SAFETY NEWSLETTER

No. 103

IN THIS ISSUE

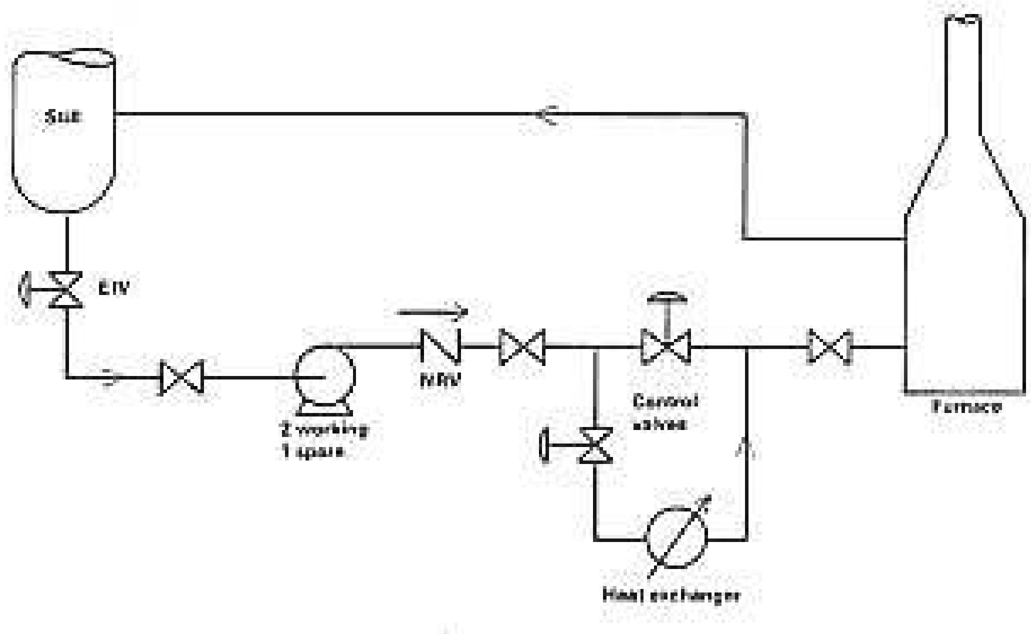
IMPERIAL CHEMICAL INDUSTRIES LIMITED

PETROCHEMICALS DIVISION

103/1 AN EMERGENCY ISOLATION VALVE STOPS A FIRE

Newsletter 101 described a number of recent fires. Another fire earlier this year was soon extinguished and damage was only slight because the right protective equipment had been installed and tested regularly.

The fire was due to a bearing failure on a pump handling hot light hydrocarbon — actually the feed pump from a still to a reboiler furnace.



The electrically-operated emergency isolation valve (EIV) on the pump suction line was closed by pressing a button. (The valve is tested regularly).

The control valve in the delivery line to the furnace was also closed. Unfortunately this valve is by-passed by the line through the heat exchanger and in the heat of the moment no-one remembered to close the valve in the by-pass line. In addition the non-return valve did not hold. The flow of oil backwards from the furnace was stopped by closing a hand valve next to the furnace which was about 100 feet from the fire.

The report on the fire recommends that another emergency isolation valve is installed in the pump delivery line.

Although the EIV was not affected by the fire, the report nevertheless recommends a critical look at the standard of fire protection of EIV's and their impulse lines — many such valves are not fire-protected at all. Rotork can supply a fire-resistant sack to put over the valves and this is being tested.

The non-return valves on all three pumps were out-of-order. On one the seat had become unscrewed, on another the fulcrum pin was badly worn and on the third the pin was worn right through and the flap was loose. The valves had not been inspected since the plant was built. As mentioned in Newsletter 61/6, when failure of a non-return valve can affect the safety of the plant, it should be scheduled for regular inspection.

If control valves are used for emergency isolation a special switch may be necessary to close them in an emergency, so that operators do not have to go to the control room to alter the set-points on the controllers.

The operation of an emergency isolation valve should automatically shut down any pump in the line and trip the fuel supply to any furnace.

103/2 AN OXYGEN ANALYSER IS LEFT IN THE TEST POSITION, THUS DISARMING A TRIP

An oxidation plant is provided with an oxygen analyser on the vapour space of the first oxidiser. The range is 0-5%; at 1.5% oxygen an alarm sounds and at 4% oxygen the air supply is tripped 0.8% oxygen is necessary for an explosion so there is an adequate safety margin.

To calibrate the oxygen analyser the range is changed to 0-25% by turning a switch. Air can then be used for calibration.

