

IMPERIAL CHEMICAL INDUSTRIES PETROCHEMICALS DIVISION

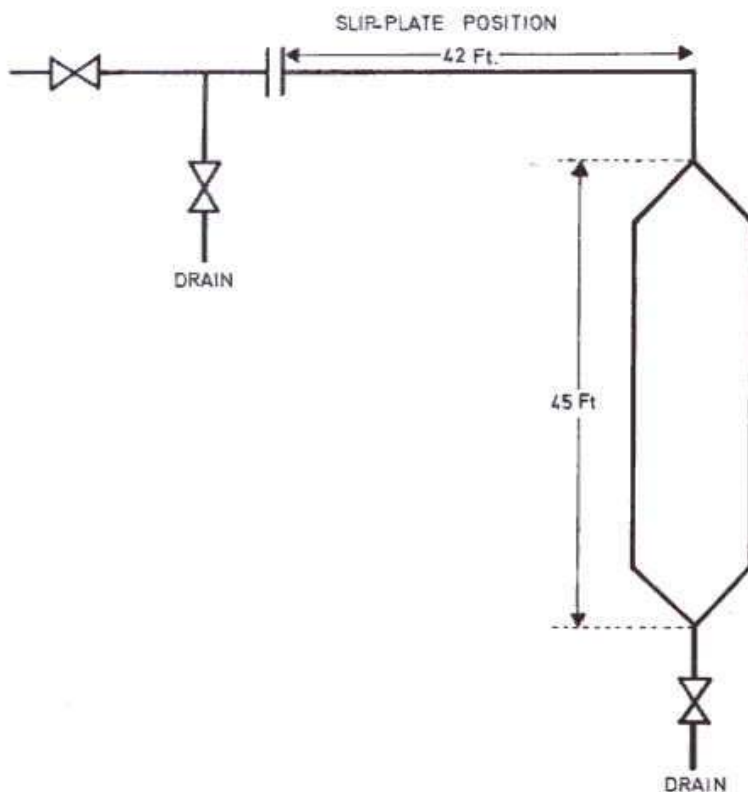
SAFETY NEWSLETTER NUMBER 31

By Trevor Kletz

31/1 MIXTURES OF NITROGEN AND HYDROCARBON WILL BURN

It is not always realised that a mixture of nitrogen and hydrocarbon gas or vapour will burn unless the hydrocarbon concentration is less than about 10%.

This was illustrated by an incident which occurred recently in another Division. A vessel was swept out with nitrogen and handed to maintenance to fit a slip-plate in the overhead line. A small quantity of naphtha was drained from the bottom of the vessel; it was realised that some naphtha might be left inside but this was not considered to be a hazard as the vessel was 45 feet tall and the slip-plate position was 42 feet away on a line which came out of the top of the vessel.



When the overhead line was broken a mixture of nitrogen and naphtha, under slight pressure, came out and caught fire, injuring a man. The source of ignition was a hot pipe.

The drain valve near the slip-plate position was opened before the fitter started work but there was no time for the slight pressure in the vessel (20 milliatms) to blow off. Sometimes in cases like this a slight pressure of nitrogen is deliberately maintained in order to prevent air diffusing into the equipment.

Before the Permit-to-Work was issued for breaking the joint the gas coming out of the drain valve was tested with a combustible gas detector. No gas was detected. A mixture of nitrogen and hydrocarbon will not effect a combustible gas detector — air has to be present.

Remember: Most mixtures of nitrogen and hydrocarbons will burn. Treat them with the same respect as you would treat hydrocarbons.

A combustible gas detector will not respond to a mixture of hydrocarbon and nitrogen, unless it is mixed with air.

31/2 LOSS PREVENTION GUIDES

A great deal of information has been published in Petrochemicals Division during the last few years on various aspects of safety in the design and operation of plants. Only a part of this material is available in File Reports and Engineering Department Design Guides and Specifications; much valuable matter is in the form of letters and reports of limited circulation. An attempt is, therefore, being made to prepare summary documents, called Loss Prevention Guides, to bring as much as possible of this information together in summary form. It is hoped the Guides will be useful to those responsible for the design or operation of plants in reminding them of the hazards associated with particular plant items and indicating where advice is available to overcome their problems. Several master sets of the documents referred to in the Guides are being prepared so that they are readily available. The Design Guides are not intended in themselves to give complete answers to problems but to ensure that the reader is made aware of sources of information and experience.

A start has been made with Relief and Blowdown, Non-Pressure Storage Tanks, Hazard Analysis, Furnace Fires and Explosions, Vessel Entry Certificates, Static Electricity, Lightning and Stray Currents and Thermal radiation and these documents will soon be issued in loose-leaf form. Dr R.K.G. (Ext. B.3901) who is co-ordinating this work will be glad to discuss his present plans and to receive any suggestions on items that might be included in the Guides. Copies of the Guides will be available from Division Reports Centres as Report No. 0.200,698/A.

