IMPERIAL CHEMICAL INDUSTRIES LIMITED

PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No.87

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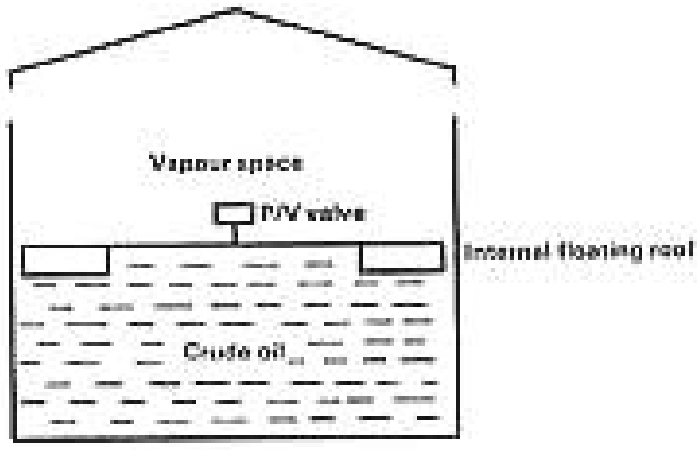
87/1 THE STORY OF A TANK FIRE

An official report has now appeared on the crude oil tank fire at Philadelphia on August 17 1975. A fixed roof tank had been fitted with an internal floating roof in order to reduce vapour losses and thus pollution of the atmosphere. Similar internal floating roofs are being fitted in many parts of the World.

As a result of a late change in design the level at which the floating roof came off-float had been raised but this was not marked on the drawings which were given to the operators. As a result, without intending to, they took the roof off-float. The pressure-vacuum valve opened, allowing air to be sucked into the space beneath the floating roof.

When the tank was refilled with warm crude oil at 37 °C, vapour was pushed out into the space above the floating roof and then out into the atmosphere through the vents on the fixed roof tank.



This vapour was ignited at a boiler house some distance away. Many people were surprised that the vapour travelled so far without dispersing, but there was some damage to the boiler house and this supports the view that ignition occurred there.

The fire flashed back to the storage tank and the vapour burned as it came out of the vents.

Pumping was therefore stopped. Vapour no longer came out of the vents, air got in and a mild explosion occurred inside the fixed roof tank. This forced the floating roof down like a piston and some of the crude oil came up through the seal past the side of the floating roof and out of the vents on the fixed roof tank.

This oil caught fire, causing a number of pipeline joints to fail and this caused further oil leakages. One small tank burst; fortunately it had a weak seam roof.

Over fifty fire appliances and 200 firemen attended and the fire was under control in a few hours.

The firemen were given a copy of the record sheet showing the levels in the tanks, but these were wrong as the operator had fabricated the figures.

The water level outside the bund rose as the bund drain valve had been left open and because the bund wall was damaged by the fire-fighting operations. The firemen pumped some of the water into another bund, but it ran out as the drain valve on this bund had also been left open.

An overhead power cable was damaged by the fire and fell down, giving someone an electric shock. The refinery staff therefore isolated the power to all the cables in the area. Unfortunately they did not tell the firemen what they were going to do. Some electrically driven pumps which were pumping away some of the excess water stopped and the water level rose even further. Despite a

foam cover oil floating on top of the water was ignited by a fire engine which was standing in the water. The fire spread rapidly for 500 feet; eight firemen were killed and two seriously injured. A naphtha tank ruptured causing a further spread of the fire and it took 1 5 hours to bring it under control.

The main lessons we can learn from this incident are:

1 Keep plant modifications under control and keep drawings up to date (see Newsletter 83).

2 Do not take floating roof tanks off-float except when they are being emptied for repair.

3 Keep bund drain valves locked shut. Check regularly to make sure they are shut.

4 Plan now how to get rid of fire-fighting water. If the drains will not take it, then it will have to be pumped away. (See Newsletters 39/2 and 42/6).

5 During a fire keep in close touch with the firemen and tell them what you propose to do. A copy of the full 7-page report is available on request.

