

IMPERIAL CHEMICAL INDUSTRIES PETROCHEMICALS DIVISION

SAFETY NEWSLETTER NUMBER 42

By Trevor Kletz

42/1 SIX WAYS TO SUCK IN A TANK

Several Newsletters have described ways in which tanks have been sucked in.

- (a) A tank was sucked in because the flame arrestors on all three vents were choked with dirt. They had not been cleaned for over two years (Newsletters 5/2 and 34/11).
- (b) Another tank was sucked in because a flex was connected to the vent and the other end of the flex put in a drum of water. This was done to prevent flammable vapours coming out near a welding job. When the tank was emptied water rose up the flex and the tank was sucked in (Newsletter 7/1).
- (c) Another tank was sucked in because a loose blank was put over the vent to stop fumes coming out near a walkway (Newsletter 33/1).
- (d) In another Company, a tank was sucked in because it was boxed up with some water inside and rust formation used up some of the oxygen (Newsletter 37/5a).
- (e) Many years ago a tank was sucked in because while it was being steamed a sudden thunderstorm cooled it so quickly that air could not be drawn in quickly enough through the vent. Oil Works Instruction CP10 tells us how to prevent this happening again.
- (f) Last year a tank was sucked in because a quantity of cold liquid was added to a tank (actually a batch still boiler) containing hot liquid. There was no vacuum relief valve on the vessel as the possibility of a vacuum occurring had not been foreseen.

42/2 ISOLATION FOR MAINTENANCE USING MOTORISED VALVES

Newsletters 27/3 and 39/2 have drawn attention to the need to install remotely operated isolation valves so that equipment which may leak can be isolated quickly and safely.

Sometimes this is done by fitting an electric actuator, such as a Rotork, onto an ordinary hand-operated valve. Two incidents show that if such a valve is used to isolate equipment under maintenance, then the Rotork must be defused.

The first incident occurred a few years ago, in another Division, and a man was badly scalded. A Rotork valve on a steam line suddenly opened, as the result of an electrical fault.

The second incident occurred last year, in one of our overseas companies. Some men were working on an ethylene compressor which had been isolated by an electrically operated valve. An electrician was asked to check the motor; although the valve was tagged, the electrician did not realise it was isolating equipment under maintenance and allowed the motor to open the valve. Fortunately the ethylene leak did not fire.

If a Rotork operated valve is used to isolate equipment under maintenance it must be locked with a padlock and chain to prevent anyone opening it by hand, but this alone is not sufficient. It must also be defused or the power must be locked off.

Sometimes an air-driven actuator is fitted to an ordinary isolation valve. If this valve is used to isolate equipment for maintenance, then as well as locking off the valve with a padlock and chain, the vent on the air line must be locked open. Valves which open on air failure should not be used to isolate equipment under maintenance unless the valve can be locked shut by a device powerful enough to withstand the loss of air pressure.

42/3 ANOTHER EXPLOSION IN A CENTRIFUGE

Newsletter 40, Item 6 (Quoting Newsletter 10) described an explosion in a centrifuge which occurred because the nitrogen blanketing failed. There was no alarm system and no regular analysis for oxygen content. There was no clear visible indication of the flow of nitrogen. Ignition was caused by the friction between parts of the machine. A similar incident in another company, which killed two men, was described in Newsletter 5, Item 6.

Now a centrifuge explosion has occurred in the Division. Although the centrifuge was blanketed with nitrogen the nitrogen flow was too small and the oxygen content rose to about 11%, just above the minimum level necessary for an explosion.

The nitrogen flow was too small because the range of the nitrogen rotameter was 0 - 2 ft³/min although 5 ft³/min is needed to reduce the oxygen content to a safe level. The nitrogen valve had been gagged but this did not show on the flowmeter.

The continuous oxygen analyser had been off-line for some time. Occasional checks were carried out with a portable analyser; the last one was taken ten days before the explosion.

The source of ignition was friction between parts of the centrifuge which had worked loose.

