IMPERIAL CHEMICAL INDUSTRIES
HEAVY ORGANICS DIVISION

SAFETY NEWSLETTER NUMBER 11

By Trevor Kletz

11/1 IDENTIFICATION OF EQUIPMENT FOR MAINTENANCE

Accidents due to the failure to identify carefully equipment which has been given to maintenance are reported in nearly every Newsletter. The latest incidents concern electrical equipment.

Another Company has reported that an electrician was asked to cut and remove an unused high voltage cable in a cable trench. He cut through a live 6,600 volts cable, fortunately escaping with only minor injury.

The second incident occurred nearer home. A spillage of oil from a pump caught fire. The source of ignition was an old cable end which bad been made live.

A pump (let's call it J4) had. to be moved to a new site. It was defused, the cable was sawn off and the pump was removed. It was then installed and wired up in its new location.

An electrician was asked to insert fuses in J4. He went to the fuse box, put the fuses into the spaces marked J4 and made the old cable ends live.

What should be done to prevent a recurrence?

I suggest that:

(a) When a pump is moved to a new location it is given a new number.

(b) When a pump is removed, the fuse box is marked to show that it is no longer there.

These recommendations apply, of course, to other items of electrical equipment besides pumps.

11/2 ISOLATION OF EQUIPMENT FOR MAINTENANCE

I have frequently referred in these Newsletters to the HOC Rules for the Isolation of Equipment for Maintenance. Those were introduced following a serious fire in 1967 in which three men were killed and the plant was extensively damaged. An account of the fire, its causes and the action recommended as a result has now been issued as Reports File Report No. 0.21,100/B. Anyone who does not know the reasons for the HOC Rules on the Isolation of Equipment for Maintenance can now find the full story in this report.

A serious explosion involving the isolation of equipment for maintenance has been reported by another Company. An ethylene compressor had been shutdown for maintenance and had been correctly isolated by slip-plates. When repairs were complete the slip-plates were removed <u>before</u> the machine was tried out. During the try out some ethylene leaked through the closed isolation valve into the machine and the ethylene/air mixture was ignited, either by a hot spot in the machine or by copper acetylide on the copper valve gaskets. The compressor was severely damaged.

The handback procedures for equipment which has been with maintenance should ensure that this sort of incident cannot happen.

11/3 CLEARING CHOKED LINES WITH GAS PRESSURE

Gas pressure has sometimes been used for clearing choked lines. This should never be allowed. A recent report from another Division describes how a slip-plate was made concave by the impact of a solid pushed along by gas pressure. The report includes some calculations to show how such energy can be accumulated in the plug of solid which in some cases might come out of an open

end. For example, if the pipe diameter is 2 inches, the gas pressure 50 psi and the plug is moved 50 ft. before it emerges, its kinetic energy could be 300 ft. lb., more than that of a bullet leaving a service rifle. If the plug weighted 1 lb. its exit velocity could be 300 mph.

11/4 ELECTRIC SHOCK

A workman received a severe electric shock when he bumped into an instrument. It was an old level indicator which had been out of use for 12 years but had never been defused. Finally, it corroded so badly inside that a push was enough to break down the insulation.

Is there any similar equipment in your area?

11/5 "SLOP-OVER"

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 the oil and at a lower temperature; the water slowly warms up and when it reaches a 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 26th August 1968, 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.

11/6 A MECHANICAL SHOVEL BREAKS AN ELECTRIC CABLE

When a Permit-to-Work is issued to excavate the ground it is normal practice for the electricians to certify first that there are no buried electric cables. What, however, is an "excavation"? Another Division have reported that at one of their factories a contractor asked for and received a Permit-to-Work to "level and scrape the ground". As no excavation was requested the process supervisor did not consult the electricians. The contractor used a mechanical shovel, removed several feet from the ground, and cut through a live electrical cable. It is clear that the word "excavation" needs careful definition in our Works Instructions.

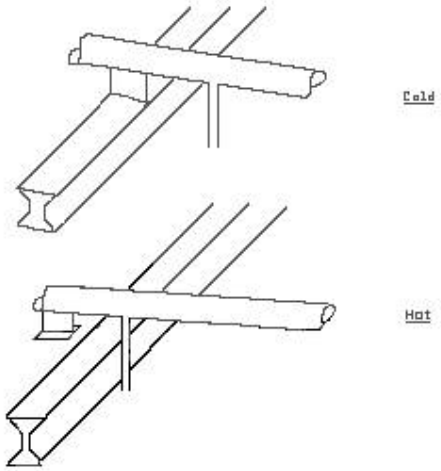
11/7 FAILURE OF COOLING. TOWER FAN BLADES

A spectacular incident occurred recently when two of the wooden blades on a cooling tower fan came off arid went into orbit. One landed 60 yards away. The blades were each bolted to two steel plates which in turn were bolted to a central boss made of cast LM5 aluminium alloy (BS1490). The failure was due to fracture of the bosses.

The metallurgist's report on the incident shows that two of the bolts had failed and that one was missing. The report recommends that all nuts and bolts are periodically checked for tightness, that self-locking nuts are not used more than once and that if any new castings are required in the future they should be made of a stronger alloy, such as LM8.