Thirty hours after a plant start-up it was found that the switch had been left in the test position. The instrument was reading 0.8% oxygen, but the oxygen concentration was actually 4%, the trip setting.

The switch is now locked in its normal position and the calibration procedure has been altered so that it is no longer necessary to change the range.

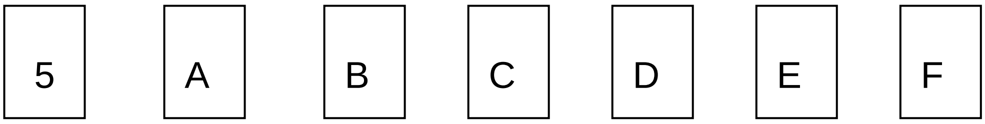
Have you got any key instruments that can be left disarmed after testing? On the oxidation plant there are hundreds of trips with disarm systems that are carefully monitored. This one slipped through the net.

103/3 PRESSING THE WRONG BUTTON AGAIN

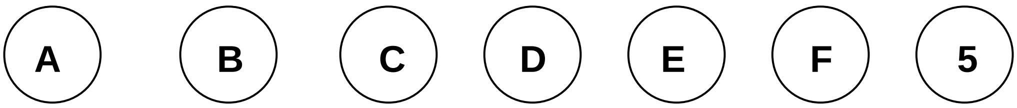
Another company has reported the following incident:

An operator was asked to close the fuel valve to furnace 5. By mistake he turned the wrong switch and isolated the fuel to furnace A. It took 1½ hours to bring the furnace back to normal conditions.

The furnaces are arranged as shown below:-



But the switches are arranged as shown below:-



The operator realised that he had to isolate the fuel to the furnace on the extreme left — so, without thinking, he went to the switch on the extreme left. Easily done.

You can say that the cause of the accident was operator error, but this will not prevent other operators making the same mistake. The real cause was the poor design of the panel which made a mistake inevitable.

In the same way many aircraft accidents are blamed on pilot error when they might have been prevented by better design. A recent book ("Pilot Error", edited by R Hurst, Crosby, Lockwood Staples, London, 1 976) quotes the following.

"Some sixty per cent of all accidents involve major factors which can be dismissed as 'pilot error'. This sort of diagnosis gives a . . . feeling of self-righteousness to those who work on the ground; but I want to state categorically that I do not believe in pilot error as a major cause of accidents. There are, it is true, a very few rare cases where it seems clear that the pilot wilfully ignored proper procedures and got himself into a situation which led to an accident. But this sort of thing perhaps accounts for one or two per cent of accidents — not sixty per cent. Pilot error accidents occur, not because they have been sloppy, careless, or wilfully disobedient, but because we on the ground have laid booby traps for them, into which they have finally fallen."

For other examples of "wrong button" accidents see Newsletters 98/6 (a lever moved the wrong way caused an aircraft to crash), 97/3, 96/7, 86/2, 74/3 and 66/3.

Recently I heard a design engineer say that if men are well-trained they "ought not" to make mistakes. Perhaps they "ought not" but unfortunately they do, and saying they "ought not" will not change human nature.

103/4 A LOOK BACK AT NEWSLETTER 3 (JULY 1968)

A fitter was working on a line isolated by a valve which was out of sight. Someone opened it and the fitter was injured by the spurt of liquid. The valve should have been locked shut.

A man was nearly gassed while working on equipment isolated by a double block and bleed. The bleed was a long thin line leading away to a stack. *Bleed valves should normally be 1½ inches bore on lines 6 inches bore and above, 1 inch bore on lines below 6 inches bore. For details see Engineering Specification PR 0310.*

A slip-plate gives a better isolation than a double block and bleed.

Other points made in Newsletter 3 were:

The atmospheres in flare and vent stacks should be analysed regularly.

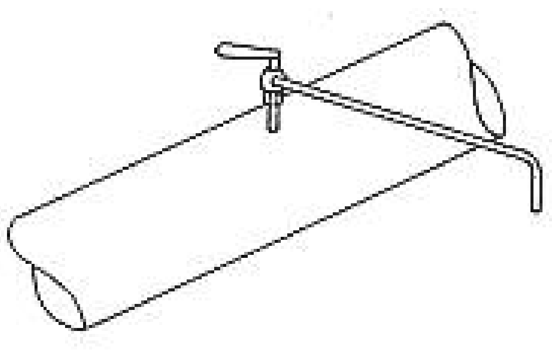
If water and hot oil are mixed the water will vaporise with explosive violence.

