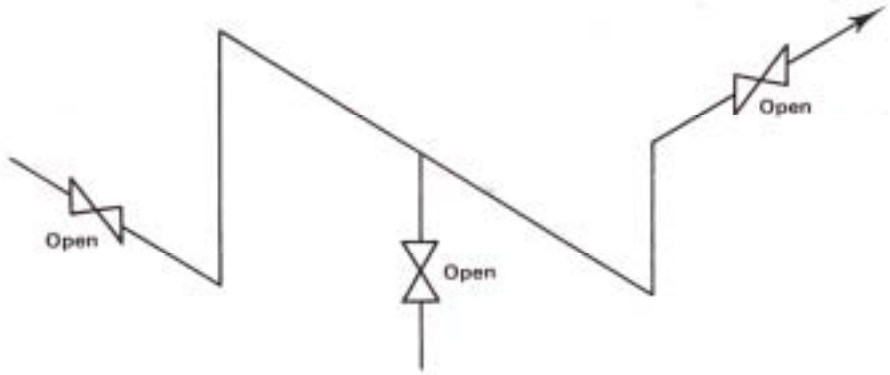
IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No 64

64/1 IN A DOUBLE BLOCK AND BLEED THE THREE VALVES SHOULD BE NEAR EACH OTHER

A serious fire occurred in one of our overseas companies because a plant was started up with a drain valve open. The drain formed part of a double block and bleed. The drain valve was left open because the two block valves and the drain valves were some way apart, and out of sight of each other.



If the two block valves and the drain valve had been near each other the operator would have seen that the drain valve was open when he opened the main valves.

The report on the incident describes it as an example “of the disastrous consequences of human error”. The report did not however suggest that people should not make errors. It accepted that, in this case, the layout of the valves made an error probable — the accident was the result of the work situation.

64/2 HEAVY OILS CATCH FIRE AGAIN

Earlier Newsletters (18/7e, 24/6, 51/2, 56/1) have described a number of fires and explosions which occurred because heavy oils were heated above their flashpoints. Most people take great care with petrol and similar liquids but gas oil, heavy fuel oil and lubricating oil are often considered non-explosive and are not treated with the same care.

Here are two more reports of heavy oil fires or explosions:

A tyre wheel had to be repaired. It was taken off the lorry and a welder started work with the tyre still inflated to 100 psig. There was a little lubricating oil inside the tyre and this exploded violently. The welder and his mate were killed and the remains of the wheel and tyre went through the roof. Afterwards, tests showed that the metal had reached 660°C., well above the temperature at which lubricating oil will explode. *From the supplement to “Occupational Safety & Health” February 1974.*

The second incident occurred in a plant in which ore is extracted with a solvent of flashpoint 42°C. (This means that the solvent will not burn until it has reached 42°C.). Any leaks of solvent drain into a pit inside the building. While some welding was taking place a burning piece of rag fell into the pit and, in a matter of seconds, the fire had spread along the solvent film which covered the water in the pit. The rag acted as a wick and set the solvent alight, although match would not have done so. The fire spread to a wooden floor. Some glass pipes soon bur and these added more fuel to the fire. In a few minutes, the building was ablaze and two-thirds of the contents were destroyed.

From a paper to be presented at the International Symposium on Loss Prevention to be held at The Hague in May 1974

64/3 WHAT'S WRONG WITH SAFETY REPORTS?

The following reports of three accidents have picked at random from three monthly safety reports, all of which have a very wide circulation, one report is from a Petrochemicals Division Works, one from another Division and one from an overseas company. In each case the whole report is reproduced.

1 Whilst cleaning the strainer on a pump suction the fitter was sprayed with phenol.
2. As a result of changes elsewhere on the plant, there was a sudden increase in the vent gas flow. This caused a small release of a poisonous gas from a tower, at a time when the batch was nearly complete. A process man was affected by the gas as he was changing over the batches.
3. The evaporator gauge glass fractured three times during a shift, each time breaking the plate glass guard and spraying the area with caustic.

These reports — like many others — tell us what happened. They do not tell us what we ought do to prevent it happening again. May I suggest, to all those who write and circulate safety reports, that it is not much good telling people what happened. TELL THEM WHAT THEY OUGHT TO DO DIFFERENTLY IN FUTURE.

