SAFETY NEWSLETTER

No. 133

SOME INCIDENTS CAUSED BY FAILING TO APPLY BASIC KNOWLEDGE

This month we describe some incidents which occurred because people did not know — or failed to apply — information which should be known to everyone who works on a plant. The incidents occurred because someone:

133/1 connected high pressure water to a process line

133/2 mixed acid and water

133/3 made a Heath Robinson repair to a tank

133/4 connected town water to process equipment

133/5 tested the end of a long pipeline and assumed the middle was gas free

133/6 heated food in a laboratory oven

133/7 did not defuse faulty electrical equipment

An Engineer's Casebook — Trapped gaskets

Accidents in other industries

ICI
IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

133/1 PRESSURE IS DANGEROUS

Many people find it hard to grasp the destructive power of gases or liquids under pressure. Newsletters 93/3, 89/7, 44/3, 44/1 and 5/2 described accidents that occurred because gases at high pressure were connected to equipment that was suitable for low pressures only.

Now another incident has occurred in the Division. High pressure water wash equipment was being used to clear a choked line. Some success was achieved but one section remained choked. It was then decided to connect the high pressure water directly to the pipe.

As the pressure of the water can be as high as 10 000 psi — it was actually about 1500 psi — and the pipe was designed for only a few hundred psi, it is not surprising that two joints blew and that after they were remade a valve broke.

Everyone should know the safe working pressure of their equipment and should never connect up a source of higher pressure.

Although equipment is fitted with relief valves, they are designed to cope with known sources of pressure, not with sources of pressure that might be added in the future.

During the investigation it became clear that high pressure water wash equipment has been directly connected to process equipment on other occasions in other parts of ICI. This should never be done except under the most exceptional circumstances, with the permission of senior management, and under carefully controlled conditions so that the test pressure of the equipment is not exceeded.

133/2 MIXING SULPHURIC ACID AND WATER

Most people know that a lot of heat is evolved when sulphuric acid and water are mixed but apparently some people do not know or have forgotten. A 1 inch bore drain line which had contained sulphuric acid was choked. It was disconnected from the plant and an attempt was made to clear the choke with water. A stream of acid spurted 15 feet into the air, injuring one of the men working on the job.

133/3 A HEATH ROBINSON REPAIR

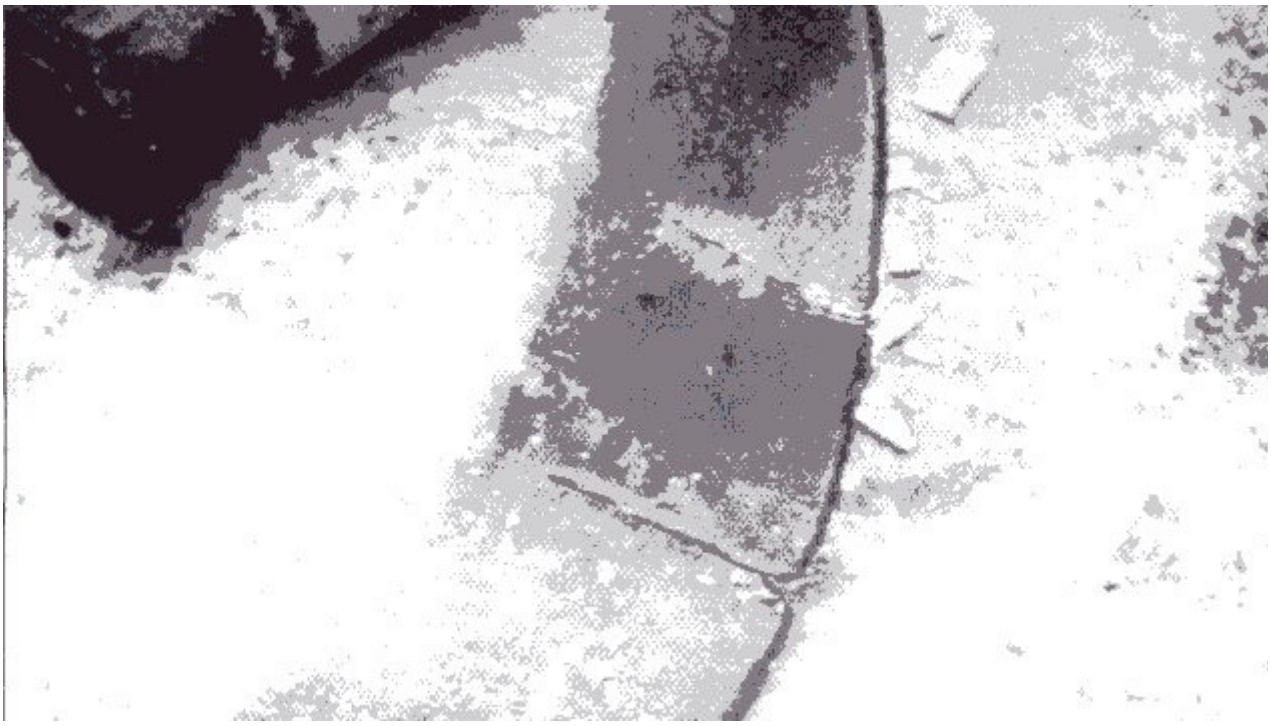
Although Heath Robinson died some years ago his disciples are still around and we employ a few of them.