Several accidents have occurred with high pressure water jet cleaning equipment.

On six occasions so far in 1968 corrosive chemicals had dripped on to metallurgists working on a plant.

103/5 COMMENTS FROM READERS

a) Commenting on Newsletter 100/2, a reader points out that if a right-angled cock had to be used it should have been installed as shown below



b) Commenting on Newsletter 98/4, several readers have suggested that it is too sweeping to say "Do not use scrap material". Scrap material can be used if we recognise that it may be contaminated and take care to clean it first.

c) Newsletter 95/5, "Which airline should I fly?" has created a lot of interest. Readers have pointed out that Swissair and El Al, already in Group II, move up to Group I if acts of war are excluded.

d) Newsletter 99/6 described washing soda as a harmless material. It is, of course, much less harmful than caustic soda (with which it was confused) but even washing soda can be unpleasant if you get it in your eyes.

103/6 OTHER MEN'S VIEWS No 2

Our culture and training teach us that men are brave; that it is natural, desirable and indeed heroic to struggle through adversities such as pain, bullies, strong teams of opposing sportsmen, and enemy troops. Man's lowly instincts therefore often generate a contempt for bad weather, or a risky flight, as just another hazard which will yield to bravery. This distortion of logic is compounded by social attitudes offering a combination of censure and sneaking admiration for the man who breaks the rules and wins; while of course, the wrath of righteous indignation is called down upon the man' who breaks the rules and loses. But most, if not all, men have the occasional desire to kick over the traces and to take risks they would not ordinarily take, as the accident statistics on young drivers confirm. For them, as for many other people, the safe course often carries with it a slight, but nevertheless perceptible loss of face; and 'face' — as the antithesis of weakness — must be preserved.

Pilots are trained to control the urge to express 'manhood' by flying dangerously, and the urge is controlled, but not entirely destroyed. Mason (1972) quotes the case of a Convair Metropolitan aircraft which came in to land at a small, fog-shrouded coastal town. The weather was below limits but the pilot succeeded in landing at his third attempt. A second Convair approached and was told by the airport Tower that the first aircraft was already on the ground — information which clearly represented sufficient challenge to the incoming pilot to sustain him through two abortive approaches before his aircraft crashed into a group of houses, killing 41 people.

M Allnutt in "Pilot Error's" edited by R Hurst, Crosby, Lockwood, Staples, London, 1976.

103/7 UNUSUAL ACCIDENTS No 70

The rotating assembly of a large pump had been removed for overhaul. A blank had been fitted across the opening of the volute chamber. The blank was of thinner material than the stuffing box back plate, so it was necessary to fit nut spacers onto the studs in the volute casing to ensure a sound joint.

When the blank was removed from the volute casing for reassembly of the pump, the nut spacers were placed on top of the motor. At some time during or between the removal of the blank and the cleaning up operations, two of the nut spacers got pushed or knocked along one of the spaces between the motor cooling ribs and passed under the fan guard (which had not been removed).

On starting the pump there was a bang and a splintering noise and the two nut spacers shot through the fibreglass fan guard. Luckily, no one was injured.

The nut spacers have now been welded to the blank flange so that they cannot find their way behind the fan guard.

103/8 PROCESS SAFETY REPORTS AND GUIDES

Newsletter 56/9 (September 1973) announced the setting up of an ICI Process Safety Panel. The following is a list of the Reports and Guides issued so far. They are available from Division Reports Centres.

Process Safety Report Number	**Title**	**Library Number**
1	REVIEW OF DUST EXPLOSION TEST METHODS	HO/SD/740009/1A
2	SEMINAR	HO/SD/740009/2A
	HAZARD AND OPERABILITY STUDIES	

	JUNE 1974	
3	VENTING — STATE OF THE ART	HO/SD/740009/3A
4	SEMINAR EVALUATION OF RISK APRIL 1975	HO/SD/740009/4A
5	VENTS, LEAKS AND SPILLS (A review of methods available to assess subsequent gas dispersion and its consequences)	HO/S D/740009/5A
6	SEMINAR CONTROL OVER MINOR PLANT MODIFICATIONS DECEMBER 1975	HO/SD/740009/6A
7	THE TESTING OF CHEMICALS AND CHEMICAL PROCESSES FOR SELF-GENERATED FIRE AND EXPLOSION HAZARDS	HO/SD/740009/7A
8	SEMINAR DEVELOPMENT OF INTRINSICALLY SAFER PLANTS AND PROCESSES OCTOBER 1976	HO/SD/740009/8B Category B — Confidential
9	REVIEW OF THE SIZING OF VENTS FOR GAS FLOW AND POLYMERISATION REACTORS	HO/SD/740009/9A