It will be some time before all the Loss Prevention Guides are available. In the meantime, Safety Note 71/1 I gives a list of reports on safety issued in Petrochemicals Division during the last few years. Copies are available on request.

31/3 WATCH OUT FOR SOLIDS IN RELIEF VALVE TAIL PIPES & PLANT VENTS

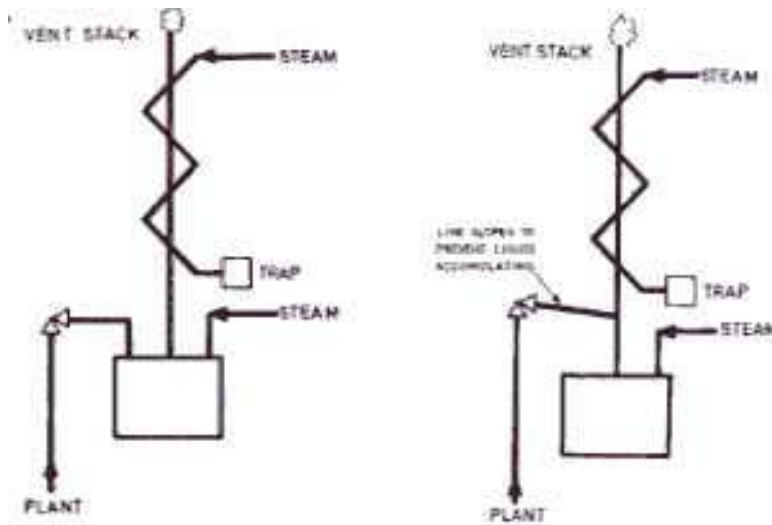
On several occasions plant has been overpressured because the relief valve tail pipe was blocked or restricted.

Materials like benzene (m. pt. 5.5°C.), cyclohexane (m. pt. 6.5°C) or water can freeze. If the tail pipes are long enough for this to occur — more than a few feet long — then they should be steam-traced.

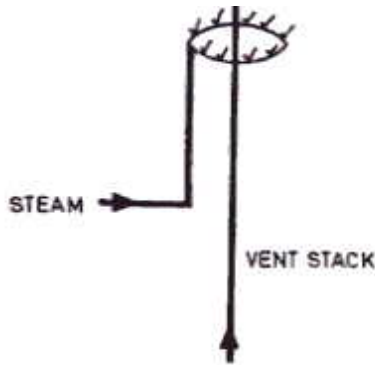
On one of the Division's plants there was a change in the quality of the feedstock. When a relief valve lifted, the feedstock set solid on the tail pipe.

Steam is sometimes used to disperse the gases from relief valves or plant vents. (A note by Henry Simpson on "Purging of Relief and Blowdown Systems", 7.5.69, tells us when nitrogen or steam should be used and the flow rate required). It is better to use nitrogen as steam is liable to freeze and as the steam may bring with it rust or sludge which may accumulate in the tail pipe and prevent the relief valve lifting fully or re-seating.

If nitrogen is not available and steam has to be used the steam should be added to a sump where solids can collect and the tail pipe or vent stack should be steam traced. The diagrams show two ways of this.



Alternatively, external steam dispersion can be used.



This system will not, of course, prevent gas diffusing into the vent stack when there is no flow of vented gases. The steam must be added below the top of the stack to prevent condensate falling into it.

31/4 FIXING HOSES TO PLASTIC PIPES

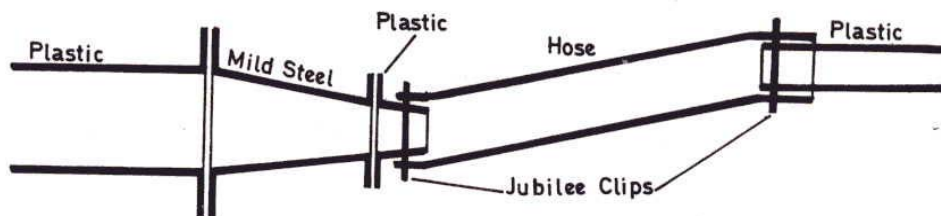
A man was splashed with acid when a hose came undone. Three things were wrong

(a) Although the pipeline and hose were resistant to acid, a mild steel bobbin piece had been used to reduce the pipeline down to the size of the hose. The steel was attacked by acid, forming hydrogen, and the pressure blew off the hose.

(b) The hose was pushed over the plastic (polypropylene) pipe and fixed with a Jubilee clip.

The friction between a hose and a plastic pipe is much less than between, a hose and steel, and is insufficient for a tight grip. Grooving the pipe might have helped but the best way is to use a hose which has a plastic flange welded to it (supported, if necessary, by a steel backing plate).

