IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No.76

76/1 A PUMP IS REMOVED WITHOUT A CLEARANCE CERTIFICATE

The following incident, which occurred recently in the Division, is, I hope and believe, exceptional, but it does show how easily things can go wrong.

At a meeting one Thursday morning it was decided to do a number of jobs on a plant. Three of them were:-

Remove the suction bend leading to pump J12

Remove suction valve from pump J12

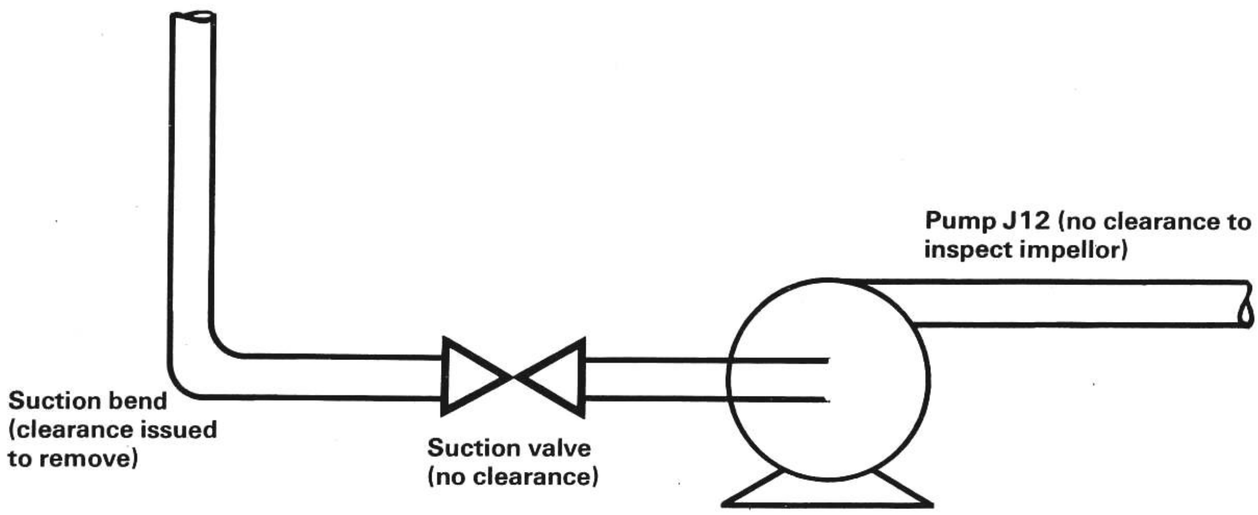
Inspect the impellor on pump J12

During the night many jobs were prepared and clearance certificates (Permits-to-work) made out. A clearance was made out for the first of these three jobs, but no clearances were made out for the other two jobs.

On Friday morning the maintenance supervisor accepted the clearances that had been made out. On Friday afternoon, pump J12 was dismantled and the impellor examined.

On Sunday morning the process supervisor checked up on the work in progress and could not find a clearance for this job. Investigation showed that the pump had, in fact, been dismantled without a clearance. Fortunately, no-one was hurt.

When the maintenance supervisor accepted a number of clearances on Friday morning he left them all in the book. Later on he thought he had signed a clearance to inspect the impellor on J12. The confusion may have arisen because he had accepted a clearance to remove the suction bend on J12, and also clearances to remove a suction bend and inspect the impellor on another pump.



Several lessons can be learned from this incident.

1. The top copy of the clearance certificate should not be left in the book. It should be taken away by the man accepting the clearance. It is then easier for him to check the jobs for which he has clearances.

   On one works in the Division clearances are tied to the job in polythene bags.

   This system works well. Have you thought about using it on your plant?

2. On the plant concerned the maintenance supervisors had got into the habit of accepting clearances for more work than they could possibly do in the day. This makes it harder for anyone to keep track of the clearances issued and the work in progress. Clearances should be taken out as they are required.

3. Other plants have not been so lucky. People have been injured because someone "thought" that there was a clearance out for a particular job. Don't assume; make sure!

4. It would help if more men asked to see the clearance certificate before they started work. A man who asks to see a clearance is not being awkward and holding up a job — he is making a positive contribution to safety.

76/2 A FIRE ON A FLOATING ROOF TANK

Serious fires on floating roof tanks are very rare, but one occurred a few years ago in another Company. The tank was 3000 m^3 in size and was full of naphtha. It ruptured about half way up and the rupture spread two-thirds of the way round the tank. The naphtha splashed over the edge of the bund and was set alight by a welding generator. Six other tanks were destroyed. Many people were burned by the heat radiation, and the total damage amounted to £7m.