The photograph opposite, taken some years ago, shows how easily enthusiasm to get a job done can result in work which is not up to our usual standards.

A 24 inch manhole branch on a vessel had corroded and had to be replaced. A new branch was made and the old branch was removed. When the new branch was offered up to the opening in the vessel it was found to be a little bit too small; the old branch was 24 inch *internal* diameter, while the new one was 24 inch *external* diameter.

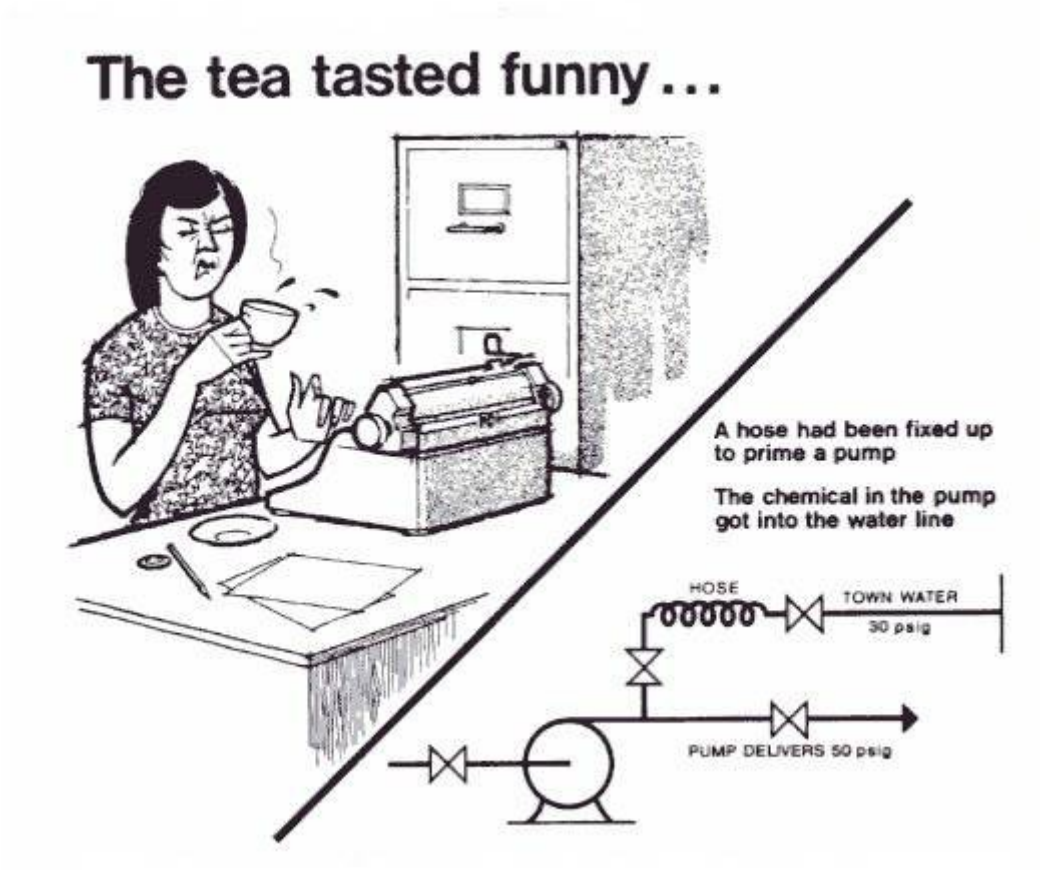
The supervisor therefore decided to make a series of parallel cuts in the branch, splay them out so that they fitted the hole in the vessel and weld up the gaps. The photograph shows the branch after cutting. Fortunately, before the job could be completed it came to the notice of a senior engineer and it was stopped.

