

# **IMPERIAL CHEMICAL INDUSTRIES LIMITED** **PETROCHEMICALS DIVISION**

## **SAFETY NEWSLETTER No. 62**

### **62/1 BOX GIRDER BRIDGES**

We have read a lot about box girder bridges in the newspapers since the Yarra River Bridge in Melbourne, Australia, collapsed during construction in October 1970. Since then, existing box girder bridges have been made in new designs.

However, the cause of the collapse was not errors in design but errors in construction, in particular, an attempt to force together components that had been badly made and did not fit. To quote from the official report, "The difference in camber occurred because of the failure of the John Holland (Construction) Pty Ltd., Engineers, to assemble the boxes of each half span with sufficient care and skill to ensure that the camber of each half span was the same as the other or differed only, in acceptable degree".

The message, that comes out of the official report on the incident, is the need for close co-operation between design and construction organisations. The consulting engineers produced a design which took little account of the contractor's erection problems whilst the contractor did not understand the design philosophy and did not appreciate that traditional methods of erection could not be used. Construction management must be part of the project team and must work closely with the designers so that they solve problems together.

The style of organisation used for construction work by ICI is not the same as the traditional consulting engineer/contractor arrangement used on the Yarra Bridge Project. Nevertheless, earlier Newsletters have described incidents that occurred, or nearly occurred, because the construction team did not understand the designers' intentions.

- (a) Contractors welded a tie across a U-bend to make construction easier and then left it in, thus imposing a strain on the pipe as it warmed up (Newsletter 30/4).
- (b) Contractors fitted temporary cleats on to the weak seam roof of a storage tank, again to facilitate construction, and then left them on (Newsletter 62/2). On other occasions, contractors have strengthened the roof to wall weld, not realising it was supposed to be left weak.
- (c) Contractors pressure tested a tank with compressed air and burst it (Newsletter 44/1).
- (d) Contractors connected up new pipelines without authority (Newsletter 56/4).
- (e) Pipelines were fixed too rigidly so that they did not have room to expand as they warmed up (Newsletter 10/6 and 30/4).

In all these incidents there has been a failure to translate the design intent into the correct physical items. This is not so much a criticism of the construction work as of poor communication from the designers to the constructors, and to those responsible for the final acceptance of the equipment. In our organisation, it is not possible or practical for every designer to watch the construction methods and to check the completed job in detail, but the design information must be clear and fully specified, the construction staff should work with the designers to assess the implication of construction methods on the design, and the completed work must be fully checked to ensure that it complies with the design. The problem is essentially one of communication.

The full report on the Yarra Bridge collapse ("Report of Royal Commission into the Failure of the West Gate Bridge", State of Victoria Government Printer, Melbourne, 1971) can be borrowed from Petrochemicals Division Reports File.