(c) Jubilee clips are unsuitable for industrial use with hazardous materials (see Newsletter 1, Item 4 and Newsletter 2, Item 4), Bolted clamps should be used instead.



31/5 A CYLINDER IS HEATED AND EXPLODES

Another company has described how a cylinder exploded and killed a man. (See the Quarterly Safety Summary of the British Chemical Industry Safety Council, October-December 1970). The cylinder contained LPG and was used to supply a laboratory. The cylinder was heated electrically so that the gas evaporated at a sufficiently high rate. By mistake the cylinder was isolated and the electric heating left on. The cylinder got so hot that the pressure inside was sufficient to burst it.

If a cylinder has to be heated, the best heating medium is hot air, the air being heated by steam or electricity. Calculations must be made to check that if the air flow is left on and the cylinder isolated, it cannot get so hot that its safe working pressure is exceeded.

The use of steam, water or other heat transfer liquids is not recommended as they may corrode the cylinder.

31/6 THREE YEARS AGO

The value of the Petrochemicals Division policy of locking shut valves used for isolating equipment for maintenance work is shown by a lost-time accident which occurred recently in another Division. A fitter was working on a section of line which was isolated from plant at operating pressure by a single isolation valve which was out of his sight. Somebody, it is believed, opened the isolation valve and the fitter was injured by the spurt of liquid.

From Safety Newsletter No. 3, July 1968.

31/7 SOME UNUSUAL ACCIDENTS - No. 1

In 1950, legal history was made when an Australian worker won damages from his Melbourne employers because he dislocated his jaw while yawning at work. The courts decided that the damage caused by yawning was an industrial injury.

Reason: the man's job was so monotonous he couldn't help yawning.

31/8 BREATHING APPARATUS — OLD STYLE

Breathing apparatus has been developed over the past 200 years but the very first respirator of all was a fireman's beard and moustache. A face full of whiskers was an essential qualification for every fireman and one of his orders in action was, 'Wet your beard, take it in your teeth, and in you go through the smoke'.

The value of the burp was recognised in the old fire service, whenever the wet whiskers failed. Firemen suffering from the effect of smoke were advised to drink highly carbonised beer and to eat fresh warm rolls because 'the ensuing eructations will cause the smoke to be withdrawn from the lungs and stomach'.

From "Safety", the accident prevention magazine of the British Steel Corporation, May 1971.

31/9 RECENT PUBLICATIONS

(a) The Home Office has published a "Code of Practice for the Storage of Liquefied Petroleum Gases at Fixed Installations" (HMSO 30p). On the whole it is consistent with the ICI Code but less stringent. We shall continue to use the ICI Code (ICI Engineering Codes and Regulations, Group 0, Vol. I .6, Liquefied Flammable Gases — Storage and Handling), which is available from Standards Sections, Division Engineering Departments.

(b) Any idea how many fires and explosions there are in the oil and chemical industries? If you are interested we can let you have a collage of newspaper cuttings from the first five months of this year. A summary of incidents reported in the press from the end of 1969 to May 1971.

(c) Safety Note 71/12 summarises some information on the reliability of positive displacement meters.

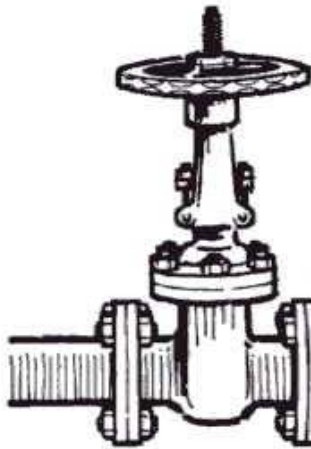
For copies of (b) and (c) or for more information on any item in this Newsletter, please write to Miss M. N, Organic House, Billingham, or ring B.3927. If you do not see this Newsletter regularly, and would like your own copy please ask Miss N to add your name to the circulation list.

July 1971,

While the fitter was dismantling
the equipment
OIL SPRAYED OUT

The protruding spindle shows
that the isolation valve was not
fully closed.....

Dirt in it cleared suddenly



If valves cannot be fully closed,
equipment must be isolated by slip-plates



Several people have asked if this incident, shown on our July calendar, really happened. It did.

A process supervisor closed the valve as far as it would go. He realised that the spindle was projecting and that the valve was not fully closed but he could not close it any more and he assumed that it was blocked with debris. He opened the drain valve on the equipment and proved that the isolation valve was not leaking. There was no other isolation valve further back. He therefore, issued a permit for the fitter to dismantle the equipment. It was a quick job so he did not ask for a slip-plate to be fitted. He locked the isolation valve. (This should have been shown on the drawing).

While the fitter was dismantling the equipment the choke suddenly cleared and oil sprayed out.

If a valve cannot be closed fully — as in this case — a slip-plate should be fitted, even for a quick job. The slip-plate is fitted under controlled conditions and should the choke suddenly clear while it is being fitted, the situation is under control.