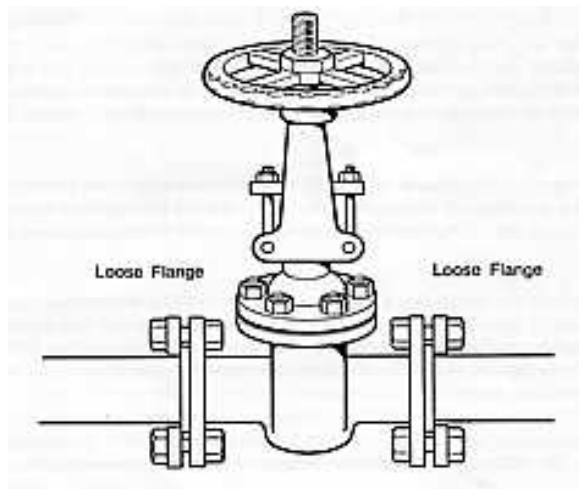
Obviously there should be a clear indication of nitrogen flow and either a low flow alarm, a low pressure alarm or a high oxygen concentration alarm. If reliance is placed on a low flow or low pressure alarm, the occasional check should be made with an oxygen analyser.

Fortunately, because the oxygen content was just above the minimum level the explosion was not very violent and caused little or no damage. The explosion reminded those concerned of the need for nitrogen blanketing, without injuring anyone or damaging any equipment. Unfortunately, we cannot be sure that all our explosions will be as harmless.

42/4 LOOSE FLANGES

We do not use many loose-backing flanges on pipelines in Petrochemicals Division. They are, however, used on pipelines made from aluminium or titanium. They are used on some plants for stainless steel lines though they are not permitted under our current specifications.

If you have any loose flanges on your plant there is one hazard of which you should be aware. If bolts are slackened off slightly, for example, as the first stage in the removal of a valve, there is nothing to hold the valve in position and it could swing over, injuring anyone who happens to be in the way. (**See 43/7**)



When the bolts are slackened there is nothing to prevent the valve falling over.

42/5 THE ANGELS' SHARE

There is an advertisement for Bisquit, a French brandy, which states:

"Rank has its privileges and heaven its perks. One of the many perks the angels are privileged to enjoy is free Bisquit. Every year, since 1819, 3% of our precious cognac vanishes into thin air while it is maturing in its oak casks.

The French refer to this strange phenomenon as 'the angels' share'

If the angels drink cognac, they must eat slip-plates with it. Every year a lot more than 3% of our slip-plates evaporate. Although spectacle plates are more expensive initially, they are a lot cheaper in the long run because the spectacle plate cannot disappear. We now fit spectacle plates widely on new plants. (Remember that they rust in the open position and therefore the joint faces should be protected).

42/6 HAVE YOU ENOUGH FIRE—FIGHTING WATER ON YOUR PLANT?

Two years ago one of our overseas companies designed a new plant, costing about £500,000, for an established site. They worked out the amount of fire-fighting water they would need — it came to 8,000 gallons per minute. Only 2,000 gpm were available and the cost of supplying the extra 6,000 gpm was very high — about £200,000 — a lot of money to add on to a small project.

Fighting a fire on several of the existing plants on the site would also need about 8,000 gpm but nobody had worked out the quantity required. In the end the Site spent the money required to improve the fire-fighting water supply but charged it to Site services and not to the new plant.

In Petrochemicals Division, during the last few years we have estimated the amounts of water we would need to fight fires on our major plants and we have made sure that it is available. A lot of money has been spent on new pipelines and reservoirs. Readers in other Divisions, who have not already done so, might like to estimate the amount of water they would need and check that it is available.

Water at low pressure for boosting by the Fire Brigade pumps should be counted as well as water available at 100 - 150 psi, provided the Fire Brigade can supply the necessary pumps.

Do not forget that what goes in has to come out — or stay there. As mentioned in Newsletter 39, Item 2, we should make sure that the water we put on a fire can get away, either through the drains or by pumps.

42/7 THREE MONTHS IN THE LIFE OF AN OIL COMPANY

Newsletter 12, Item 4 and Newsletter 18, Item 7, described the incidents which occurred in one of the major oil companies during two three-month periods. The same company has now sent us a report of another three-months operations. Ten serious incidents occurred. They are listed below. If you would like to see the full report on any or all of them please let us know.

1. LPG leak ignited by faulty conduit.
2. Furnace explosion caused by short-cutting the light-up procedure.
3. Fire caused by issuing a fire-permit for welding near a hose (which leaked) and near a spillage. (Two fires from one source of ignition).
4. Samples were left on a laboratory hot plate which was too hot; they caught fire.
5. Furnace tube failure — operator ignored a low flowmeter reading because it was known to have a poor performance and because the pump was “obviously” pumping.
6. Ammonia solution was made up by adding anhydrous ammonia to an ordinary drum of water!
7. Furnace fire — a catchpot in the fuel gas line was by-passed and a slug of liquid spread to the outside of the furnace. (The company have had several similar incidents in recent years).
8. A vent discharged hot oil to atmosphere in the plant area.
9. A relief valve lifted and discharged butane to atmosphere.
10. A fitter was given a Permit to do a job on a hot oil pump. He broke into the wrong pump.