Because of the size of the job there was no chance of the work being completed but with a small job this might not be the case. Do not allow enthusiasm to get a job done result in low standards.



133/4 NEVER CONNECT TOWN WATER TO PROCESS EQUIPMENT

The following appeared in Newsletter 90, page 21.



Never connect town water to process equipment

Another company have now described a similar and more serious incident. A caustic soda pump was

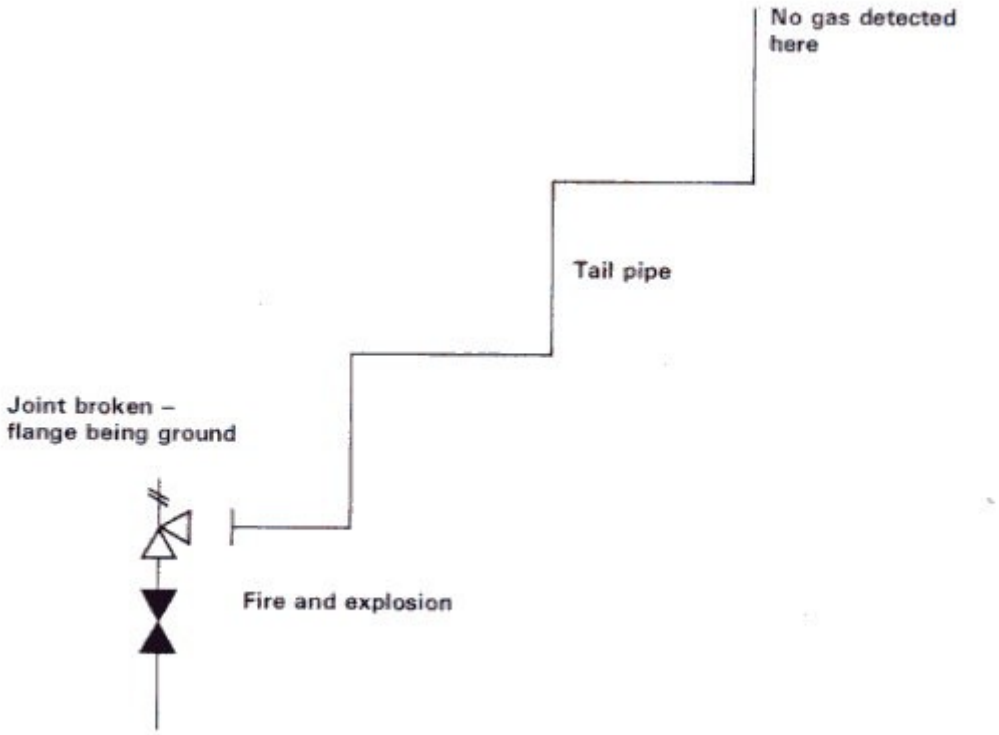
provided with a water quenched packed gland connected to the town water supply. This pump was not running, but as the suction valve was open there was a pressure in the pump when the spare pump was on line. Due to a fault in the gland, caustic soda flowed back into the water line and contaminated the drinking water pipelines. A man filled a glass of water from a washbasin and drank a dilute caustic soda solution. He was taken to hospital with first, second and third degree burns to his lips, mouth, throat and oesophagus.

It is illegal and unsafe to connect town water supplies directly to process equipment, either temporarily or permanently. There must always be a break tank in between.

133/5 AN EXPLOSION IN A PIPELINE BECAUSE IT WAS NOT PROPERLY CLEANED OR TESTED BEFORE WELDING

Welding had to be carried out — during a shut-down — on a relief valve tail pipe. It was disconnected at both ends and four hours later the atmosphere at the end furthest from the relief valve was tested with a combustible gas detector. The head of the detector was pushed as far down the tail pipe as it would go; no gas was detected and a permit-to-work was issued.

