SAFETY NEWSLETTER

No. 101

IN THIS ISSUE

SOME RECENT FIRES

IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

THREE BIG FIRES WITH LESSONS FOR US AIl

This month we describe three serious fires which have occurred in ICI during the last year or so. They all show points of general interest.

101/1 A BLOWDOWN SYSTEM FAILS TO WORK BUT FIREWALLS CONFINE THE FIRE

A fire which occurred in the Division earlier this year was our most serious fire for several years. Several lessons of general interest can be drawn from the report (PC21763/1 & 2/B).

1 The fire started when a leak occurred on a valve of a specialised and unusual design. The leak occurred at the joint between the two halves of the body. The joint was of the spigot and recess type with 1/32 inch CAF material trapped at the bottom of the recess. The diametral clearance between the spigot and recess should be very small; however, over years of use it had become many times greater, thus allowing some of the joint material to be blown out through it. It appears that the importance of maintaining a small clearance had been forgotten. (See page 7).

Is there any similar equipment on your plant?

There was no obvious source of ignition but the leaking gas was close to its auto-ignition temperature.

2 On the plant concerned a number of leaks have occurred over the years, some of which have fired. The leaks have been stopped and the fires extinguished by opening blowdown valves at the bottom of the major vessels and blowing all the liquid and gas into a blowdown tank and stack. On this occasion many of the blowdown valves failed to open. The gas pressure blew off in 20 minutes through leaking joints and through a pipe which ruptured due to the heat; the liquid leaked out gradually and the fire lasted for four hours.

The blowdown valves are operated by gas pressure, process gas being used. Some failed to operate because there was water in the impulse lines and this had frozen. During the week before the leak it had been exceptionally cold and the plant had been shut down. If the plant had been on line the heat from the plant might have prevented freezing.

Two years ago an operability study was done on the plant. The team were asked if water might be present in the impulse lines and they said “No”. Some of the men on the plant knew that, when impulse lines were broken, liquid came out, but the significance of this was not appreciated and the information was not passed on to the managers.

Operability studies are not infallible. They harness know/edge and experience in a systematic way but no technique can make up for lack of knowledge.

Note: On most plants we prefer to blow off the gas pressure when a fire occurs but leave the liquid in the plant, as it absorbs heat and prevents damage to the vessels. See Newsletter 28/7.

3 The emergency blowdown system is tested every time the plant shuts down — every few months. It might be better to test it before start up — to make sure it is in working order — but previously the emergency valves had never been known to fail to open but they had sometimes failed to shut, so there was good reason for the practice. Now the blow-down valves are tested before start-up — and more often.

When do you test your emergency systems?

4 The emergency blowdown system had been extended at various times and consisted of a number of small valves, of various shapes and sizes, in different parts of the control room. Although it was operated correctly the opportunities for error were large and the system is now being rationalised.

What do your emergency controls look like?

5 The equipment which leaked was isolated from the rest of the plant by a brick wall which was very effective in restricting damage — on one side destruction, on the other side paint not even scorched.

On most p/ants we do not like fire-walls as they restrict ventilation but they can be very

valuable if a section of a p/ant is particularly liable to leak. Access to the area behind the fire-wall should be restricted.

6 When the operators first saw the leak they tried to isolate it. To do so they could close one of two valves, A and B. After the fire they were sure that A had been closed but examination of the wreckage showed that A was open and B was closed.

When people are under stress their recollection of detail may be incorrect. Their actions may also be incorrect although they were not in this case.

101/2 UNSUITABLE USE OF PLASTICS CAUSES A FIRE TO ESCALATE

The second fire occurred in another Division and caused extensive damage.

It started when a 40 gallon drum burst in a process area due to polymerisation of the contents. Drums had occasionally burst before in areas of lower fire risk and this had come to be accepted.

On this occasion the sticky liquid inside the drum caught fire. The source of ignition is not known; perhaps the lid produced a spark when it hit the tiled floor.

The fire would probably have been small — but for three factors:

(a) Some plastic pipes melted and flammable liquid came out, adding to the fire. The report states:

"Plastic (ie, polythene) pipes have been used extensively.... The need for such a material has been on the grounds of either cleanability, disposability or flexibility and the Panel accept that this is justified to a degree. However, the extent and manner of such use is certainly questionable."

"…… use should be limited to those sections where there is a clear benefit and then only when effective arrangements can be made to prevent a major spillage or failure. Such arrangements should preferably include automatic closure of feed valves and also adequate operational procedures to ensure that plastic pipes are not left unattended under pressure."