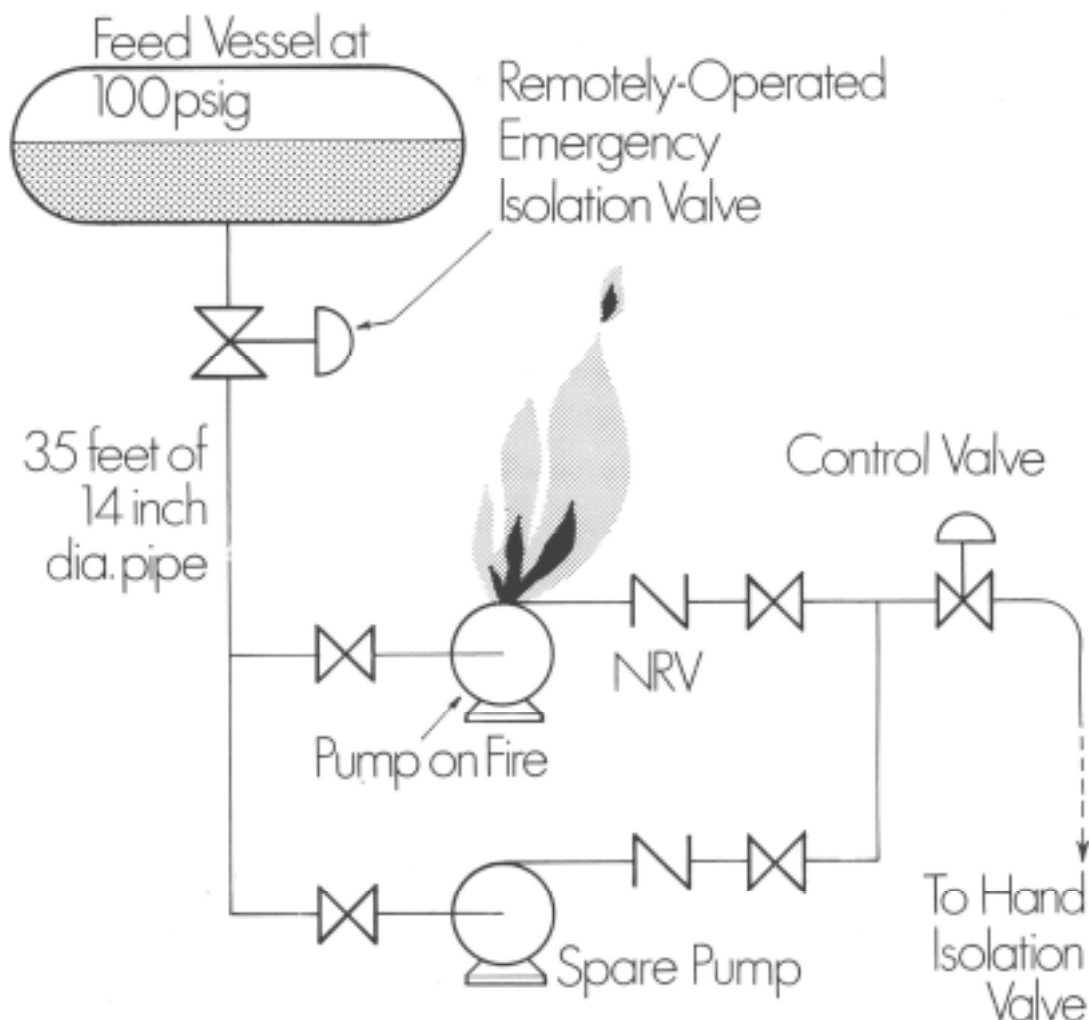
### **62/2 STOP PRESS — A REMOTELY OPERATED VALVE STOPS A FIRE**

A recent incident has shown the value of remotely-operated emergency isolation valves.

A leak of light hydrocarbon from a pump caught fire. The flames were 30 feet high. From the control room, the operator closed a remotely-operated valve in the pump suction line. The flames soon died

down and the fire burned itself out in twenty minutes. It would have been impossible to have closed a hand-operated valve in the same position and if the emergency valve had not been provided the fire would have burned for many hours. The emergency valve had been tested regularly; it could not be fully closed during testing but was closed part-way.

Back-flow from the delivery side of the pump was prevented by a non-return valve, by closing a control valve and by closing a hand valve well away from the fire.



**REMINDERS:** Newsletter 39/2 described a fire which burned for six hours in the middle of a congested plant because the operating switches for remotely-operated valves were placed too near the leak and could not be operated in time.

Remotely-operated valves are intended for isolating leaks which do not fire as well as those that do. Newsletter 60/1 described how two experienced supervisors entered a gas cloud to close hand valves instead of using the remotely-operated valves.

### 62/3 A STORAGE TANK GOES INTO ORBIT

In August 1972 a fire occurred in a storage area in Los Angeles. The TV showed pictures of a storage tank which took off like a rocket with flames coming out of the base.

The pipelines between the storage tanks and the loading area came over the top of a bund wall. A road tank wagon hit a pipe and it broke off inside the bund; the tank wagon's engine ignited the spillage, thus starting a bund fire. Altogether, 21 tanks and 5 tank wagons were damaged or destroyed.

The tank which took off was about 100m<sup>3</sup> in volume and contained the mono-methyl ether of ethylene glycol (also known as "Methyl Ethoxol" and by various other trade names). This material has a flash point of about 1000°F (400°C) and is therefore not flammable at ordinary temperatures, (though in

the Los Angeles climate it will not be much below its flash point). The tank in which it was stored was originally designed as a pressure vessel to operate at 5 psig but was used as a storage tank and vented to atmosphere.