87/2 DO NOT PUT FIN-FAN COOLERS OVER PUMPS

A serious fire in another company started with a leak on a residue pump. There was a bank of fin-fan coolers situated above the pump and the up-draught created by the fans caused serious damage to the coolers.

There was a remotely-operated emergency isolation valve on the suction of the pump. This was soon operated and the initial fire extinguished, but by this time the cooler had already started to leak and the fire continued for a long time.

The company concerned have recently laid out a number of new plants with fin-fans above the pump alleys. They are not going to lay out any more in this way.

Reminder: Newsletter 68/4 recommended that air cooler fans should be stopped in a fire. The stop buttons should be located at least 30 feet from the fans or duplicated in a safe area.

87/3 A STAND-BY DRIFTS INTO A SHUTDOWN

A batch vacuum distillation column was put on stand-by because there was some trouble on the plant which took the product. The still boiler was heated by Thermex and the supply was isolated by closing the control valve. As the plant was expected back on line in a short time the hand isolation valves were not closed and water was kept flowing through the condenser. However, vacuum was broken and a 6 inch diameter vent on the boiler was opened.

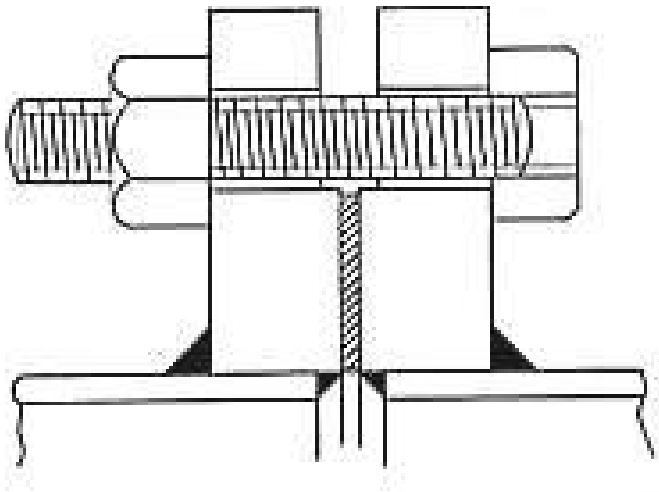
The trouble with the downstream plant took longer than expected to put right and the distillation column stayed on stand-by for five days. No readings were taken and when the chart recording the boiler temperature ran out it was not replaced.

After the still had been on stand-by for five days there was a sudden ejection of liquid from the vent on the boiler. About 0.2 ton was distributed over the surrounding area, but fortunately it did not ignite. It was then found that there was a leak of Thermex through the control valve and the temperature of the boiler had gradually risen from 75°C to 143°C, the boiling point of the contents. Bumping of the boiler contents caused emission of some of the liquid.

It is often difficult to decide when to take a plant off stand-by and shut it down. Is everyone clear what is meant by these terms? Do your instructions give any guidance? Do they define a maximum period on stand-by, particularly if, as in the present case, control valves are used for isolation? When your plant is on stand-by, how many of the normal readings are taken?

87/4 AFTER A SHUTDOWN SOME FLANGES WERE FOUND BOLTED INCORRECTLY

When a plant came back on line after a long shutdown it was found that some of the flanges had been secured with stud bolts and nuts instead of ordinary bolts and nuts, and that some of the stud bolts were located so that there was more protruding on one side than on the other. In some cases one of the nuts was secured by only two or three threads.



Nobody knows why this had been done. Probably one nut was tighter than the other and, in attempting to tighten this nut, the whole stud was screwed through the second nut. Whatever the reason it produced a dangerous situation as the pressure on different parts of the flange was not the same.

In addition, stud bolts should not be indiscriminately mixed with ordinary bolts or used in their place, as they are often made of different grades of steel and produce a different tension.

On the plant concerned, the eight-bolt joints the bolts were changed one bolt at a time. Four-bolt joints were secured with clamps until the next shutdown.

Look out for any similar installations on your plant.