Safety Note 74/4 surveyed the use of plastic pipes in Petrochemicals Division and recommended that they should not normally be used for flammable liquids and gases and that if any plastic is used it should be glass-reinforced resin.

(b) Plastic filter bodies on compressed air lines melted and the escaping air made the fire burn more fiercely. The heat melted stainless steel piping and caused early failure of the fire-resistant ceiling. The report states:

"A requirement that the state of the filters should be visually apparent had been imposed at the design stage and for this reason clear plastic bodies had been selected. ""Heat resistant materials should be used for all elements of a compressed air system in any area where a spillage fire could occur."

(c) The use of Saunders diaphragm valves and, in some cases, of polythene pipe gaskets gave rise to further spillages once the equipment was enveloped in the initial fire. The report states:

"The replacement of isolation valves containing non-fire-resistant elements (eg Saunders valve diaphragms) should be considered wherever their failure could result in a spillage of hazardous materials to feed a fire."

Reminder: Newsletter 17/8 reported a small fire in an electrically-heated PVC line and recommended that these lines should not be electrically-heated.

101/3 LACK OF FIREPROOFING INCREASES DAMAGE

The third fire occurred in the Division. It started with a lagging fire which caused some flanged joints to spring and the flames caused other pipelines to fail. The feed to the plant was soon stopped and, as the inventory was not large the fire was soon out. As the structure was not fire-protected, parts of it had to be replaced.

Our usual fire-protection had been left off, for several reasons:

1 The ground underneath the plant had a good slope — about 1 in 40 — so a pool of liquid could

not form and a pool fire was impossible. However, liquid and vapour burned as they leaked and liquid burned as it dripped down the structure. The damage was comparable with that caused by a pool fire.

Do not leave off fire-protection just because the ground has a good slope.

2 The inventory in the plant was small and there were a number of emergency isolation valves.

We install emergency valves so that we can isolate the equipment which is most likely to leak, but leaks may occur elsewhere.

3 The plant was a relatively small one with a relatively low cash flow. The probability of a fire was not large and it was judged that the cost of fire-protection was not justified. Fair enough, but before you use this argument remember that *the damage caused by lack of fire-protection may be greater than you expect,*

Finally, a good point about all three fires — no-one was injured.

101/4 CAN YOU TELL WHETHER A BALL VALVE IS SHUT OR OPEN FROM THE POSITION OF THE HANDLE?

Usually you can, but there are a few ball valves in which it is possible to fix the handle in the wrong position and then you cannot tell whether the valve is open or shut. The following is a list of these types:

1 Old pattern Klinger cocks
2 Old pattern Truflo ball valves ½ inch - 2 inch nb, series 1000
3 Serck Audco/JSL ball valves ½ inch - 2 inch nb
4 Worcester ball valves 3 inch - 8 inch nb

Have you got any of these on your plant?

101/5 A QUESTION I HAVE HEARD ASKED—

"WHAT DO THE FACTORY INSPECTORATE THINK IS ADEQUATE TRAINING,

ADEQUATE SUPERVISION, A SAFE SYSTEM OF WORK AND SO ON?"

Under the Health and Safety at Work Act employers have to provide a safe plant and system of work and adequate instruction, training and supervision. At a meeting a few months ago a Factory Inspector was asked to describe a safe system of work, adequate training and so on. This question shows that some people do not understand the intentions of the Act.

The old system of control, as illustrated by the Factories Act and followed in most other countries, is for the authorities to write regulations which industry must follow.

In the UK we have come to realise that regulations cannot keep pace with complex and rapidly changing technologies and that another method of control is needed. It was suggested in the Robens Report and brought into operation by the Health and Safety at Work Act (1974).

Under this Act it is the responsibility of the employer to decide what is a safe plant and method of working and what is adequate instruction, training and supervision (unless there happens to be an old regulation on the subject). If the Factory Inspectorate do not agree they will say so, and, if necessary, will issue an Improvement Notice or a Prohibition Notice. But in the first place it is up to the employer to decide. The Factory Inspectorate are always willing to give advice on specific technical matters, for example, on the guarding of machinery, but they cannot claim to know the problems of an industry better than those who work there. Those who work in the industry are those best qualified to decide what is adequate instruction, training and supervision.

The disadvantage of the new system is that we cannot find the answers to our questions by looking up a book of rules. We have to decide for ourselves what is adequate (assisted in many cases by Codes of Practice). But this is outweighed by the advantages. We are not confined by rules which are out-of-date or inapplicable.