The rupture of the tank was due to corrosion. At the point where the crack started the walls were only one-tenth of the original thickness. The tank was 25 years old. The corrosion was made worse by projecting bolts in the roof shoes which produced grooves in the tank walls.

As a result of this incident the Division now recommends that storage tanks containing naphtha or similar materials should be inspected internally at intervals of not more than six years; if any corrosion is found, then ultrasonic thickness checks should be carried out.

76/3 USE OF REDUNDANT EQUIPMENT—AN EXAMPLE OF THE PROBLEMS WHICH CAN OCCUR

On a new project it was decided to use two 20 year old stainless steel jacketed vessels. Because of the age of the vessels and damage to the dished ends arising from previous service it was decided to replace the dished ends.

After the new dished ends had been welded on, the new welds were radiographed. The radiographs on the second vessel covered a small section of one of the original welds and showed that this was most unsatisfactory. Further examination showed that most of the old welds were in the same condition and they had to be chipped out and re-made.

By this time the first vessel had been installed in the plant. It was further examined; the old welds were found to be in the same poor condition and had to be removed and re-made. The whole project was delayed for a month.

Twenty years or more ago standards of construction and inspection were not as high as they are today. Before you use an old vessel on a new project make sure it conforms to the same standards as the rest of the plant. Do this early to reduce the risk of delay.

76/4 ELECTRONIC POCKET CALCULATORS

We have been asked if these are electrically safe and in particular, if they can be taken into no smoking or de-matching areas where leaks of flammable gas or vapour may be present.

They are not electrically safe, and if used in the presence of a flammable concentration of gas or vapour, they could ignite it and cause a fire or explosion. They should not, therefore, be taken into areas where leaks of flammable gas or liquid may occur.

The hazard, however, is not a very great one. If there is a leak of flammable gas or vapour, not many people are likely to stand in the middle of it working out the size of the leak or the chance that it will ignite.

You may, therefore, take your calculator down to your office on the plant, but do not carry it around the plant.

As pointed out in Newsletter 6/4, electric wrist watches are quite safe to use in no smoking and de-matching areas.

76/5 DO YOU KNOW THE DIFFERENCE BETWEEN psi ABSOLUTE AND psi GAUGE?

A pressure gauge in the Division was seen marked “psig absolute”. This made us ask the question above.

The air around us exerts a pressure of 15 pounds per square inch (psi) (or, to be precise, 14.7 psi). An ordinary pressure gauge measures the difference between the pressure in the plant and the pressure in the atmosphere. So when we say the pressure in the plant is 20 psi gauge (psig for short) we mean that the pressure inside it is 20 psi greater than the pressure of the atmosphere. The total pressure is 35 psi absolute (psia for short).

If we pump the contents out of a vessel and do not let any air get in, then the pressure inside falls below 15 psia. A complete vacuum is 0 psia or -1 5 psig.

Sometimes pressure is measured in bars instead of psi. One bar is about 15 psi or one atmosphere. (To be precise, one bar = 14.5 psi or 0.987 atmosphere). As with psi, bars can be absolute or gauge.

Complete vacuum	0 psia	=	-1 5 psig	=	0 bara	=	-1 barg
Half vacuum	7.5 psia	=	-7.5 psig	=	0.5 bara	=	-0.5 barg
Atmospheric pressure	1 5 psia	=	0 psig	=	1 bara	=	0 barg

76/6 SOME QUESTIONS I AM OFTEN ASKED

11-MOST OF OUR CHECKING WILL SHOW NOTHING WRONG-SO WHAT IS OUR INCENTIVE TO CONTINUE?

In these Newsletters I have frequently stressed the need for regular testing and checking of protective equipment. Trips and alarms should be tested regularly. Flame traps should be checked regularly. Electric motors should be switched on after defusing to make sure the correct fuses have been withdrawn, and so on.

Most of the time the checker will find nothing wrong. If he is testing trips, he can expect to find a fault in each trip about once in two years. How do we keep up people’s interest and enthusiasm and prevent them taking short cuts?

There is no easy answer, but the following thoughts may help:

1. *Try to fit the man to the job.* Regular, routine checking suits some people, but others cannot stand it. Alternatively, move people around so that they don't have too much checking to do; but do not move them so often that expertise is lost.

