# SAFETY NEWSLETTER

## No. 104

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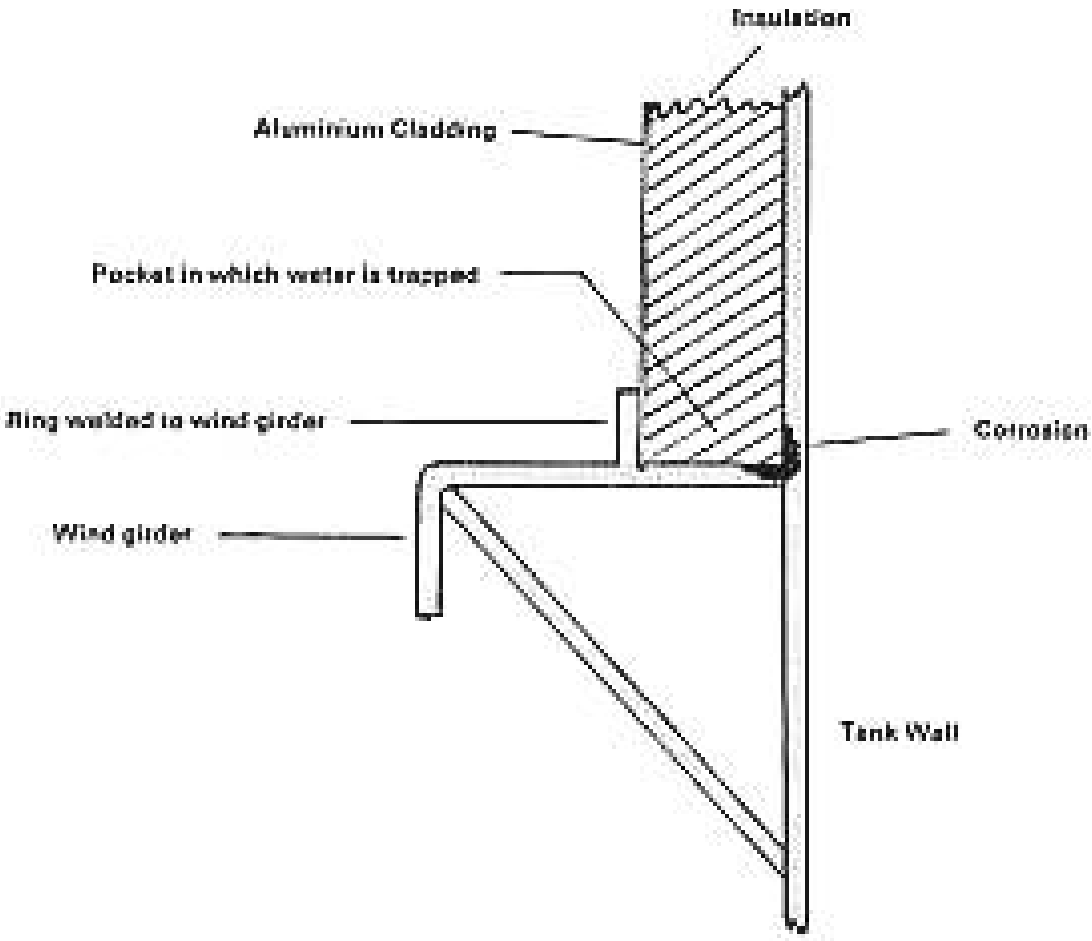
**IMPERIAL CHEMICAL INDUSTRIES LIMITED**

**PETROCHEMICALS DIVISION**

**104/1 ANOTHER STORAGE TANK FAILURE**

Newsletter 100/4 described a massive leak due to corrosion of a storage tank in another company. About the time the Newsletter appeared severe corrosion was detected in one of our floating roof fuel oil storage tanks (30 000 $m^3$). Fortunately, it was noticed before a serious spillage occurred.

When the tank was built the insulation contractor welded a vertical strip of metal on to the wind girder to provide a support for the insulation. Water collected in the channel formed in this way and caused corrosion. A large crack appeared, about 10 feet long.




As it is almost impossible to clean a tank which has contained heavy oil — see Newsletter 82/5 — the leak was sealed with resin and the tank emptied and filled with water. The tank was then repaired by welding a strip over the crack and the corroded region.

Newsletter 100/4 recommended that the bottom 200 mm of a tank should be left free of insulation so that it can be inspected for corrosion. A strip above a wind girder or any other place where water may collect should also be kept free of insulation.

If you have insulated tanks fitted with wind girders you may like to check them for corrosion.

Another incident, similar to that described, occurred last year on a tank fitted with a concrete ring round the base to support the insulation. Water collected in the space between the ring and the tank and caused severe corrosion.

One of our overseas companies has reported corrosion of insulated pressure vessels due to accumulation of water on insulation support rings and other projections. This could have been avoided by better attention to the detail of design.

