SAFETY NEWSLETTER

No. 160
SUMMER MISCELLANY

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED

PETROCHEMICALS DIVISION

160/1 “GULLIVER’S TRAVELS” - FOREIGN CORRESPONDENTS’ REPORT

In Safety Newsletter Item 158/6 I suggested that the use of kitchen timers might help process operators to avoid over-filling storage tanks. One reader had just been involved in an inquiry into the third overflow incident in three years on the same tank. His suggestion of a timer had been rejected but he got the decision reversed after he produced the Newsletter!

Another correspondent was less flattering but very helpful. He wrote “Personal timers aren’t so unusual. Some laboratory workers in my Department use them as a reminder to do certain critical operations at the right times. The timers are small and attach to a coat lapel and produce an audible alarm at the end of the timing period. Unfortunately the operator still has to remember what he should do.” Later our correspondent supplied details of two types of timer in common use.

If you would like the details and are on an ICI site in the UK please use your inter-site dialling code to ring RD or TW on P2845, at the Wilton Centre.

160/2 CABLE TRAYS AND DUCTS ARE FIRE CONDUCTORS

After a recent fire, observers expressed surprise at the extent of damage on the floor above the seat of the fire. Cables had been installed leading from one level to the other through a hole in the concrete floor. The aperture round the cables had not been sealed in any way. Flames spread along the cables, rapidly burning off the insulation, and the draught through the hole encouraged the process.

A similar thing can happen when cables are threaded through ducts and the entry and exit points are not properly sealed.

Another cause of trouble is the removal of access panels to allow maintenance work or modifications to be carried out - and then leaving them off indefinitely. A fire starting near the opening can then spread through the duct and emerge in unexpected places.

There is a similar effect if panels in suspended ceilings are not replaced. It is thought that the fire in the Stardust Club in Dublin in 1981 spread so rapidly at least partly because of this. Some panels had not been properly installed after modifications to light fittings and ventilation grilles.

This subject was extensively discussed in Loss Prevention Bulletin No 041, published by the Institution of Chemical Engineers.

160/3 GUESSWORK AND GASKETS

Recently after a nasty leak of ammonia from a pipeline joint it was found that a ‘modified’ gasket had been used. Parts of the outer metal retaining ring of a spiral wound gasket had been ground away to make the gasket fit inside the flange bolts. Not only was the original gasket too large, but the flange faces were not suitable for use with any gasket of that type.

In another incident, liquid propylene leaked from a flanged pipeline joint because a CAF (compressed asbestos fibre) gasket was used instead of a spiral wound gasket.

The specification of the gasket for a pipeline joint needs as much care as the specification of the materials of the pipeline itself. This is especially so for pipelines carrying hazardous materials or operating under extreme conditions of temperature and pressure.

If the gasket supplied, or the only one apparently available at the time of a repair, does not fit don't modify it - take advice. Otherwise your cure may be worse than the original complaint.

An article, "Taking the guesswork out of gaskets", CME November 1981 pages 23-29 provides a lot of food for thought. It also shows how many and varied are the types of gasket now in use.

160/4 AN UNEXPECTED ROBOT - A FORK LIFT TRUCK WITH A MIND OF ITS OWN

An operator disconnected the charger from the battery of a fork lift truck. He then reconnected the battery to the electrical system of the truck. Immediately he did so, the truck moved forward and collided with a car. The truck did not stop moving forward until the operator jumped on the truck and applied the foot brake.

It was found that (a) the truck's handbrake had not been fully applied, (b) the driver's seat had been lifted to allow battery charging to take place, (c) the gear lever was in the forward drive position and (d) ignition switch was in the 'on' position.

The vehicle was fitted with a pressure switch which should have allowed the truck to be driven only when pressure was applied intentionally, properly by the driver sitting on the seat. When pressure is removed the gear lever is intended to return to the neutral position. This pressure switch was found to be seized in the 'on' position and so the dependant safety devices were not actuated.

All users of equipment should be trained to observe symptoms of failure of safety systems and the need for the causes to be repaired

The normal shut-down procedures should always be used when equipment is put out of use unless there is a deliberate intention to check trip or shut-down systems. After such a check all other switches etc., should be put in the intended position.

In this case the ignition switch should have been put to 'off' and the failure of the gear lever to return to neutral should have been investigated.

For more information on any item in this newsletter please phone P2845 or write to us at Wilton. If you do not see this Newsletter regularly and would like your own copy, please ask us to add your name to the circulation list.

June 1982

An Engineer's Casebook No. 60
RELIABILITY OF AUTOMATIC PROTECTIVE TRIP SYSTEMS

Automatic protective trip systems are not perfect; this is an obvious truth. This note explains the concept of safety as provided by such systems, subsequently referred to as trip systems, and identifies the conditions which must be observed to maintain the ability of a system to protect personnel and plant.

