

IMPERIAL CHEMICAL INDUSTRIES HEAVY ORGANICS DIVISION

SAFETY NEWSLETTER NUMBER 5

By Trevor Kletz

5/1 REPEATED RESETTING OF A TRIP SYSTEM RESULTS IN THE BURSTING OF A VESSEL

An electric heater heats a circulating nitrogen system. A choke occurred elsewhere in the system and caused the circulation to stop. The flowmeter was not working so this was not apparent to the operators. The heater got too hot and a high temperature trip shut off the electricity supply. The operator assumed that the trip was faulty and reset it. Ten minutes later it tripped out again. The operator again assumed it was faulty and reset it for the second time. After another ten minutes the power was tripped out for the third time and for the third time the operator reset the trip. Soon afterwards the shell of the heater split open.

The immediate cause of the rupture was the readiness of the operator to assume that the trip was faulty. Even though it repeatedly tripped out he did not investigate. Contributory factors were:

- (1) The temperature setting on the trip was too high and
- (2) During the time the incident took place the supervisor was not present; he was handing over his job to the next shift and this is traditionally done not in the Control Room, but in a distant office.

5/2 TANK VENTS

Two recent incidents have drawn attention to the need to maintain in good condition the vents on tanks which are not fitted with relief valves but are vented directly to the atmosphere.

In the first incident a tank was sucked in because the flame arrestors in all three vents were choked with dirt. The flame arrestors are scheduled for yearly removal and inspection but because of pressure of work they had not been inspected for 2¹/₂ years.

In this first incident no-one was hurt but the second incident had serious consequences - two bystanders were killed. A material, which crystallises at 97°C, was stored in the molten state in a storage tank kept hot by a steam coil, and vented by means of a 3" diameter hole in the top. The inlet line to the tank was blown with air to make sure that it was clear before moving in more material - the usual practice. The vent was choked with solid material. The pressure in the tank rose and the end was blown off.

These two incidents show that all vents on tanks must be checked regularly. We have systems for checking relief valves; the simplest sort of relief valve - a hole - also needs regular checking. It should be possible to see clearly that the hole is clear. If the tank contains flammable vapour so that a flame arrestor has to be fitted in the hole, then the ideal arrangement is one in which the flame arrestor can be lifted out by hand and both the vent and the flame arrestor seen to be clean. If we have to rely on fitters to remove flame arrestors, then inspection may be delayed by pressure of work.

When tanks are used for the storage of substances which are solid at ambient temperatures, the vents (whether fitted with flame arrestors or not) must be well heated and should be checked frequently say every day. If the checker cannot see that the vent is clear then a dip-hole in the tank should be opened before any movement of gas or liquid is made into the tank or any withdrawal of liquid takes place. Alternatively the tank can be fitted with a simple flap valve, but the operator must check that this is working freely.

These incidents also show that many operators do not appreciate that tanks (and other items of equipment) may not always withstand the pressures to which they can be subjected to normal use. In our training of Process Operators there is a danger of teaching them sophisticated chemical

engineering and forgetting that they may not understand simple facts like this. The incident described in Item 1 above illustrates the same point.

5/3 TESTING THE ATMOSPHERE IN STACKS (see also 18/4)

In Newsletter No. 3 I said, "During the last few years a number of explosions have occurred in flare and vent stacks. They could have been prevented by regularly analysing the atmosphere in the base of the stack to see if any air was getting in. Regular analysis of the atmospheres in all stacks is strongly recommended. In Chemical Engineering Progress, June 1968, p. 49, there is an account of a number of flare stack explosions which occurred because in one way or another air had been allowed to enter the base of the stack. In some cases corrosion had occurred, in other cases a valve had been left open, in all cases the purge gas had been isolated or the flow of purge gas was too small. The incidents described are very similar to those which have occurred on HOC plants and which could have been prevented by regular monitoring of the atmosphere in the stack.

5/4 DIRECT CONNECTIONS TO SERVICE LINES

If we install permanent connections between process lines and service lines then if the pressure in the service line fails, it becomes contaminated with process material. Nitrogen lines often become contaminated in this way; four times in the Division this year. Direct connection of Tees Valley Water lines to other lines, is, of course, illegal.

On the other hand, if we have no permanent connections and use flexes, operators are liable to get splashed with process material when disconnecting the flex.

What is the best action to take?