The bund fire heated this tank up above its flash point. The vapour coming out of the vent was ignited and the fire flashed back into the tank. As the tank did not have a weak seam roof it split at the bottom seam and the entire tank and contents went into orbit.

The lessons we can learn from this incident are:

- 1 Vessels which are exposed to fire must be kept cool with water. If the tank had been drenched with water the contents would not have been heated above their flash point. Note that fixed water drenching is normally designed to cope with radiant heat only. If a vessel is exposed to direct flame impingement, then extra water must be supplied by portable appliances.
- 2 Storage tanks should be supplied with a weak seam roof. Sometimes an old pressure vessel is used as a low pressure storage tank. If this is done then cooling with water in a fire is particularly important.
3. When designing plants for hot climates, remember that materials that are below their flash points in England may be above their flash points or closer to their flash points. Vapour pressures may be higher. Cooling of storage tanks or shading of drum storage areas may be necessary.

For further details of the Los Angeles incident see Case History No. 1887, published by the Manufacturing Chemists' Association and Loss Prevention, 1972, Volume 7, Page 119.

#### **62/4 OIL WILL SPREAD A LONG WAY ON TOP OF WATER**

In Newsletter 60, Item 9 I said "If there is a spillage of petrol, the vapour will not spread very far — perhaps a foot or two above the surface of the liquid and ten feet downwind."

If the petrol is spilt on top of the water it will spread a long way. Newsletter 11, Item 10 described an incident which occurred in 1966. A welder was constructing a new pipeline 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 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.

Newsletter 53, Item 6 described how 35 tons of petrol was spilt on the Manchester Ship Canal. Six people were killed half a mile away when the spillage caught fire 2½ hours later.

#### **62/5 "WHAT IS THE SAFE WORKING PRESSURE FOR 3/8 INCH DIAMETER COPPER PIPE?"**

The hydraulic oil system on a machine had to be modified. The system can get up to a pressure of 3600 psig.

The man carrying out the modification asked what was the safe working pressure of 3/8 inch copper pipe. He was told 10,000 psig. He therefore used 3/8 inch copper pipe for the modification.

3/8 inch copper pipe of 10 swg wall thickness can be obtained in a grade that is safe to use at 10,000 psig. However, the 3/8 inch copper pipe stocked in the Works concerned is 18 swg wall thickness and its safe working pressure is only 1555 psig.

Fortunately, the mistake was discovered before an accident occurred but the modifications have had to be replaced.

Before you ask anyone or tell anyone the safe working pressure or any other property of pipe, sheet, valve or anything else, make sure you specify the grade, thickness, heat treatment and so on.

## **62/6 IN BRIEF**

- a) A note in "Engineering News" for December 1973 (Report No. A.128,120/73/12) describes the precautions to be taken to avoid stress corrosion cracking in ammonia storage vessels air must be rigorously excluded.
- b) Another note in the same issue describes the precautions that should be taken in the design and fabrication of lifting lugs. A large slip-plate weighing half a ton fell while being lifted; it was discovered afterwards that the lug had been welded on without any particular care. All lugs and eyebolts should be checked before use to make sure they have not corroded.
- c) A dangerous incident occurred in a furnace because components from one type of burner became interchanged with components from another type of burner, made by the same firm.

## **62/7 THE PLANT IS NOT THE ONLY PLACE WITH FIRE PROBLEMS**

A visitor commented on the smell in the printing room of a large office block. On examination we found:

- 1 Some of the ventilation fans had been switched off to save power!.
- 2 Cans of solvent were standing about with caps missing! By law, if there is more than half a litre of highly flammable solvent it must be kept in a metal cupboard.
- 3 Waste solvent was poured down the sink in the building. The drain outside was blocked and the solvent floated on top of the water near an open window! Waste solvent should be kept in a can.
- 4 Rags, wet with solvent, were put in the waste paper basket. A bin should be provided and kept outside.
5. There was only one fire extinguisher in the room and only one girl knew how to use it.

Have you had a look at the printing room in your building?

