IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No. 58

58/1 ARE YOUR TRIP TESTS LIKE "REAL LIFE"?

We have often pointed out that trips and alarms must be tested regularly or they may not work when required. (See for example Newsletter 28 Item 2 and Report No A.200,669/A.)

The test should resemble the real life situation as closely as possible. Two recent incidents show the need for this.

In the first incident a high temperature trip on a furnace failed to operate with the result that the furnace was seriously damaged and was out of action for several months. The trip did not work because the pointer touched the plastic front of the instrument case and this prevented it moving to the trip level. The instrument was tested regularly by injecting a current from a potentiometer but to do this the instrument was removed from its case and taken to the workshop.

For a full account of the incident see Report No. 0.21,554/B.

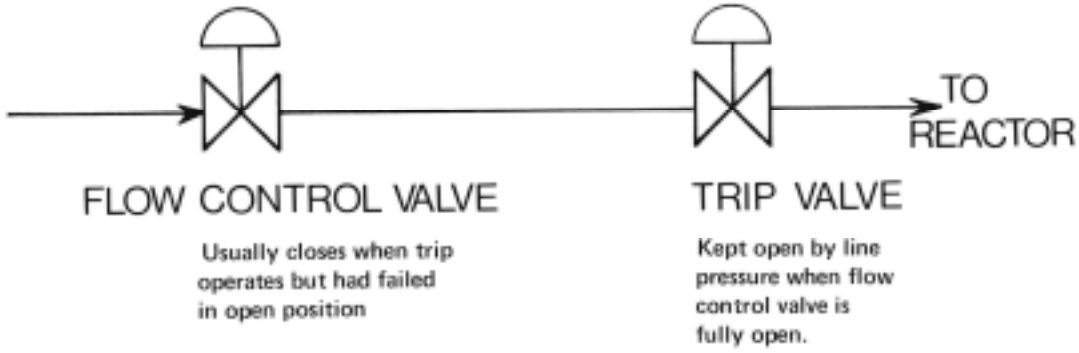
(Incidentally, whenever possible temperature alarms and trips should be tested by injecting a current from a potentiometer not by altering the set-point. If they are tested by altering the set-point, this will not show up faults which prevent the instruments responding to high (or low) temperatures.)

In the second incident there was a high temperature on a reactor. The high temperature trip detected the rise in temperature but the trip valve in the feed line failed to close.

Afterwards it was found that the pressure drop through the valve was so high that the valve could not close against it. It was a globe type valve and to close, the valve had to move against the flow. Butterfly valves can behave similarly.

The trip was tested regularly but normally the flow control valve shuts as well as the trip valve and this reduces the pressure drop through the trip valve.

When the temperature run-away occurred the flow control valve had failed in the full open position — this was the cause of the runaway — and the full upstream pressure was applied to the trip valve. This prevented it closing.



Whenever possible trip valves should be installed so that the flow assists closing and the valves should be tested against the maximum flow and differential pressure likely to occur during trip conditions.

58/2 AN INSTRUMENT REPLACES CANARIES AND DETECTS A LEAKING GAS

At one time small animals such as mice or canaries were widely used for detecting dangerous amounts of certain gases or vapours in the atmosphere. Now instruments are doing them out of a

job. Many people like to see canaries or mice but the new instruments are more sensitive, as the following story shows.

A plant control room was fitted with a new and more sensitive instrument for measuring carbon monoxide (a Hartman and Brown infra-red analyser) and the canaries which used to be used have been prematurely retired. A few weeks after the new instrument had been installed 76 ppm of carbon monoxide was detected in the control room. The maximum level permitted for continuous working (the threshold limit value) is 50 ppm but higher concentrations can be tolerated provided the average over the working day does not exceed 50 ppm (see supplement).

Investigation showed that a piece of equipment had been blown down to atmosphere and that some of the carbon monoxide had entered the control room ventilation system.

76 ppm of carbon monoxide will not make anyone feel ill (not even a canary) and similar concentrations may have been experienced for a short time for many years without anyone knowing about it. Now that we do know it is quite simple to make a change in operating procedure which should prevent it happening again. If this is not successful then the position of the vent or the air intake can be modified.