While the relief valve discharge flange was being ground, a flash and bang occurred at the other end of the tail pipe. Fortunately, no-one was hurt.



Gas in the tail pipe — 20 m long and containing a number of bends — had not dispersed and had not been detected by a test at the other end of the pipe.

Before allowing welding or similar operations on a pipeline which has or could have contained flammable gas or liquid:

Sweep out the line with steam or nitrogen from end to end.

Test at the point at which welding will be carried out. If necessary, a test hole may have to be drilled in the pipeline.

Reminder: Even service lines in plant areas should be tested before welding as they may be

contaminated with flammable materials. See Newsletter 51/7 and Chemical Engineering Progress, April 1974, p 83.

133/6 DON'T USE LABORATORY OVENS FOR FOOD

Over the years, it became 'custom and practice', in a laboratory in another Division, for people to heat food in a laboratory oven.

One day some silica gel left in the oven gave off some toxic fumes, they affected the food and a man became ill after eating it.

Never heat food in laboratory or plant equipment.

Never take food into a laboratory.

133/7 A LOOK BACK AT NEWSLETTER 33 (OCTOBER 1971)

Faulty electrical equipment should be defused

The stirrer on a storage tank was known to be faulty and the operators were told not to use it.

Nevertheless, somebody switched it on and half a ton of petrol leaked out of the gland before a supervisor saw it and switched it off.

Faulty electrical equipment should be defused so that it cannot be switched on.

133/8 OTHER MEN'S VIEWS No 18

"The chemical industry... continually comes up with accidents the causes of which are more the province of Dr Spock than of Dr Who"

T Timpson, "Acceptable Risk, Who Says So?", British Safety Council, 1978, p 25.

133/9 UNUSUAL INCIDENTS No 94

An unusual vapour cloud explosion

In 1978 two Danish doctors reported that a patient died after an electrical surgical knife ignited intestinal gases and caused his digestive organs to explode.

Melbourne Age, 10 January 1980

133/10 COMMENTS FROM READERS

Newsletters 130/3 and 89/1 described how water (or steam) in a heat exchanger tube can be frozen by evaporation of a liquefied gas in the shell. A reader points out that water in the tubes can also be frozen by reduction of the pressure on a supercritical gas in the shell. A tube has actually been ruptured in the Division in this way. The reduction in pressure was due to a relief valve failing to reseat.

133/11 RECENT PUBLICATIONS

(a) Managers are increasingly dependent on the advice of experts (See Newsletter 105/6). Unable or unwilling to read the expert's report, they are tempted to look only at the recommendations on the last page. Safety Note 80/2 suggests some key points that managers can check when presented with reports on hazard analysis, the application of numerical methods to safety problems.

(b) "How Far Should We Go In Bringing Old Plants Up To Modern Standards?", for presentation at the next AIChE Loss Prevention Symposium, based on Safety Note 79/3.

(c) "Some Instruments Which Cannot do What we Want Them to do", for presentation at the next AIChE Loss Prevention Symposium, based on Newsletter 119.

(d) "The Man in the Middle — Some Accidents Caused by Simple Mistakes", for presentation at the 3rd International Symposium on Loss Prevention and Safety Promotion in the Process Industries, September 1980, based on Newsletters 123 and 109.

(e) "Safety Aspects of Pressurized Systems", for presentation at the 4th International Conference on Pressure Vessel Technology, May 1980, based on Safety Note 79/5.

(f) "Industrial Safety — The Shaking of the Foundations", my inaugural lecture at the University of Technology, Loughborough.

(g) Report No 0.200, 908/A summarises all the fires, explosions and releases of toxic materials in the oil and chemical industries that were reported in the press last year.

For copies of these publications, except (g), or for more information on any item in this Newsletter please 'phone ET (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.

March 1980

Staying on the top floor of a Swiss hotel, a reader found the fire door locked. He went to reception and asked what he should do if there was a fire. He was told to come down for the key.