2. *Explain why we need to test and check so often.* First of all, make sure the test frequency is about right. Suppose we have a trip that, on average, develops a fault once every two years, and suppose we test it every month. On average, it will fail half-way between tests and will be out of action for two weeks every two years, or for 2% of the time.

   Now, suppose the trip is called upon to operate in anger once every two years. Then since it is out of action for 2% of the time, it will fail to operate when required once every

   2 X 100/2 = 100 years

   If we have 100 trips on the plant and test everyone each month, then one trip will fail to operate when required every year. If we test less often, failures will be more frequent.

3. *Check up from time to time* to see that the testing is being done. Take an interest in it. Look at the records and talk to the men on the job. Show by your attitude that you regard testing as important. Ask the testers to suggest ways of improving the methods they use.

76/7 UNUSUAL ACCIDENTS NO.46

A car caught fire after an accident. The driver of a passing beer truck stopped, grabbed some beer cans from his vehicle, shook them violently, then opened them and used the foaming liquid to extinguish the blaze.

From "Family Safety'~ Spring 1972.

76/8 ANOTHER MISLEADING NOTICE

NO ENTRY.
CLEARANCE CERTIFICATE
REQUIRED

If the full-stop is not noticed, the meaning is changed.

76/9 SOME PETROL FIRES

The Annual Reports of the Inspectors of Explosives usually contain several accounts of people killed or injured because they did not treat petrol with sufficient respect. The Report for 1973 was no exception. Here are three of the incidents which it described:-

(a) A petrol pump attendant saw petrol running out from the boot of a car. She told the occupants, but the driver said "I will wait until I get home; I don't want to get my clothes mucked up". The car was driven away and half a mile down the road it burst into flames and both occupants died. The petrol filling pipe had become detached from the petrol tank and most of the petrol had entered the boot.

(b) A man took his motor cycle to bits in the kitchen and cleaned the parts with petrol using an open pan 3 ft away from a lighted paraffin heater. His wife and a three weeks old baby were in the same room. The petrol vapour caught fire and the man and his wife were both seriously burned; the baby escaped harm.

(c) A man was cleaning a clock using petrol in a plastic bucket standing in the kitchen sink. The vapour was ignited by the gas cooker and the man then tried to put the fire out by pouring water over it. This spread the fire.

Never bring petrol into the house and never use petrol for cleaning. Use Genklene, ICI's non-flammable solvent.

76/10 RECENT PUBLICATIONS

(a) A note dated 26 March 1975 summarises the papers presented at the recent Loss Prevention Symposium organised by the American Institute of Chemical Engineers.

(b) If you attended the Module 9 discussions last year on "Some Accidents of 1973", you should have received an illustrated booklet describing the incidents and the actions recommended to prevent them happening again. If you have not received one please let us know.

For more information on any item in this Newsletter, please write to E.T. at Wilton, or phone ext. P2845. 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.

May 1975

SUPPLEMENT A TO SAFETY NEWSLETTER NO.76

The following article is a little outside our usual scope, but is included to show that technical change produces consequences that are not foreseen. Sometimes, though not in this case, the changes affect the safety of the p/ant.

THE STOCKTON & DARLINGTON RAILWAY AS AN EXAMPLE OF A FAILURE TO SEE THE CONSEQUENCES OF A CHANGE IN TECHNOLOGY.

In 1975 we celebrate the 150th anniversary of the opening of the Stockton and Darlington Railway, not the first railway in the world, because horse drawn railways had been in use since the 17th century, but the first public passenger railway to use steam.

While we are congratulating the founders on their enterprise, it is interesting to note that they failed to foresee many of the consequences of their proposals, and thus the profits they would make. Their proposals forecast only a modest return on capital, though adequate by the standards of the day.

The story of the Stockton and Darlington Railway may therefore interest many people who have to justify other expenditure proposals. The following notes are taken from “A History of the Stockton and Darlington Railway” by J S Jeans, originally published in 1875 and recently reissued by Frank Graham Publishers, of Newcastle.

The construction of the Railway was justified on the assumption that it would carry coal and other goods traffic from the Auckland coalfields to Darlington, Yarm, Stockton and neighbouring areas. No allowance was made for passenger traffic, coal for further shipment by sea or the speed of travel.

1 Passenger Traffic

In 1825 a stagecoach ran three times a week between Stockton and Darlington, and its proprietor barely made a profit. The promoters of the Stockton and Darlington Railway felt that even if they captured all this traffic its value was negligible and they made no allowance for the revenue from passenger traffic in their calculations. They failed to foresee the enormous growth in passenger traffic that the railway would bring. Before the railway ordinary people rarely, if ever, travelled more than walking distance from their homes.