87/5 SOME QUESTIONS I AM OFTEN ASKED

21—WHAT SHOULD WE DO TO OLD PLANTS WHEN STANDARDS CHANGE?

The action we take depends on the importance of the change and whether or not it is possible to put it into operation on existing plants.

For example, our standards on layout are now better than they used to be. We like to lay out our plants in blocks with a gap of 50 feet between them in order to prevent the spread of fire and allow access for fire fighting. It also provides better access for maintenance work. But it is obviously impossible to pull our existing plants further apart, although we would like to do so.

In other cases new standards are only a slight improvement on the old and in these cases we do not modify existing equipment, even though it would be possible to do so — it would use up money and effort which would be better spent in other ways.

When a new standard produces a real increase in safety and can be introduced on existing plants we do spend a lot of money on modifying them. For example, in recent years we have installed gas detectors on many old plants so that we know when a leak occurs and we have installed additional remotely-operated emergency isolation valves so that we can isolate a leak. In Petrochemicals Division we spend nearly a million pounds a year on improving our old plants.

87/6 UNUSUAL ACCIDENTS NO 56— FIRE PERMITS CAUSE A SHUTDOWN

On one Works on the Wilton Site fire permits are displayed on the job and fixed to any convenient item of equipment. On one plant they were stuffed into the open end of a 1½ inch pipe. The man who did this probably thought it was a scaffold pole or a disused pipe.

Unfortunately, it was the end of a pipe which supplied a controlled air bleed into a vacuum system — to control or break the vacuum. The air rate was controlled by a motor valve. A failure of this system caused product to be sucked into a condenser and a two-day shutdown was necessary to clean out the blocked equipment. The motor valve, which had failed to break the vacuum, was taken to pieces, and found to be blocked by the remains of several fire permits.

87/7 COMMENTS FROM READERS

(a) Newsletter 82/2 described an incident which occurred because a clearance was not read carefully and people were not clear on the job to be done.

A reader points out that when a clearance is signed off as job complete we usually assume that the man has done the job that Process wanted him to do. In fact, he will have done the job he thought they wanted him to do and this may not be the same. The job should therefore always be inspected by Process to make sure that the job completed is the one they wanted.

(b) Newsletter 82/5 stated “It is almost impossible to clean completely tanks which have contained heavy oils or materials which polymerise ….”

A reader reports that a few years ago he had to clean thoroughly a tank which was going to be used for the storage of a pure chemical. None of the usual solvents worked and it was cleaned in the end with a great deal of hard labour by rubbing on an industrial hand cleaner.

This method may be useful when great cleanliness is required to avoid contamination. I would not like to be certain that it would make a tank which has contained heavy oils safe for welding unless one is sure that there is no heavy oil left in cracks and crevices.

(c) Newsletter 85/2 pointed out that equipment which is sent outside for repair should, whenever possible, be made spotlessly clean. A reader points out that on the Wilton Site there is a facility for burning coke from heavily fouled heat exchangers at a relatively low temperature (460^{o}C maximum) so that the metal is not affected. Residual dust is removed by blowing and flushing with water.

For further details phone Howard Williams on Extension W.6863.

(d) Newsletter 84/5 suggested fitting plastic balloons over the ends of relief valve tail pipes. A reader describes another method which has been used successfully. A pneumatic airstream detector, made from commercially available components, is fitted in the vent pipe and can detect as little as half a ton of ethylene per day. Details can be obtained from Peter Gill, Plastics Division, Wilton, telephone W.6640. See item 92/8(a).

87/8 A MAJOR FIRE —ALTHOUGH THE REGULATIONS WERE FOLLOWED

The November 1975 issue of *Fire Prevention* includes a summary of the official report on the fire in Fairfield Old People’s Home, Nottinghamshire in December 1974 in which 18 of the 50 residents died.

