provision.

1.6 Value of Liquid De-burdening

The fire was finally extinguished by emptying the vessel feeding the fire, into a road tank wagon. Note, however, that unless vessels are feeding the fire, they should not be de-burdened.

In general, remote isolation valves provide the best way of isolating a leak (see below). The installation of special de-burdening lines often creates hazards and, therefore, no general recommendation on de-burdening is made. (See Newsletter 36, item 3.)

1.7 Value of Spare Manpower

The fire started at 06.00 hrs and 2 or 3 hours later ample manpower was available. This was most useful for handling sandbags, used fire extinguishers etc. Technical manpower, eg former plant managers, was found most useful in working out ways of emptying the vessel feeding the fire etc.

Whenever a fire extends beyond half-an-hour men should be called in to provide general manpower and to provide extra technical effort. This should be part of the emergency plan.

1.8 Other Points

The fire showed the value of a Works auxiliary fire team - the Site is too small to justify a full-time shift service - and the value of training operators in fire-fighting and the action to take in a fire.

The fire demonstrated the importance of keeping roads open. Spare fire appliances should be parked off the road.

1.9 Fire Detectors

The fire raises again the question of fire detectors. In the past Sieger combustible gas detectors have been preferred as they detect all leaks, not just those that fire. However, they do not detect leaks that fire instantaneously.

Infra-red and ultra-violet detectors are rather sophisticated for industrial use. A simple detector can be devised by utilising the fire to: -

- (a) Burn a wire and break a circuit
- or (b) Burn a plastic tube and release the air pressure
- or (c) Melt a metallic link and release a wire which is under tension.

2 REMOTELY OPERATED ISOLATION VALVES

Prevention of the fire in the first place is, of course, far better than skill in extinguishing and containing it. The suction and delivery valves on the pump which leaked had been provided with automatic operation but this was done for process reasons rather than to isolate a leak. The operating buttons were dangerously near the fire and the supervisor took a risk in operating them. By the time he did so, the electric cables had already been damaged and not all the valves shut fully.

Considerable sums have been spent on remote isolation valves. They isolated a leak which caught fire in 1970 (See Newsletter 27, Item 3) and this incident alone probably paid for all the remote isolation valves that we have installed. As a result of the recent fire we are looking at our plants again to see if there are any further locations in which remote isolation valves should be installed and if the operating buttons for existing valves are far enough away.

In many cases the stop buttons for compressor and pump motors need to be placed some way from the machines. A bad leak occurred on a compressor last year and the machine could not be stopped quickly as the stop button was too near. Safety Note 72/4 reviews the current practice in the Division and makes recommendations.

There are three types of equipment on which remote isolation valves should be installed.

- 1 Equipment which experience shows is liable to leak in service, for example, very hot or very cold pumps.
- 2 Equipment which is less likely to leak but where if it does leak a very large quantity of material will run out and there is no way of stopping it.
- 3 Equipment which is less liable to leak but where because of the size of the equipment a leak will be very large. For example, the pump which was involved in this fire.

In addition, if the inventory between the isolation valve and the leak is large, or if the isolation valve is unlikely to give a good shut-off, then a remotely operated blow-down valve may be needed as well as a remotely operated isolation valve.

Note that in some cases the isolation valve can be remote by distance rather than by the provision of pneumatic or electric power.

Valves up to about 6 inches in size are normally held open by pneumatic or electric power and, if no-one remembers to operate them, will close when the fire destroys the air line or electric cable. Large valves require power to close them and the air lines or electric cables must be given 15 minutes fire protection.

The following illustrates an argument that may be used to decide whether or not remote isolation

is justified in a particular case.

Suppose the cost of installing a remote isolation valve (or motorising an existing valve) is £1,000.

Suppose a leak on the equipment being protected could lead to damage and loss of profit worth £1,000,000.

Then if the chance of a leak of this size is greater than 1 in 1,000 in the life of the plant (or 1 in 10,000 per year) the expenditure is justified as an insurance policy, quite apart from any risk to life.

39/3 OXYGEN DEFICIENCY ALARM

Newsletter 36, Item 1, mentioned a new pocket-size instrument which sounds an alarm if the amount of oxygen in the air gets too low. It was hoped that the device would be available by the time the Newsletter appeared. Unfortunately, the manufacturers have run into difficulties and the instrument will not be on the market before the Autumn.

The portable combustible gas alarms mentioned in the same Newsletter item are now available.

39/4 A CRANE BUMPS INTO AN OVERHEAD LINE

A jib of a mobile crane recently bumped into a pipeline containing hydrogen. Fortunately, the line did not fracture. The line was not on a pipe bridge but crossed the road on its own.

The report recommends that overhead lines that cross roads should be painted with black and yellow stripes.

39/5 THREE YEARS AGO

A road tank wagon which had contained LPG was being swept out before being sent to the garage for repair. The laboratory staff were asked to analyse the atmosphere in the tanker to see if any hydrocarbon was still present. The laboratory staff are often asked to analyse the atmosphere inside LPG tankers but usually to see if there is any oxygen present. Owing to a misunderstanding they assumed that an oxygen analysis was required in this case and reported over the telephone "non-detected". The process operator assumed that no hydrocarbon had been detected and sent the tanker for repair.

Fortunately, the garage had their own check analysis carried out and this showed that LPG was still present - actually over 1 ton.

For most plant control purposes telephone results are adequate but where analyses are made for safety purposes, results should be accepted only in writing.

From Safety Newsletter No. 9, April 1969.

39/6 UNUSUAL ACCIDENTS NO. 9

One of our overseas Companies reports an unusual lost-time accident - a man leaned forward to reach the toilet paper and strained his back.

They did not count this one.

39/7 HOW TO HIJACK A 'PLANE?

On returning from my recent visit to South Africa I was pleased to find that the airline were taking steps to prevent hijacking. At the security check I was asked to open a long parcel that I was carrying. When the checker saw there were six wooden spears inside (presents for my sons and nephews) he said, "I think we had better look after these for you and give them to you when you get to London."

39/8 RECENT PUBLICATIONS

- (a) "Fire Risk in the Storage and Industrial Use of Expanded Plastics", Technical Data Note No. 29 published by the Factory Inspectorate and available from your Safety Officer or Division Library.
- (b) The Air Pollution Working Party has issued a guide to the choice of detector tubes for the determination of toxic gases in air. Copies are available from the secretary to the Working Party,

Mr D A R, Organics Division, Hexagon House, Manchester.

- (c) Newsletter 27, Item 1 and Newsletter 30, Item 1 described a number of serious incidents which have occurred as the result of corrosion at places where oil and water meet. This caused a serious fire at Esso, Fawley in 1969 and a detailed account has now been issued.
- (d) "The Design of High Integrity Protective Systems : Hazard Analysis", Note No. Olefine/9/B, describes ways of dealing with some of the problems that arise.
- (e) To estimate hazard rates we usually use the equation:

$$\text{Hazard rate} = \text{Demand rate} \times \text{Fractional Dead Time}$$

This equation will not give the correct answer if the demand rate is so high that several demands occur in each proof test interval (See Safety Newsletter 33, Item 7). A note dated 22 February 1972 gives an equation which can be used in all cases.

- (f) "Precautions to be Observed in the Use of Oxygen", Agricultural Division Code of Practice No. PA/CP/12A available from Standards Section, Agricultural Division.
- (g) An article in the "Oil and Gas Journal", 7 February 72, page 83, describes nine incidents in which compressors have been damaged by sucking in loose objects.

For copies of (c)-(e) or for more information on any other item in this Newsletter please write to Miss M N Organic House, Billingham or ring 8.3927. 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.

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