### 104/2 WRONG MATERIALS OF CONSTRUCTION AGAIN — BUT THE INCIDENT IS CONTROLLED BY THE RIGHT PROTECTIVE CLOTHING AND EQUIPMENT.

Earlier Newsletters (98/8, 78/4 and 71/6) have described incidents which occurred because the wrong material of construction was used. Here is another.

Articulated arms are often used instead of hoses for moving hazardous liquids and liquefied gases in and out of ships and road and rail tankers. The ballraces in the joints of the arms are held in by a plug which is secured by a circlip. Stainless steel circlips are normally used on arms which handle ammonia.

By mistake beryllium-copper circlips were used on an arm used for off-loading road tankers of ammonia. They failed due to stress corrosion cracking and broke into a number of pieces, allowing all the ball bearings to escape and the joint to blow wide open.

Fortunately the leak was soon stopped as the driver and operator — who were dressed in full protective clothing and wearing compressed air masks — were able to close a remotely-operated valve on the tanker's outlet pipe. A non-return valve prevented back flow from the plant.

As we use no process materials for which beryllium-copper is superior to stainless steel it has been decided to stock only the latter in future.

This illustrates a general point. The fewer grades of anything that we stock, the less opportunity there is for errors.

***Reminder:*** Newsletter 96/3 described how a hose came off a tanker causing a leak of liquefied flammable gas. As there was a remotely-operated valve at one end of the hose and a non-return valve at the other, the leak was soon stopped.

### 104/3 ANOTHER HAZARD WITH PLASTIC PIPELINES

Newsletter 101/2 recommended that plastic pipelines should not be used for flammable liquids as they disappear in a fire. A report from another company describes another disadvantage of plastic lines.

There was a spillage of solvent on open ground. It soaked into the ground and disappeared. Later it was found that the plastic fire water main had disintegrated.

***Reminder:*** Polythene drinking water pipes should not be run through oily ground as hydrocarbons are absorbed by polythene and may affect the taste of the water (Newsletter 22/6).

### 104/4 MEN ON PATROL STILL DETECT MANY ABNORMAL OCCURRENCES

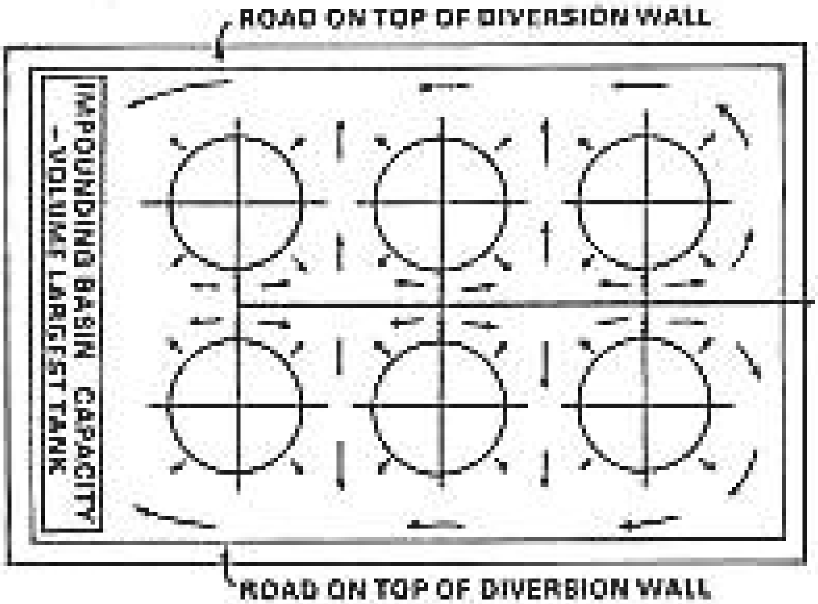
Another Company have made a detailed analysis of all their abnormal occurrences of the past five years, nearly 400 in all.

It shows that nearly 40% of the incidents were detected by routine patrols and another 5% by other people who were in the plant areas. The company, like Petrochemicals Division, have a large number of gas detectors and other alarms on their plants but nevertheless nearly half the abnormal occurrences were detected by people walking through the plant.

Our experience is similar. Although we have many combustible gas detectors and other instruments, about half our leaks are detected by people; on some plants the figure is higher.

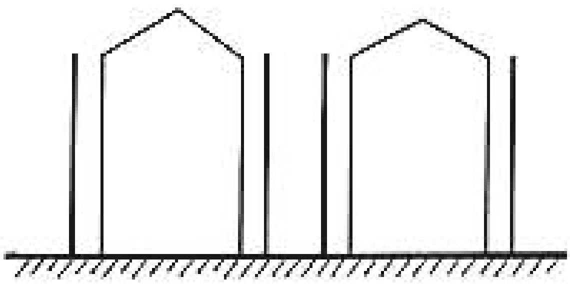
**104/5 SOME NEW IDEAS FOR STORAGE AREAS**

If we need a lot of storage tanks can we use alternatives to conventional bunds? For example, can we allow all the tanks to drain into a single catchment basin as suggested by D M Johnson in Loss Prevention, Vol, 3, 1969, p 98?