In general, contamination of service lines with flammable or corrosive materials can produce serious consequences over a wide area. Accidents with flexes on the other hand, though unpleasant, are localised and it is rare for more than one man to be involved. In general, therefore, permanent connections between service lines and process lines should be avoided unless the service is being used all the time. In this case, the service pressure and the process pressure should be monitored regularly and the service isolated if the pressure difference between them gets too low. There should be a low pressure alarm on the service supply. Non-return valves should be installed in the service line but do not rely on them working.

5/5 OXYGEN CYLINDERS

When the main isolation valve on an oxygen cylinder was opened recently there was a bang followed by a small fire on the pressure control valve. The fire was soon put out. It is believed that the pressure control screw of the regulator had not been zeroed before the bottle was opened up. As a result, when the isolation valve was opened, a surge of gas passed into the second stage of the regulator, burst the second stage diaphragm and came out through the vent.

If you use oxygen cylinders, are the operators aware that the regulator control screw must be zeroed before the isolation valve is opened?

5/6 EXPLOSION IN A CENTRIFUGE

Another Company has told us about an explosion in a centrifuge which resulted in two fatalities. The centrifuge handles a flammable solvent and was therefore blanketed with nitrogen to keep out the air. During maintenance a cover plate between the body of the centrifuge and the drive housing was left off. The nitrogen supply could not prevent air entering the body of the centrifuge and an explosion occurred. The source of ignition was probably sparking from the drive pulley which slipped and fouled the casing, but the actual cause of ignition is unimportant. If an explosive mixture is allowed to form in a vessel like a centrifuge, which contains moving parts, a source of ignition will turn up.

This incident shows the importance of regularly monitoring nitrogen blanketing to see if it is in operation and is being effective. This applies to tanks, stacks, crankcases and anywhere else where nitrogen purging is used, as well as to centrifuges. In addition, a low pressure or high oxygen alarm is desirable in a centrifuge, due to the ease with which sources of ignition can turn up in a system containing moving parts.

If you use centrifuges, I also suggest that you check them to see if there are any similar covers which can be left off in places which are not obvious when the centrifuge is assembled. The centrifuge used in the incident described was a Sharples Tornadomatic.

5/7 STORAGE OF PETROLEUM SPIRIT

Before we can store petroleum spirit we have to have a licence issued by the Local Authority, who are normally advised by the local Fire Service. The Home Office have recently issued a new Model Code for the storage of flammable liquids, for the advice of local authorities. Some parts of the Code are not clear but we have agreed on an interpretation with the Teesside Fire Service. For details please see Mr. L.B.R, HOC Engineering Department,

5/8 BREATHALYSERS

Breathalyser type kits are available for many toxic chemicals. They are simple to use and in some Works are used by supervisors and operators; in other Works by laboratory staff only. If they are available for use by supervisors and operators then they are likely to be used more often for testing doubtful atmospheres and they will encourage a greater interest in the concentrations of materials, such as benzene, in plant atmospheres. Factory Inspectors are now being issued with these kits.

5/9 SECTION MEETINGS

Many a Section or Works Manager, in a moment of good intentions, has said he will bring up safety at every one of the weekly (or monthly) meetings, and to show that it is the most important subject, will spend a few minutes on it. After a few months this is forgotten. Why?

Because the people present soon tire of hearing the Safety Foreman report in detail how someone bumped into a projecting scaffold pole, while they are waiting to discuss more important matters - the month's output, the month's costs, the coming shut-down.

Discussing safety at the Works or Section Meetings need not mean discussing the month's accidents. If they are trivial, or not of general interest, they should be ignored. It is far better to discuss those dangerous occurrences which might have caused serious injury. If there have been none, dangerous occurrences on another Works can be discussed, or the audience can be reminded of the incidents that happened last year, or the year before. Some of the incidents described in this Newsletter might even be discussed.

5/10 A QUOTATION

Incidents similar to those described in this Newsletter have happened before in the Division, some of them several times. The fact that they have happened again shows that we have still got a long way to go before we can be sure that the lessons of the past are not being forgotten.

"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" (From the Foreword to the series of 10 booklets on hazards in refining and related operations, published by The American Oil Co. If you have not seen these booklets they are strongly recommended. They are available from The American Oil Co., Whiting, Indiana. I will gladly give you a free sample.)

Many thanks to all those who replied to the message at the end of the last Newsletter. I have been encouraged .to learn that so many of my bottles landed on friendly shores.

4th November 1968