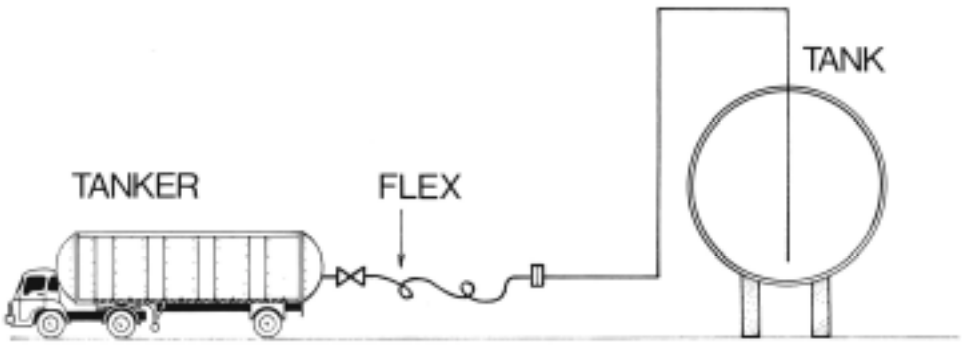
A few months later the alarm operated again — this time there was a leak on a gas booster 40 feet below the air intake.

These incidents are interesting examples of the way in which better methods of detection show up hazards which may have been there all the time, but which we did not know about before. (See also item 60/11.)

Another example is given in “Engineering News” for September, 1973 (Report NoA.128,120/73/9.) New methods of crack detection are showing up cracks in vessels that at one time would have been undetected. We must not panic and discard a vessel because of these cracks. We must decide what level of defects (or what concentration of a leaking gas or vapour) can be tolerated.

58/3 UNUSUAL ACCIDENTS NO. 28

A flammable liquid is regularly delivered to a customer by road tank wagon. It is usually blown into an elevated tank by nitrogen pressure.



One day a delivery was made by a tanker fitted with a pump, so the liquid was pumped out.

When the tanker had been emptied, the tanker’s valve was closed and the flex disconnected.

The entire contents of the tank syphoned out on the floor.

There was no valve on the pipe-line!

58/4 IT’S NOT WHAT PEOPLE SAY, IT’S WHAT THEY DO

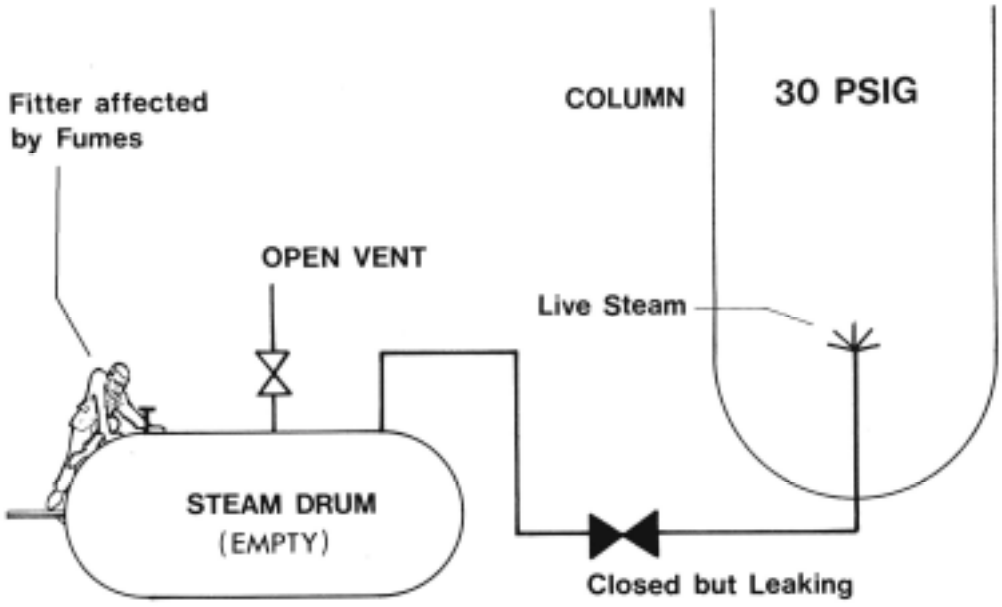
A manufacturer’s representative was demonstrating an air operated sliding plate valve which had a guillotine type of action. Although the valve was to be installed in a place which was accessible — the bottom of a hopper — the representative said that it was not necessary to fence it as the force on the slide was so low that a man could stop it with his hand. The representative was asked if he would demonstrate this by putting his hand in the valve while it closed.