The measurement of safety is called the "hazard rate", i.e. a prediction of the number of occasions over a period of one year that hazardous events will occur for a particular system.

A hazard will be present when two events coincide:-

1 A demand is made upon a trip system, i.e. some process upset occurs which is beyond the control of the process operator and this upset could create a potential hazard. The number of demands which occur each year is called the "demand rate".

AND

2 The trip system is dead, it is unable to operate because it has failed into a defeated condition. This is usually caused by a faulty component, eg. a blocked impulse line or a jammed valve. We test the systems periodically to find out whether they are alert and active. The measure of how much a system can be expected to be dead is called the 'fractional dead time". A typical simple trip system has a fractional dead time of about .025. This means that the system can be expected to function correctly for 97.5% of the time and be out of order for 2.5% of the time.

From this we arrive at a simple equation for the "hazard rate".

Hazard rate = Demand Rate x Fractional Dead Time.

The calculation of fractional dead time (f.d.t.) for a **simple** trip system is by the equation:

f.d.t.= ½ FT

where F is the expected number of failures of the trip system per year, and T is the interval between tests expressed as a fraction of a year.

To illustrate this calculation : If a pressure switch is used to sense high pressure and operate a trip valve, then this simple system can be expected to fail once every five years,

$$F=\frac{1\,failure}{5\,years}=0.2/yr$$

If we test this system by applying a test pressure four times each year then:

T= ¼ of a year

f.d.t. = ½ x 0.2 x ¼ = 0.025

i.e. the system can be expected to function correctly for 97.5% of the time and be out of order for 2.5% of the time. If a trip test is missed and is not carried out until the next scheduled test is due the f.d.t. is doubled over the 2 test intervals concerned.

There are limits to the validity of the f.d.t. equation because in practice there are faults which the tester does not rectify. The simplest example of this is the case where the tester makes a human error and leaves the valve in the line to the pressure switch closed when he has finished the routine test. The trip could then remain defeated until next it is tested. Further, the more he tests, the more probable it is that he will leave the valve closed on one occasion. In recognition of this type of fault and others which result in a trip having a minimum f.d.t. value, which may be unacceptably high, it is necessary to resort to more complex trip systems (for example, high integrity trip systems) in order to obtain an acceptable f.d.t. time.

It is important to note that the number of demands and the fractional dead time are predicted making the assumption that each type of event occurs randomly. Demands occur on a random basis when a control loop breaks down or an operator makes a human error. Trip systems become dead on a random basis when a trip system component fails.

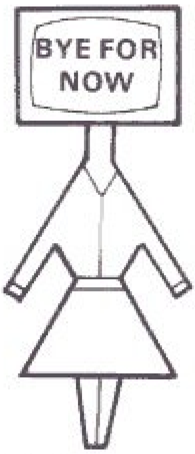
The process user can maintain the safety standards provided by the trip system by keeping to a minimum the fractional dead time and demand rate.

The fractional dead time is maintained by ensuring testing is carried out to schedule and faults which are detected between tests are rectified without delay.

The demand rate is kept to a minimum by avoiding process upsets and by good process control. The user must resist the temptation to use an automatic trip intentionally because it is convenient to do so. As examples; it is wrong to fill vessels until a high level trip operates; it is wrong to run a hot bearing until the high temperature trip stops the drive. These and similar practices increase the demand rate beyond the rate produced by genuine random demands.

J A CASS

WHO'S WHO IN SAFETY



No 37 – IRIS

It is three years since we first introduced you to IRIS in Safety Newsletter No 123. She is however, still a relatively young lady who can help you to find information on a wide range of safety topics (as well as engineering and business subjects). Moreover she has in the meantime collected a much greater store of knowledge and is somewhat more sophisticated — she responds to a greater number of techniques and approaches. Her full name is Information Retrieval by Interactive Search.

To converse with IRIS all you need is a suitable (Decwriter II/III, or VDU) terminal connected to a telephone line.

IRIS, apart from being very knowledgeable is quick, hardworking and friendly but she is a little "slow on the uptake" so your requests must be very clear. If you ask her for information on "blasts" she may tell you about blast freezing without realising that you are also interested in "explosions" and "detonations" as well.

Like most young ladies IRIS is more obliging if you take the trouble to learn how to talk to her. The following notes are intended to help you get started. For more information ask Ron Fawcett at Wilton (P2668) or Terry Flynn of the Central information unit at Millbank (4161).

Let us suppose you are requiring information on fires of liquid discharges from vents or drains which have been ignited by static electricity. The procedure is as follows:-

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