If for any reason you cannot say what ought to be done differently in future, why bother to circulate the report at all?

64/4 FORK LIFT TRUCKS

Fork lift trucks are useful and versatile pieces of equipment but they can cause serious injury and damage if they are not kept in good condition.

The need for regular inspection is shown by the following results from the routine examination of 66 fork lift trucks.

31 were found to be OK.

Of those found to be defective
22 had cracks on the mast carriage
13 had cracks where lugs are welded to the forks (see figure)
9 had cracks at fork heels (ie., the corners of the forks).

On 4 trucks that failed in service.
2 were due to mast failures and
3 forks failed at the heel.

38 replacement forks were examined of which
11 were OK.
26 had cracks where lugs were attached to the forks.
5 had cracks at fork heels.

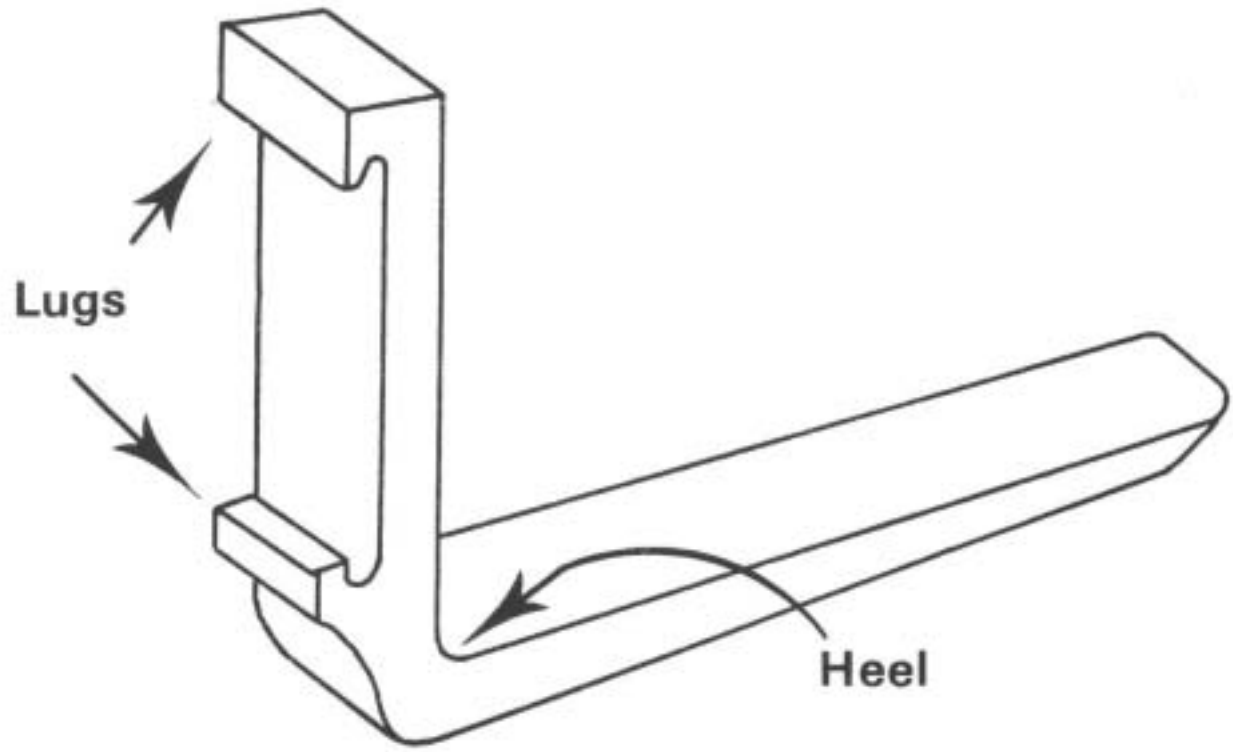
3 new trucks were examined of which
2 had cracks at the bracket to front plate weld

Crack detection was made using the magnetic particle technique.

This item is taken from the ICI "Materials Handling Review" for February/March 1974. The same issue describes how a crane tipped while lifting a large electric motor. The driver had been given the weight of the rotor instead of the weight of the complete load and he ignored his alarm bell.

Another item reports that Allied Chemicals can supply a cleaner for flame traps which is better than caustic soda solution.