2 Coal for Shipment by Sea

Most of the profits of the Stockton and Darlington Railway came from the transport of coal to the staithes at Stockton and Middlesbrough, from where it was shipped to London by sea. It is often forgotten now that the railway was built to supply the coal needed for Stockton and Yarm, and for those parts of Cleveland to which it could be transported further by horse. If the possibility of shipping coal to London was foreseen, it was considered too speculative to be included in the calculations, (or perhaps it was left out in order to prevent opposition from the Tyne and Wear interests, the main providers of coal for London).

In fact, coal for transport by sea from the Tees grew rapidly from 1224 tons in 1822 to 66,000 tons in 1828 and 261,000 tons in 1834. It later declined as coal was sent by sea from Hartlepool and direct to London by rail.

3 Speed of Travel

As an alternative to the Stockton and Darlington Railway, a canal was considered and strongly advocated by many people. In listing the advantages of a railway no credit was claimed for the greater speed of transport. Before 1825, the greatest speed achieved on a steam railway over any distance was 4 or 5 mph. The usual speed of travel on a canal was 7 mph. The promoters did not foresee the great increases in speed that would occur. In fact the Stockton and Darlington coal trains averaged 12 mph from the start.

4 Loading Gauges

The bridges on the Stockton and Darlington Railway set the standard size for all the railways in the UK, They are smaller than in most other countries and to this day the carriages on British Railways are narrower and less tall than on most other railways.

5 Wheel Gauges

The 4 feet 8 inches used by the Stockton and Darlington Railway, after being increased by 0.5 inch, became the standard for much of the world. Four feet 8 inches was chosen as it was the gauge used on the colliery railways for which George Stephenson had previously been responsible. Wider and narrower gauges had, and still have, their advocates. So far as I know, no quantitative comparison of the two has been published. Wider gauges will cost more in track construction, but carriages should be cheaper as they will not be so long and thin. The optimum gauge will therefore depend on the traffic.

It is interesting that an arbitrary decision by the founders of the Stockton and Darlington Railway set a standard for the world. (No one seems to know why it was increased by 0.5 inch).

CONCLUSION

It is not my aim to minimise the achievements of Edward Pease and his collaborators — the world is in their debt and perhaps they did foresee more than they said, but their Quaker caution made them claim only that which they felt was sure. My object is to show that any change in technology may have more consequences, good or bad, than are obvious at first sight and that we should be prepared to let our minds ‘freewheel’ a little and see what they might be.

SUPPLEMENT B TO SAFETY NEWSLETTER NO 76

"THE FLIXBOROUGH DISASTER"

The official report on the explosion at the Nypro factory on 1 June 1970 has now been published by HMSO, price £2.5O.

The report shows - and the evidence is very clearly set out - that the explosion occurred because a temporary pipe had not been properly designed.

".... there was no proper design study, no proper consideration of the need for support, no safety testing$_2$ no reference to the relevant British Standard and no reference to the bellows manufacturers 'Designers Guide.,"

"…no drawing of the pipe was made other than in chalk on the workshop floor,"

"The blame for the defects in the design, support and testing of the pipe must be shared between the many individuals concerned. at and below Board level, but it should be made plain that no blame attaches to those whose task was fabrication and instal1ation,"

"The disaster was caused wholly by the coincidence of a number of unlikely errors in the design and installation of a modification."

The main 'Lesson to be Learned' according to the Report is that:-

"Any modification should be designed, constructed, tested and maintained to the same standards as the original plant."

A number of general observations are made and some of these are worth quoting..

"In his evidence to us Mr V C Marshall who was appointed Safety Adviser to the Transport and General Workers Union on the day after the disaster and who was celled on their behalf stated "hazard analysis recognises that hazard cannot be entirely eliminated and that it is necessary to concentrate resources on those risks which exceed a specific value".

"We agree with this statement which accords with reality. No plant can be made absolutely safe any more than a car, aeroplane, or home can be made absolutely safe. It is important that this is recognised for if it is not, plant, which complies with whatever may be the requirements of the day tends to be regarded as absolutely safe and the measure of alertness to risk is thereby reduced."

"In many cases there may be a better return (with regard to safety) from expenditure on making the original plant safer than by providing elaborate safety systems to deal with potential inadequacies."

TREVOR A KLETZ
18 May 1975