The fire started in one room, probably because a resident was smoking in bed. It spread rapidly to the whole of the single storey building through the roof void which was completely open without a single partition. The danger of the roof void had been recognised and plans had been prepared to erect partitions but the work had not been started at the time of the fire. To quote from *Fire Prevention:*

'The delay in starting work on the roof voids was, says the report, due partly to the lack of understanding of the problem in the County Architect's department; partly to the habitual reliance of the architects on the Building Regulations, which did not deal with the problem at all; and partly to the enormity of the problem in a county which had 305 CLASP buildings. The County Architect was also faced during this period with the difficulties of local government re-organisation and the alarm over high alumina cement. Consequently it took from the spring of 1973 until February 1974 for the department to devise a means of fire-stopping in existing buildings and to obtain an estimate; and from then until December 1974 to obtain the financial authority. It was then incorporated in a three-year programme of expenditure starting in April 1975."

As in the report on the fire at Summerland in the Isle of Man in 1973 (see Newsletter 69/6) the lack of attention to safety in the training of architects was criticised.

Two points arise out from the account of the fire.

1 In designing or operating a plant or building it is not sufficient to follow the existing codes and regulations. They may be out of date. They may not cover all the problems. At Fairfield the architects followed the Building Regulations but this did not prevent the fire.

   Newsletter 61/1 described how a hydraulic crane collapsed on to a plant without any alarm sounding. The warning devices on the cranes satisfied the recognised Codes of Practice but these had been written for mechanical strut cranes.

2 When we recognise a hazard it sometimes takes a long time before we have decided what we ought to do about it, obtained sanction, ordered the equipment and actually got on with the job. An accident can happen at any time during this period. Some delay is inevitable, but it can be too great. Unnecessary delay is almost as serious as failing to recognise the hazard in the first place.

The January 1976 issue of *Fire Prevention* describes another fire in an old people's home, in August 1975 in Essex, which also spread rapidly through the roof void. Although walls had been built in the roof, they were useless, as large openings had been left in them to allow people to walk through. Fortunately in this case everyone was rescued in time.

87/9 RECENT PUBLICATIONS

(a) Text books on Chemical Engineering give equations for calculating the rate of flow of liquid along a pipeline. Building Research Establishment Current Paper CP 96/75 gives equations for calculating the rate of flow of people along corridors and staircases. It enables the evacuation times of buildings to be estimated. (It is available from the BRE, Garston, Watford, WD2 7JR).

(b) The latest edition of "Company Contacts for Engineering and Allied Subjects" can be obtained from Engineering Services Department, London.

(c) Report No HO/SD/760003/A, available from Division Reports Centres, is an introduction to hazard and operability studies. Compared with earlier reports, for example No HO/SD/740009/4A, the papers and discussion at a seminar on operability studies, this new report concentrates on the application of operability studies to small scale and batch plants. It will be published soon by the Chemical Industries Association.

(d) "Accidents Caused by Reverse Flow", an article, which appeared in the March 1976 issue of *Hydrocarbon Processing*, is an extended version of Newsletter 79/1.

(e) A note dated 21 April 1976 summarises the papers presented at the recent Loss Prevention Symposium organised by the American Institute of Chemical Engineers.

For copies of (d) or (e) 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.

May 1976

Who's Who in Safety?

NO.4— R B ROBERTSON

Dick Robertson was born in Dundee, Scotland, and was brought up, he says, on marmalade, shortbread, Presbyterianism and whisky.

He started work as an engineering draughtsman, laying out plant and designing machines for the food industry, and in time became assistant works engineer for three paper mills. He then spent eight years working on industrial ventilation and dust extraction.

The Wilton Site was still a green field when he joined ICI as a heating and ventilation engineer in 1947. In 1968 he was given an additional part-time job — looking at the fire risks on Petrochemicals Division plants, having, he says, no other qualification than the ability to recognise a fire hose reel by reading the label. He soon realised that there were more rules of thumb than science in the business and decided to do something about it.

During the past eight years he has built up a fire design philosophy which has made Petrochemicals Division the forerunner in the Company in many aspects of this field.

He believes that it is essential to retain a flexible approach to fire problems, prefers guidance to rules, and considers that fire prevention in design is still in its infancy.

Dick is married with two daughters, one at University and one at sixth-form college. His hobby is producing amateur dramatics.