"Materials Handling News" can be obtained from Mr. A. P, Productivity Services Dept., Organics Division, Manchester.



64/5 UNUSUAL ACCIDENTS NO. 34

Another company has reported that a complete power failure occurred in one of its factories. All plants had to shut down quickly and this caused several leaks and small fires. The Fire Brigade was called. When they arrived they could not get into the works because there was no power available to open the electrically operated barriers at the gate house.

64/6 DR. H. G. SIMPSON

In August 1970, in Safety Newsletter 21, we reported that Henry Simpson had retired. He came back as a consultant and for nearly four more years continued to help us with his practical advice, his long experience and his unsurpassed ability to find quantitative solutions to problems. In April this year he finally retired (though a few weeks after the official date he was still here, attending a final meeting, checking his last report, indexing his files).

Much of his work is summarized in two reports which will become classics of loss prevention, 0.21,186/B, "Safety in the Design of Plants Handling Liquefied Light Hydrocarbons" and 0.21,388/B, "Safety Aspects of Plant Layout". Both are available from Division Reports Centres.

A summary of the first report appeared as a supplement to Newsletter 26 and is reprinted in this issue.

A shortened version of the second report was published in IChemE Symposium Series No. 34 "Major Loss Prevention in Process Industries", 1971, p.105.

64/7 RECENT PUBLICATIONS

(a) If a road or rail tank wagon containing liquefied gas under pressure is involved in an accident and exposed to fire, it may burst and fragments may be flung hundreds of feet. The tank wagon should be kept cool with water. If this is not possible the surrounding area should be evacuated. A paper by R.D.S. estimates this size of the danger area
(b) Another paper by R.D.S. estimates the area to be evacuated if a road or rail tank wagon containing toxic gas is involved in an accident.
(c) A recent paper describes the results of a series of experiments in Japan in which a compressor house was filled with an ethylene/air mixture and ignited.
(d) Incidents in the Oil Industry No. 11 describes a number of incidents which have occurred during the storage and transport of hydrocarbons.
(e) An article in "Fire", April 1974, page 571, describes how the bursting of a hose, while off-loading a tank wagon, led to a fire which destroyed a large part of Scottish Tar Distillers Falkirk factory.

For copies of (a) - (d) 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.

A WARNING FROM THE "GOOD FOOD GUIDE" (1974 edition)

The Post House, Middlesbrough:

The girls who serve try hard but 'they haven't the knack of flaming the enormous kebab called Whitby Sword, and the customer risks being napalmed!'

QUESTION

Will a relief valve, properly designed and maintained always prevent a vessel bursting?

Answer in the next issue.

April 1974

SUPPLEMENT TO SAFETY NEWSLETTER No. 64

(Reprinted from Safety Newsletter No. 26)

SAFETY IN DESIGN OF PLANTS
HANDLING LIQUEFIED LIGHT HYDROCARBONS

Safety Newsletter 21, Item 10 mentioned this report, No. 0.21.186/B, by Dr H G Simpson, available from Division Reports Centres. It summarises four years work and the conclusions and recommendations are worth quoting in full, as they summarise the main points to be followed in designing plants which will handle these materials. Most of the recommendations also apply to other liquefied flammable gases.

Experience shows that the cloud of vapour generated from any major escape of liquefied hydrocarbons is likely to find a source of ignition, often with disastrous results.

Because of this the basic approach to safety in processing, storage and handling of liquefied hydrocarbons must be one of prevention, aiming to eliminate accidental escape wherever possible and to ensure that such spillage as does occur is restricted to a manageable quantity and can be dispersed safely.

Existing recommendations for safe practice in handling liquefied hydrocarbons conflict among themselves in a number of important aspects, creating the need for re-assessment of the associated hazards and methods of dealing with them.

The following measures for safety in design of plants handling liquefied hydrocarbons are recommended for adoption by Petrochemicals Division.

1. Particular care should be taken in the selection of materials of construction of equipment which may at any time contain liquefied hydrocarbons at sub-zero temperatures.

2. The capacity of fire relief valves should be determined as described in API RP 2000 and not as described in API RP 520, as was formerly the practice.

3. Particular care should be taken with the arrangement of vent lines from relief valves on low pressure refrigerated storage tanks to avoid causing excessive back pressure.