11/8 RUPTURE OF A PIPE-LINE CAUSES A FIRE

Another Company have reported a serious fire which resulted from the rupture of a pipeline carrying hot oil at 300°C, The pipeline, which was 10 ins ID, was fitted with a $^3/_4$ in branch on the underside $4^3/_4$ in from a girder on which the pipe rested. Then the pipe was put into service and heated up to 300°C. The expansion of the pipe was sufficient to bring the branch into contact with the girder and knock it off. Calculations later showed that the expansion of the pipe, which was 120 ft. long would result in the branch moving $6\ ^1/_4$ ins.



11/9 WHY DO PIPELINES LEAK

A recent incident shows the importance of asking this question rather than just putting a strap round the pipeline and carrying on. A pin-hole leak developed in a pipeline carrying condensate at 105°C. into a condensate collecting drum. The leak got bigger until finally the plant was shut down. It was then found that the scouring action of the hot water and steam as they reached the end of the pipe had eroded the pipe and the flange and that if the plant had been left on line for one or two weeks more, then the pipe would have blown off.

11/10 NEVER WELD WHEN WATER IS LYING ABOUT

An incident which occurred a few years ago shows the importance of this rule. A welder was constructing a new pipe-line while 65 ft. away a fitter removed a slip-plate from another pipe. It was realised that a small amount of light oil would probably be spilt but it was judged that the vapour would not spread anything like 65 ft. Unfortunately the pipe duct was flooded and the oil which came out of the broken joint spread along the surface the surface of the water and was ignited by the welder's torch. The fitter's mate was badly burnt and later died.

The incident shows the importance of inspecting the exact location before a Permit-to-Work or |Fire Permit is issued. From the office the two jobs might have seemed far apart; on the site the water could have been seen. It also shows that welding or the use of a naked flame of any sort should never be permitted when pools of water are standing about, or spillages some distance away may be ignited.

11/11 REGULAR INSPECTION OF PERMITS-TO-WORK

A newspaper recently asked a number of clergymen for their views on mini-skirts. One of them was reported as saying that he could not comment as he never looked at girl's skirts and did not know how long they were.

This is the attitude that many managers and engineers used to have towards clearance certificates and Permits-to-Work. They did not know whether they covered everything or not as they rarely looked at them.

When an accident occurs it is unlikely that a short-cut was taken for the first time. It is more likely that short-cutting has been going on for weeks, months or even years, not just by one supervisor but by many. Regular inspection of clearances by the manager would have shown up and stopped the irregularities before the accident happened.

Nowadays most managers and engineers look closely every week at many clearances and in HOC Division there is a Board instruction that they should do so.

11/12 "GUIDE TO VENTING OF STORAGE TANKS"

The Guide mentioned in Newsletter 8, Item 5, has now been revised and issued as HOC Report No. 0.200.625/A, by B.G.D.

11/13 A PETROL FIRE AT HOME

In a house in Hartlepool last year, some cans of petrol were ignited by sparks from a fire. The occupier was fined £10 for keeping petrol in a dwelling house and for keeping it in a container not labelled “Petroleum Spirit”

11/14 ENGINEERING FAULTS ON NEW PLANTS

HOC Division sprang from the old Billlngham Division, which in turn started as a branch of Brunner Mond & Co. Nearly 100 years ago the founders put their little capital into the construction of a plant for the manufacture of soda ash by a new method. A recent account of some of their early difficulties with their equipment will evoke sympathy in the minds of the engineers who have had to start up some of our new plants.

“Their early years were dogged by failures of the mechanical plant which they bought. They had, of course, many chemical problems, but these were comparatively easily solved. On the mechanical side, however, it was touch and go whether they would be able to continue. The following extracts from their correspondence give an indication of their troubles;

January 1874 - to the engine builders.

We very much regret to have to tell you that the wrought iron hoop round the slide valves in one of the engines is broken and the other shows signs of giving way. The iron is bad, and we dare not leave the as yet unbroken one in. Please get two stronger ones made at once. The broken one we return by your man. We are most bitterly disappointed by these often repeated failures of one part after another and have to tell you frankly that we do not mean to bear all the loss ourselves.

May 1874 - to the engine builders.

Yours of yesterday asking for payment duly to hand. We regret to have to inform you that after working a very few days, the fly-wheel has given way. We have ordered a new one to be made with all possible dispatch, and shall hold you responsible for its cost.

June 1874 - to the boilermakers.

Another disaster, which might have been very serious, occurred late last night. One of the tubes of one of our Howard’s boilers burst, fortunately without hurting anyone, and without doing any serious damage.

This evening at seven o’clock, a tube in the other boiler has given way, after being tested yesterday to 280 lb. The safety valve was set to blow off at 102, and the boiler was full of water, The boiler-man was severely scalded and is in danger of his life. Under these circumstances your reputation and our very existence is at stake. We request that you will send your foreman and your inspector here at once. We dare not put fire under your boilers again except with your guarantee that care on our part is all that is required.”

From an article by G.A.J. Begg in “The Chartered Mechanical Engineer”, March 1969, page 9.

2nd July 1969