As shown, this will not save a lot of land, but if we can use the same basin to serve another group of tanks on the far side, and even ones above and below, then there will be savings. It may mean spending a little more at the start to save money later.

Alternatively, can we save land by making the bunds smaller and the bund walls higher? In the ultimate we could make the bund wall as tall as the tank and locate it about 1 metre from the tank. This method is used for liquefied gases stored refrigerated at atmospheric pressure; it could be used for petrol and other flammable liquids.



However, this system has disadvantages. If the material in the tank is flammable — and if it was not we would probably not want a full-size bund — small leaks may produce an explosive mixture in the space between the tank and the bund. Water may collect in the space, causing corrosion, and inspection will be difficult. It may be necessary to roof the space between the tank and the bund.

Nevertheless, the ‘tall bund’ may be worth considering if we are short of space.

**104/6 A LOOK BACK AT NEWSLETTER 4**

Like Newsletters 1 to 3, Newsletter 4 (issued in September 1968) described some accidents which occurred during maintenance. A liquid ammonia pump was dismantled leaving an open end on the suction line — no blank, no slip-plate, not even a lock on the valve. It is believed that someone cracked open the valve and was killed by the escaping ammonia (Newsletters 4/1 and 68/6).

Two tanks were prepared for entry. Their atmospheres were analysed. The laboratory reported 20.4% oxygen in each. Something aroused the supervisor's suspicions. He had the tests repeated and found that the oxygen content was only a few per cent.

What went wrong?

In one case there was a choke in the analyser and no sample passed through it. A bubbler has now been fitted.

In the second case the sample was taken too near a man-hole. Samples should be taken at several points well inside a vessel.

**104/7 OTHER MEN'S VIEWS—No 3**

The fact is — and we believe this to be widely recognised — the traditional concepts of the criminal law are not readily applicable to the majority of infringements which arise under this type of legislation. Relatively few offences are clear-cut, few arise from reckless indifference to the possibility of causing injury, few can be laid without qualification at the door of a particular individual. The typical infringement or combination of infringements arises rather through carelessness, oversight, lack of knowledge or means, inadequate supervision or sheer inefficiency. In such circumstances the process of prosecution and punishment by the criminal courts is largely an irrelevancy. The real need is for a constructive means of ensuring that practical improvements are made and preventative measures adopted.

From *The Robens Report ("Safety and Health at Work: Report of the Committee 1970-1972"), HMSO, 1972, paragraph 261.*

**104/8 UNUSUAL ACCIDENTS No 71**

Newsletter 97/2 described how a plastic gas main was installed without any slack in it to allow for contraction. When the ground cooled the pipe pulled out of a compression coupling and the gas leaked into a hotel and exploded.

A reader recalls a similar incident a few years ago. He was working for a water board laying water pipes to isolated farmhouses. Originally copper pipe was used but this was changed to polythene pipe. It was decided to see how easy it was to fix a branch on a polythene pipe. An excavation was made round the pipe and a plumber cut the pipe with a hacksaw. The reader comments:

*"I wish I had a photograph of the expression of horror and awe on the face of the plumber as he watched the two cut ends of the pipe slowly and inexorably disappearing into the walls of the trench."*

The pipe had been laid under tension.

For more information on any item in this Newsletter please 'phone Eileen Turner (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 Turner to add your name to the circulation list.

October 1977

**An Engineer's Casebook No 4— Pipework**

Our plants contain a lot of pipework most of which attracts little or no attention and only a few pipes are subject to regular examination. Pipe wall thickness must be such as to contain the stress due to pressure otherwise failure will result. Stress arising from other causes, for example thermal expansion or dead weight loading, may exceed the yield stress without a failure occurring. The piping takes up a slightly different configuration to hold the stress at the yield value. Provided this sort of thing does not take place too frequently, in which case a fatigue failure may result, or the extra dead weight is so severe as to cause gross displacement by bending, things will be alright.

The smaller sizes of pipe usually have a handsome degree of over-design built into them so that they tolerate the normal wear and tear of being on a production unit. For sizes 8 inches and above, and for higher pressures, design is more closely related to allowable stress levels. Above 12 inches or so piping is normally tailored to the particular duty and purpose designed for it, using calculated wall thickness. Consequently it is important that it is installed as the designer intended and operated within the design limits of pressure, temperature etc.; there is no extra arbitrary factor of safety built in as in the smaller line sizes. In 1972 a 22 inch IP steam main developed a crack after some years of service. This might be described as a fairly severe duty carrying superheated steam at 250 psig and 365°C, certainly an application where the design was based on calculated wall thickness and adequate flexibility to accommodate the thermal expansion within the allowable stress range.