4. Liquid relief valves should be provided on pipelines or other equipment which may be endangered by thermal expansion of locked in liquid.

5. Small branches on pressure vessels and major pipelines should be supported mechanically to prevent them from being broken off.

6. Particular care should be taken to protect equipment against fire exposure by a suitable combination of water cooling and fireproof insulation to ensure that metal temperatures cannot rise sufficiently to cause failure at relief valve set pressures.

7. No attempt should be made to extinguish a liquefied hydrocarbon fire except by cutting off the supply of hydrocarbon, nor should a cloud of vapour from an escape which is not on fire be deliberately ignited.

8. Pumps should in general be fitted with mechanical seals instead of packed glands to reduce leakage.

9. Process draining and sampling facilities should be designed to withstand mechanical breakage, to minimise the risk of blockage by ice or hydrate and to restrict the quantity of any spillage. There should be a robust connection and first isolation on the plant or storage vessel and a second valve, of not more than ¾ in. size for draining or ¼ in. for sampling, separated from the first by at least 3 ft

of piping. The discharge pipe from the drain of not more than ¾ in. bore should deliver clear of the vessel and be supported to prevent breakage by jet forces. Both valves should have means of actuation which cannot be readily removed. Samples should be taken only into a bomb through a closed ¼ in. bore piping system.
10. Pressure storage vessels should preferably be designed with only one connection below the liquid level, fully welded up to a first remotely operated fire-safe isolation valve located clear of the area of the tank and behind a diversion wall.

11. Valve connections should be provided on process vessels for disposal of residues of liquefied hydrocarbons, preferably to a closed flare system. No bleed direct to atmosphere should be of more than ¾ in. bore.

12. Remotely controlled isolation valves should be provided on items of equipment which are liable to leak significantly in service.

13. Discharge of heavy vapour from relief valves and blowdowns should be vented to a closed system, preferably with a flarestack, except when it is possible to discharge to atmosphere at sufficient velocity to ensure safe dilution by jet mixing with air.

14. Excess flow valves should be installed in liquid and vapour connections which are regularly broken to atmosphere, particularly the flexible hose connections used in tank wagon operations.

15. Whenever possible, equipment should be located at the safe distances from sources of ignition determined by the quantitative method of assessment described in the Report. The horizontal extent of Division 2 areas in electrical classification should be taken the same as the safe distance.

16. The ground under pressure storage vessels should be impervious and should slope so that any liquid spillage will flow away from the vessels to a catchment area where it can be safely disposed of, or can burn if it ignites without causing further hazard. Suitable diversion and retaining walls should be provided to prevent uncontrolled spread of the spillage. The height of the walls should be suitably limited in relation to their distance apart to allow minor leakage to be dispersed by natural air movement. The retention capacity for liquid should be decided in relation to the amount likely to escape allowing for flash-off and boil-off from the ground.

17. Low pressure refrigerated storage tanks should be fully bunded, and the floor of the bund should be sloped so that spillage flows preferentially away from the tank.

18. The principle of diverting liquid spillage away from equipment should be applied in process areas wherever possible.

19. In plant or storage areas where safe distances from sources of ignition cannot be met, or in areas near a factory perimeter adjacent to public roads or property the installation of a steam curtain should be considered.

I would like to add two comments.

Recent work (see Safety Note 70/15) suggests that remotely operated isolation valves are better than excess flow valves.

Flammable gas detectors should be installed in areas where experience shows there is a significant chance of a leak.

The report includes a review of accidental escapes of LPG which have occurred in the Division and elsewhere and a comparison of the various Codes which have been produced.

TREVOR A KLETZ *Division Safety Adviser*

Postscript — A volume of the ICI Engineering Codes and Regulations, Group D, Volume 1 .6, “Liquefied Flammable Gases — Storage and Handling”, has been drawn up by an Inter-Divisional Panel, under the chairmanship of Lewis Jenkins, which included Dr Simpson. It compliments his report, giving detailed guidance on the way in which many of his recommendations should be carried out. The Code is available from Standards Section, Engineering Department (Ext. 6.3393), from the corresponding sections in other Divisions and, outside ICI, from the Royal Society for the Prevention of Accidents, Brighton Road, Purley, Surrey, CR2 2UR.