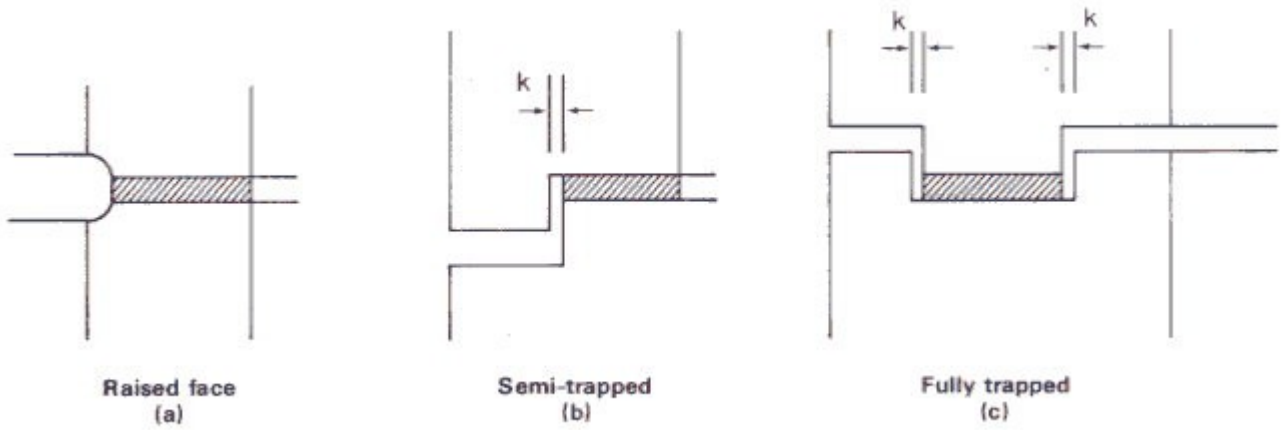
An Engineer's Casebook No 33
TRAPPED GASKETS

Overheard in the Foreman's Office one day: "The spare metal-jacketted gasket for C-37 bonnet to tubesheet joint was the wrong size and would not fit. I've told Joe to cut one out of caf (compressed asbestos fibre). O.K.?"

Well it all depends on the actual design of joint as to whether caf would be acceptable or not.

There should always be sufficient bolt load to seat and compress the caf since this material is significantly softer and requires only about a third of the load to yield metal-jacketed asbestos-filled gaskets. As a rough guide a minimum bolt load of 1 t/in^2 is required for caf gaskets and 3 t/in^2 for metal-jacketted asbestos.

The acceptability of caf must be judged against the gasket containment features of the joint. These can be one of three types



In general, when metal-jacketted gaskets are specified in the design of raised face joints as in (a), caf should not be used as a substitute. Spirally wound joints to BS 3381 incorporating an outer ring to carry the radial pressure load would be suitable.

Caf could be used with the semi and fully trapped designs (b) and (c) provided that the clearance (k) between the inside and outside of the metal recess in the flanges is acceptably small. What is acceptably small? Small enough so that a compressed CAF gasket of the nominal thickness chosen cannot be blown out by a combination of fluid pressure and extrusion by the bolt load. For a nominal $^1/_{32}$ inch thick gasket about 0.020 inch, for an $^1/_8$ inch gasket about $^3/_{32}$ inch.

When using substitute caf gaskets care should be taken to ensure concentricity between the spigot and socket diameters of the mating flanges so that gap 'k' is uniform. Failure to do so on horizontal exchangers, where a typical diametral clearance is 1/8 inch, will result in nothing at the bottom and $^1/_8$ inch at the top.

E H Frank

ACCIDENTS IN OTHER INDUSTRIES

Accidents in other industries often illustrate very clearly the principles of accident prevention. As we are not involved, we see the messages more clearly. For this reason I have often described railway accidents (Newsletters 109/4, 85/5, 82/7 and 80/6), and accidents in coalmines (Newsletters 106/5 and 70/4) and steelworks (Newsletter 88/1) in earlier Newsletters.

Some years ago a headline in the “Farmers Weekly” said:

Tail Biting in Pigs

Faults in Management and Supervision.

Now the Health and Safety Executive have reported a rise in the number of people killed by bulls (six in two years, many of them experienced people) and have issued recommendations. With a few slight changes they apply to hydrocarbons!

— treat every bull with respect and caution;

— adopt safe systems of work;

— ensure suitable and well-maintained facilities are available with which to control the bull...

— make use of the safety equipment...

— have available to help, if needed, a second person...

However the HSE have overlooked the intrinsically safe solution: keep fewer bulls and make more use of artificial insemination.

What you don’t have, can’t kill!