The Factory Inspectors prefer the new system too (though some have not yet got used to it) as it gives them greater powers. If they want to stop an unsafe practice they no longer have to find a

regulation that has been broken. (There is an old story about a Factory Inspector who wanted to prosecute a firm who had been working unsafely; fortunately he found one regulation they had broken — they had not whitewashed the factory walls every 14 months as required by the Factories Act, Section 1(3) (c)). At the same time the Factory Inspectorate are unlikely to abuse their powers. They are responsible to the Health and Safety Commission — a body representing employers, trade unions and local authorities.

101/6 UNUSUAL ACCIDENTS No. 68

While driving a Landrover along a public road, two members of the Division heard a noise coming from below. They stopped and looked underneath but could see nothing wrong and so, as they were near their destination, they decided to carry on slowly. They had reached the end of their journey when the brakes failed and they hit the side of the garage. Although they were going slowly, the door and wall were pushed in.

It was found that a piece of lagging wire had been picked up by the vehicle and had wrapped itself round the transmission shaft. The end of the wire, as it turned round and round, cut through the rear flexible brake pipe causing failure of the brakes.

101/7 RECENT PUBLICATIONS

(a) Report No PC.200,850/A summarises 72 fires and explosions, 23 toxic releases and 43 transport accidents in the oil and chemical industries reported in the press during 1976.

(b) Safety Note 77/7 summarises some recent papers on hazard analysis. (Safety Note 75/3 summarised some earlier papers).

(c) Safety Note 77/8 gives more information on water curtains for dispersing leaks including a comparison with steam curtains and a sample calculation.

(d) “Do we really need major hazard substances in our industry?”. A short article from “Safety and Rescue”, May 1977.

Item (a) can be obtained from Division Reports Centres. For copies of (b)—(d) 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 T to add your name to the circulation list.

July 1977

With this issue we start a new series on practical advice to plant engineers on some of the problems they meet in their daily work.

AN ENGINEER'S CASEBOOK

No 1 — OVERHAUL, REPAIR, RECONDITION - WHAT DO WE MEAN?

Item 101/1 in this Newsletter referred to a leak which developed at the body joint of an HP valve leading ultimately to a fire. Intensive investigation afterwards revealed that the specified close fit between the spigot and recess of the trapped joint, dimensioned on the detail drawing of the valve, had been lost. The diametral clearance should not have exceeded 0.002 inch; in fact it varied from 0.021 inch to 0.029 inch. Clearances of this magnitude are too great for full containment of the 1/32 inch thick CAF gasket material, a requirement of a trapped joint.

The valves concerned were sent out for overhaul and repair to a workshop which had undertaken such work for decades. However, very few of these special valves now remain in service and most of the men who were familiar with them have retired, particularly the supervisors and inspectors, who, in the absence of written overhaul and reconditioning procedures, applied their own standards based on experience.

Close inspection showed up other undesirable features in reconditioned valves and brought home the need to specify what is meant by "overhaul and repair" or "recondition as required". In general it will be necessary to do more than quote the original Standard or Drawing No since these rarely indicate allowable weardown tolerances. It will be necessary to agree with the repairer precisely what is to be done, when, and how, so that reconditioned items are truly equivalent to new ones.

E H FRANK

WHO'S WHO IN SAFETY

No 15 — Dr G I Cain

Graham Cain left Crewe, where he was born and brought up, to study chemical engineering at Birmingham University, gaining a PhD for research into heat transfer in fluidised beds.

After spending his first nine months with ICI in the Research Department of HOC Division, he was transferred to Oil Works in 1967 as part of a special shift team, afterwards becoming assistant plant manager and special duties manager in the carbonylation machines area.

Since Graham became Oil Works Technical Safety Manager in 1969, the Works' safety performance has improved year by year and, particularly in 1976, there has been a general increase in "personal safety awareness".

Graham has travelled throughout Europe from Yugoslavia to the Pyrenees and to Iceland (to enjoy a snowstorm in August) in pursuit of his main hobby, mountain and moorland walking. While crossing a mountain ridge in France there was a sudden hailstorm and Graham was made forcibly aware of one of the lesser-known dangers of climbing — and an accident statistic often quoted by safety experts — when he was nearly struck by lightning. The group had to sit out the storm using the technique recommended in the "Mountain Safety Handbook": Get off the highest point, sit down, if possible on a non-conductor such as a rucksack, and place your elbows on your knees so that any lightning strike by-passes the trunk.

Graham, a bachelor, is also interested in the safer pastimes of photography, gardening and listening to music.