After the failure, which was in the form of a circumferential crack on the bottom of the pipe and may not have been due solely to overstress, the line run was checked against the designer's drawing. The following findings are quoted from the report on the incident.

Spring support H1 had its springs fully compressed.

Spring support H2 was shown on the drawing but not fitted.

Spring support H3 was in position but was not attached to the pipe.

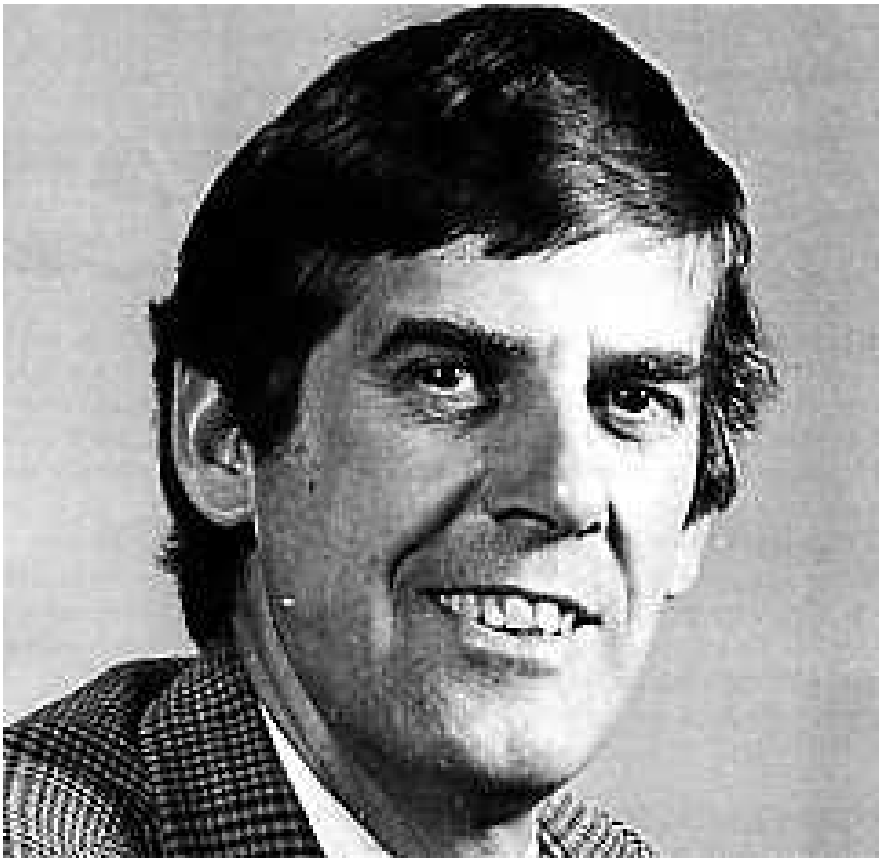
Spring support H4 was in position but the nuts on the end of the support rods were slack.

When the stresses in the line were computed in the 'as found' condition the maximum was 60 000 $lbf/in^2$, more than twice the maximum allowable. Failure was not surprising.

It is important that the larger diameter lines on a plant are given a pre-commissioning check for compliance with the designer's drawings. Hangers, guides and anchors are not 'optional extras' but essential features, particularly on the larger pipelines.

E H Frank

# WHO'S WHO IN SAFETY



**No 18 - S B Gibson**

Barry Gibson started at Keele University in the second year of its existence and graduated in mathematics and physics. As well as playing rugby, he also enjoyed basketball, bridge and some of the other indoor sports for which Keele is well-known.

His first job was on rocket development with Armstrong-Siddeley Motors Ltd and it spanned the Suez crises. The frustration of watching the tremendous power liberated during test firings when he couldn't get sufficient petrol to sustain his Morris Minor's meagre appetite was only one of the reasons which led him to seek the good life with ICI.

Joining Mond Division in 1957, he spent the next 14 years working in the instrumentation field, five of them at Cassel Works in the North-East; since moving back to the North-West he has wondered what has happened to winter.

In 1971 he was appointed Mond Division Reliability Engineer; since then he has pioneered the application of reliability engineering techniques to a variety of activities. Hazard studies and analyses for the Division capital programme now form a substantial portion of the work load of the Reliability Engineering Section which he now manages.

Since the wood pigeons seemed to benefit most from his horticultural activities, his main hobby now is keeping his golf handicap below his wife's. His two daughters aged four and nine are still not sure whether he works for ICI or Sandiway Golf Club.