PROCESS SAFETY GUIDES

Process Safety Guide Number	Title	Library Number
1	EMERGENCY ISOLATION OF CHEMICAL PLANT (Published in Chemical Engineering Progress, Sept. 1975, p 63)	HO/SD/740010/1
2	PROTECTION OF PRESSURE VESSELS AGAINST EXCESSIVE TEMPERATURE (Published in part in Hydrocarbon Processing, August 1977, p98)	HO/SD/740010/2
3	LOSS PREVENTION—THE EFFECT OF PLANT LAYOUT	HO/SD/740010/3
4	GUIDE TO HAZARD ANALYSIS	HO/SD/740010/4

103/9 RECENT PUBLICATION

An article in the Journal of Occupational Accidents, July 1977, Vol 1, No 3, page 203, shows how the explosion pressures developed at Flixborough were estimated from the damage.

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.

September 1977

AN ENGINEER'S CASEBOOK

No 3— Bellows

In 1971 there was a survey in the Division on the use of expansion bellows and a report, available only in ICI, was issued (No PC.200, 812/A). The report, which was commissioned after two expensive major plant shut downs caused by on-line failure of metallic expansion bellows units, commented that 'The introduction of an expansion bellows into a plant in most cases gives rise to a weak link in a system which otherwise is constructed to a uniform standard of mechanical strength.'

The report analysed the cause of 53 reported bellows failures; 20 of these were due to stress corrosion cracking by caustic or chlorides and 1 7 were due to an initial construction or installation fault. Two recommendations were made to reduce these causes. The first was that bellows should preferably be made from Incolloy 825 to eliminate stress corrosion cracking by chlorides, though not by caustic. The second was that bellows should be installed in the field in a way similar to that used for critical items of equipment.

Since 1971 the number of bellows in new plants has been sharply reduced and in a few instances existing units were replaced by piping systems with inherent flexibility. The 1972 revision of the ICI Pressure Vessel Code (ICI Engineering Code and Regulations, Group B, Volume 1.4, available outside ICI from the Royal Society for the Prevention of Accidents, Queensway, Birmingham B4 6BS) required the registration of selected expansion bellows in known erosive/corrosive service or where a high hazard would be created by failure. Registration required regular inspection.

Unfortunately failures continue, though at a much reduced level following actions taken and general publicity, due to incomplete control. In a recent incident a large unit, operating at 600 psi, in the inlet line to a steam turbine blew apart only a few hours after it had been installed. The unit, which was brand new, relied on split rings bolted round its convolutions to support them and equalise expansion between the multiple corrugations. The accident investigation found that some of the split rings and one of the end skirt rings were slack with gaps of up to 9/16" between the butts of the half rings. The gaps, notably the one round the first ring, removed most of the support from the first corrugation allowing the unit to squirm and through that to precipitate total failure by rupture where the Incolloy 825 membrane was welded to the stub ends.

The enquiry could not establish why some of the split ring bolts were slack nor if anyone had deliberately slacked them, for example, to have a look at the corrugation underneath. It did establish that no precommissioning inspection took place and there was every chance that had one been carried out the slack rings would have been corrected.

Registered bellows units must be treated like pressure vessels and subjected to a thorough examination by an equipment inspector before entering service and at the prescribed routine interval thereafter.

E H Frank

Reminder Other bellows failures are described in Newsletters 71/2 and 74/1. Newsletters 45/4 and 47/5a described damage to a bellows before delivery.

WHO'S WHO IN SAFETY

No 17 E H Frank

Harland Frank, author of our Engineer's Casebook, was born in Sunderland and served an apprenticeship as a fitter and turner with a firm of marine and general engineers on the North-East coast. He was released to attend King's College, Newcastle to study mechanical engineering and after graduating was directed into the Army where he saw active service during the war in combined operations and armoured units.

He joined ICI Billingham Division as a draughtsman in 1947, went to Clitheroe Works in 1952 as a plant engineer and, after a short spell in Engineering Department when Heavy Organic Chemicals Division was formed in 1958, was on Olefine Works and North Tees Works until 1971, latterly as Works Engineer. During this period he was involved with all the big single stream units and with many start-ups. He presently acts as Engineering Consultant to Production Department.

His main hobby is operating and maintaining his 1918 4 HP steam tractor, though anything with an engineering interest makes him tick. He is married and has four sons.