## **62/8 WHAT THE LAW SAYS NO. 16**

Mr. Bux was employed by a firm called Slough Metals to lift out molten metal with a ladle and pour it into a die. After some months, he was provided with goggles and told to wear them. They misted up so he told his supervisor they were useless and stopped wearing them. Nobody tried to make him wear them. After a year, he was splashed with molten metal, lost the sight of one eye and part of the sight of the other.

Mr. Bux claimed damages against Slough Metals for negligence. The trial judge found that though the company had provided goggles, as required by the Factories Act, they had failed in their duty of care to their employee because they did not take reasonable steps to ensure that the goggles were worn. This decision was upheld by the Court of Appeal. The courts decided that 40 per cent of the blame for the injury was due to Mr. Bux and therefore damages were reduced from £30,000 to £18,000.

There is nothing very new in this decision, I could have quoted other similar ones, but it does show very clearly that it is not sufficient for an employer to provide protective clothing; he must take reasonable steps to see that it is worn. "Reasonable steps" does not mean that someone has to stand over an employee all the time but it does mean that whenever a manager or supervisor passes a man who is not wearing the right protective clothing he must not let the occasion pass without, at the very least, trying to persuade him to wear it.

## **62/9 UNUSUAL ACCIDENTS NO. 32**

Earlier this year we received a message from the police that two drums had fallen off a lorry; there was no label on them except for a stencilled batch number and the smell was said to be "obnoxious". We sent a van 30 miles to collect them. They contained a thick, bright yellow liquid with a smell of acetic acid.

A telephone call to the drum manufacturer made it possible to trace the company responsible; they were very pleased that the drums had not been lost. They contained homogenised egg yolks bound for a London mayonnaise factory.

## 62/10 RECENT PUBLICATIONS

- (a) Suppose there were seven accidents one month and five the next. Are we really doing better or is the difference due to chance? Safety Note 74/6 includes some graphs which may help you to decide.
- (b) Safety Note 74/7 lists some published estimates of human error rates and also some estimates used by ICI staff. The reasons why we need data on human reliability are discussed and also some pitfalls in the use of the data.
- (c) Agricultural Division have revised their booklet on isolating oil and water lines by freezing with DRIKOLD. Copies are available from Mrs N. S, Agricultural Division (Extn. B 3810).

For copies of (a) and (b) or for more information on any item in this Newsletter please write to Mrs. P.H, Organic House, Billingham or ring B.3927. If you do not see this Newsletter regularly and would like your own copy, please ask Mrs H to add your name to the circulation list.

March 1974

## **ENVIROMENTAL NEWS ICI WASTE RE-USE SERVICE**

“One man’s waste may be another man’s feedstock”. This is perhaps too much to expect, but nevertheless opportunities do exist for re-using unwanted chemicals from processes. These are already being demonstrated in Europe where a number of industrial countries have established chemical waste exchange services and reports suggest that business is booming. To date no comparable service has been established in the UK and ICI has decided to establish a pilot scheme within the Company.

So, if you have chemical wastes which you consider might be of use elsewhere or indeed are on the look out for such materials for re-use within your processes — contact Mr. K.D. M, Section Buyer, Purchasing and Supply Department, Wilton (extension W.6137). He may well be able to help you.

# To All Concerned in Handling Phenol

A young man of 26 of another Company was splashed on his face, arms and the front of his pullover with a mixture of water and phenol.

The approximate sequence of events was as follows:-

One minute after the splashing the man was at a sink washing his face and arms with water.

One minute later another man was helping him, using a recommended solvent.

Six minutes later a first-aider removed the man's pullover and shirt and began swabbing his chest with the solvent. At about this time the man began to show signs of drowsiness.

Ten minutes later the patient was in a coma.

Twenty-six minutes after the incident the man was dead.

This happened in October 1973.

## COULD THIS TRAGEDY HAVE BEEN AVOIDED?

Do **YOU** wear protective clothing when there is a risk of being splashed with phenol?

Do you know that **ALL** contaminated skin must be treated **IMMEDIATELY**?

Do you **KNOW** where the solvent to remove phenol splashes is kept?

Do you **KNOW** where the shower is and is it **REALLY** in working order?



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