The last three incidents are of particular interest. Our current standards do not, of course, allow us to discharge hazardous liquids or gases to atmosphere from vents or relief valves unless jet mixing occurs. We have a number of old plants, however, where discharges occur without jet mixing and on these plants any discharge is a dangerous occurrence.

Incidents like the last one have occurred many times in the Division. Reports like this provide a useful reminder of the need to tag.

42/8 THREE YEARS AGO

“Slop-over, boil-over, foam-over, and puking are some of the names used to describe the phenomenon which occurs when water and hot oil are mixed together. Sometimes water is added to a tank containing oil above 100°C. Sometimes there is a water layer below a layer of hot oil and at a lower temperature; the water slowly warms up and when it reaches 100°C slop-over occurs. The water is vaporised very rapidly and a froth of steam and oil rises up in the tank and may blow the roof off.

An incident of this sort occurs in the Division about once/year and this year's incident has now happened; fortunately it was not a serious one. A note dated 26 August 68, on “Heated Tanks Containing a Water Layer” describes the various ways in which a slop-over can occur and the precautions necessary to prevent it. Copies are available on request. There are some good pictures of slop-overs in “Hazards of Water”, No. 1 in the series of booklets on the hazards of process operation, published by the American Oil Company. I have a few copies to spare. ” [These booklets are now produced by BP and sold by the Institution of Chemical Engineers].

From Safety Newsletter No. 11, July 1969.

In "Industrial Safety" for October 70, page 486, there is a note on the greatest slop-over that ever occurred. On 27 August 1883 at Krakatoa a volcano erupted beneath the sea. A cubic mile of water was vaporised and a cubic mile of rock was blown into the air, some of it to a height of 14 miles. The sound was heard 3,000 miles away.

42/9 WHAT THE LAW SAYS NO.3

The standard which the law requires is that (the employers) should take reasonable care for the safety of their workmen. In order to discharge that duty properly an employer must make allowance for the imperfections of the human nature. When he asks his men to work with dangerous substances he must provide appliances to safeguard them: he must set in force a proper system by which they use the appliances and take the necessary precautions, and he must do his best to see that they adhere to it. He must remember that men doing a routine task are often heedless of their own safety and may become slack about taking precautions. He must, therefore, by his foreman, do his best to keep them up to the mark and not tolerate any slackness. He cannot throw all the blame on them if he has not shown a good example himself.

42/10 UNUSUAL ACCIDENTS NO. 12

A man rushed out of his house in a hurry and backed his car down the drive. When he tried to brake at the bottom his shoe lace, which he hadn't tied, was trapped in the door and wouldn't allow him to transfer his foot far enough across to reach the brake.

From Mond Division Safety Report, May 1972.

42/11 RECENT PUBLICATIONS

- (a) *"We were impressed by the uncompromising attitude towards safety. At — almost a military discipline prevailed. At — a motto appeared as a plaque on the wall of the conference room: 'Our work is never so urgent or important that we cannot take time to do it safely — do not believe in trips as a principle and prefer to rely on the operators'*

These statements occur in Safety Note 72/10, "Some Examples of the American Attitude to Safety".

- (b) "Major Fire-Fighting Techniques in the Oil Industry", the report of a meeting organised by the Institute of Petroleum Safety Sub-Committee.
- (c) If you attended the Module 5 discussion on accidents due to human failing you should have received a 'souvenir booklet'. If you have not, we can let you have one.
- (d) Newsletter 1, Item 3, suggested that leaks might be stopped by squashing the pipeline. Agricultural Division 'Engineering Technical Services Progress Report for May 1972, available from Division Reports Centres, Ref. No. A.17880/72/5, describes how a steam leak was stopped by nipping a 1 inch diameter 150 psi steam pipe. It was nipped in two places, the pipe was drilled in between and Furmanite was injected.

Pipes should not, of course, be nipped without expert advice.

- (e) Have you ever wondered who are the experts in the various ICI Divisions on hazard analysis, refrigeration, dust explosions, distillation and a host of other subjects? If so, you will be interested in "Divisional Contacts for Some Engineering and Allied Subjects", issued by Engineering Services Department, Millbank.

For copies of (a) — (c) or for more information on any item in this Newsletter please write to Miss M. N, Organic House, Billingham or ring B.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. July 1972