He declined to do so and the valve was fenced.

From “Safety Matters”, published by Organics Division, No. 2-73.

58/5 FOUR YEARS AGO

A fitter was affected by fumes while working on a steam drum. One of the steam lines from the drum was used for stripping a process column operating at 30 psig. A valve on the line to the column was closed but the line was not slip-plated. When the steam pressure was blown-off, vapours from the column came through the leaking valve into the steam line.



The Petrochemicals Division rules on the isolation of equipment for maintenance state that equipment which is given to maintenance must be isolated by slip-plates or other equally effective means unless the job to be done is so quick that fitting slip-plates would take as long and be as hazardous as the main job.

From Safety Newsletter No. 14 November 1969

58/6 FIRE-PROOFING HAS A LONG HISTORY

It is our policy to fireproof all load-bearing structures up to a height of 30 ft. and also all storage vessels for liquefied flammable gases and other specially hazardous materials. Engineering Specification CIV 0406 gives details of the methods we recommend.

Fire-proofing is nothing new. To quote from “The Englishman’s Castle” by J Gloag, p.46:— *“The plastering of walls, inside and out, had originally been a precaution against fire. The fear of fire haunted the towns and cities of the Middle Ages. The use of thatch for new buildings in London had been forbidden as early as 1212, and at that time the city council had made an order that all cookshops on the Thames were to be plastered. A cookshop was often the starting place of a fire. Plastering became a recognised craft, and it was used to provide a good surface for painting.*

REMINDER: Newsletter 55, Item 6 pointed out that if part of the fire-proofing on a structure is missing, the whole structure is at risk.

58/7 A HAZARD WITH MOBILE CRANES

Some mobile cranes supplied by plant hire contractors contain cab heaters which are unsuitable for use in areas where flammable gases or vapours may be present. In these heaters diesel fuel is burnt and the hot gases are passed through a heat exchanger. The air needed for combustion is drawn from the surrounding atmosphere. If this air becomes contaminated with flammable gas or vapour the heater would ignite it.

We must take care that these heaters are not used on any cranes which we hire.

But we must not let the crane driver get too cold, or he may not be able to operate his controls accurately. Another type of heater may have to be installed.

58/8 WHAT THE LAW SAYS, NO. 14

To fix nails into concrete, we often use special guns which shoot the nails into the concrete. According to a newspaper report, some cartridges for these guns were accidentally thrown onto a rubbish tip and then put into an incinerator. They blew up, injuring a man.

What does the law say about the storage of these cartridges?

The "Law Relating to Explosives" by Watts states:

"There are no legal restrictions on the way in which explosives are kept for private use. It is desirable that they should be kept in a locked box, labelled or otherwise marked Explosives"

A Company is a "private user". We should, however follow the recommendations of British Standard 4078 1966 which states that a cartridge-operated tool should be kept in a rigid, lockable box or case, provided with compartments to contain the splinter guard, the operating and maintenance instructions and a pair of goggles. The makers usually supply additional compartments for cleaning tools, cartridge boxes and pins. A tool should always be taken to the place of use in its box and should be kept in it, and the box locked, whenever it is not in use. Tools should never be kept loose in store, but always in the box. Whenever the box is taken from or returned to the store, it should always be checked to make sure the contents are complete. The store itself should be secure, and only authorised persons should be allowed inside.

58/9 RECENT PUBLICATIONS

a) Theoretically valves with back seat bushings can be re-packed on line with the valve under pressure. Is it safe to do so? A note by Harland Frank dated 2 October describes the circumstances when this can be done.

b) Concern has been expressed on several occasions about the length of Works Instructions and the amount of detail they contain, making it difficult for people to become thoroughly familiar with them and to find their way about them. See for example Safety Newsletter No 47, item 2. To try and overcome this problem one Works in the Division has prepared a 17 page alphabetical guide to their permanent instructions. A copy is available on request.

c) lCl is collaborating with other chemical companies to produce a series of Codes of Practice on the storage and handling of hazardous chemicals. The first of these, on Chlorine, has just been issued. It can be obtained from Division Reports Centres by asking for Report No HO/SD/73006/1

For copies of (a) and (b) or for more information on any item in this Newsletter please write to me or ring B.3927. If you do not see this Newsletter regularly and would like your name added to the circulation list, please let me know.

Trevor A. Kletz

November 1973

SUPPLEMENT TO SAFETY NEWSLETTER NO 58

DANGEROUS CONCENTRATIONS

What is a “dangerous concentration”? This note tries to explain.

We handle two sorts of dangerous gases and vapours those that are flammable or explosive and those that are toxic or poisonous. (Flammable and explosive, when applied to gases or vapours mean the same — a fire turns into an explosion when the gases that are formed by burning cannot get away and the pressure rises.)

A dangerous concentration of a flammable gas or vapour in air is one that will burn or explode. A certain minimum amount of gas or vapour is needed and this is called the lower explosive limit or LEL. The following are the lower explosive limits of some of the materials we handle:

	Lower Explosive Limit	
	% Volume by Volume	Parts per million
Methanol	6.8	8,000
Naphtha & petrol	1.0	10,000
Benzene	1.3	13,000
Propylene	2.0	20,000
Acetone	2.6	26,000
Ethylene Oxide	3.0	30,000
Ethylene	3.1	31,000
Hydrogen	4.0	40,000
Carbon Monoxide	12.5	125,000
Ammonia	16.0	160,000

You should know the lower explosive limits of the materials handled on your plant. They can be found in many reference books. Flammable gas detectors such as the Sieger are usually calibrated in % LEL. A full-scale reading means that the mixture of gas or vapour and air will just burn or explode. A 10% reading means that ten times as much gas or vapour would be needed for an explosion to occur. However, in another part of the plant or vessel being tested the concentration may be higher and so we do not allow welding to take place if the reading on a flammable gas detector is 10% or more.

When we are dealing with toxic concentrations we talk about Threshold Limit Values or TLV’s. The TLV is the concentration that can safely be breathed for an eight-hour working day, year after year. TLV’s are much smaller than LEL’s and are usually measured in parts per million. The following are the TLV’s for some of the materials we handle:—

	Parts per million	
Acetone	1,000	
Naphtha & petrol	About 500	but it depends on the composition.
Methanol	200	
Carbon monoxide	50	
Ethylene oxide	50	
Benzene	25	
Ammonia	25	

For example, 50 ppm of carbon monoxide can be breathed for an eight-hour day, or rather more for a shorter period so long as the average is not more than 50 ppm.

TLV's are quoted in "Threshold Limit Values for 1972", Technical Data Note No 2/72, available free from the Factory Inspectorate. In this booklet some TLV's are marked 'C' (for ceiling), for example, benzene. This means that the TLV should not be exceeded and that we cannot take an average over the working day.

Some gases such as hydrogen and ethylene are not toxic at all, though in very large concentrations they could asphyxiate you, that is, they could reduce the oxygen content of the air so that you could not breathe.

Note that most threshold limit values are a lot lower than the lower explosive limits. So if a gas detector gives a zero reading it means that the atmosphere is not explosive but it does not mean it is safe to breathe. Before entry is allowed into a confined space which has contained a toxic gas or vapour, the amount of this gas or vapour in the atmosphere should be measured. For example, if a vessel has contained carbon monoxide, the concentration of carbon monoxide must be measured. A test with a combustible gas detector is not enough.

Correction to Newsletter 58 (Supplement

The lower explosive limit of methanol is 6.8%, not 0.8%.
All the lower explosive limits quoted are for atmospheric temperature and pressure.