ICL PLASTICS: THE LESSONS FROM THE TRAGEDY

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The premises of ICL Plastics Ltd in Maryhill, Glasgow, exploded on 11th May 2004, causing complete collapse of the building. Nine people were killed, and 33 with injuries were rescued from the rubble. This was the largest single loss of life in a workplace accident in Scotland since Piper Alpha, and inevitably attracted media attention. Once the immediate rescue phase was over, and long before the technical causes of the explosion were established, allegations started to emerge about the poor working conditions in the factory, and about the actions of HSE to address those conditions. These have been the subject of a report which drew heavily from interviews with former employees. (Watterson and Taylor, Universities of Stirling and Strathclyde 2007).

Many of these allegations related to quite recent involvement by HSE inspectors, but once it was clear that the cause of the explosion was a gas release from a corroded underground line carrying propane, the focus of the official inquiries changed. The procurator fiscal concentrated attention on advice concerning LPG given to ICL by HSE, and the gas supply companies Calor and later J Gas. This tragedy gives us however, a rare chance to see a bigger picture, and look at the activities by HSE at this site over a much longer period.

Two ICL companies were prosecuted in June 2006 for their failure to maintain an underground LPG pipe, and a substantial fine imposed, limited by the judge to an amount he felt the company could pay, without going out of business. A guilty plea at the trial meant that very little of the history of this site was made public. Subsequently in late 2007, public pressure for a full inquiry was accepted by UK and Scottish ministers. The hearings, chaired by Lord Gill were held during summer and autumn 2008, and a large amount of written evidence, was provided as well as verbal evidence from many who had dealings with the site over a period of more than 20 years.

This paper draws from that inquiry, but was written before the inquiry report was published, and so represents the views of the author, uninfluenced by the conclusions of the inquiry. It avoids commentary on the action of any individual, but concentrates instead on the lessons to be learnt, by those who have LPG tanks on their premises, the gas companies who supply the gas, the LPG trade association and others who write guidance, building control authorities and HSE.

LPG STORAGE

An LPG tank was installed on the ICL site in around 1969 by Calor, and as was the usual practise, ICL and not Calor arranged for the installation of fixed underground pipework from the tank to the factory building, and internally pipework to the equipment which used gas.

During the following years, the building was modified, the ground levels changed, and a very poorly ventilated basement was created. The building owners made no contact with the building control authorities over these changes. Scottish building regulations at that time did have requirements relating to gas service pipes and the entry points into buildings.

ICL received regular visits from the Factory Inspectorate, later HSE from this date, and quite diverse problems were raised. This was a place where every visit seemed to produce something new and worrying. In 1971 it was general fire precautions, with issues still unresolved 5 years later. Machinery guarding, health risks, electrical safety, noise, and use of fork lift trucks all appeared as matters which the management did not control properly.

In 1982, the local HSE inspector recognised deficiencies in the LPG tank, and asked for specialist support. Fundamentally there was not room on site for the 2t gas tank, but a set of improvements designed to make it acceptably safe were recommended by the specialist. Six years later, little had changed, if anything the site was worse, and another specialist was asked what should be done.

A different set of proposals concerning the LPG installation was sent to the company in 1988, and included in this was a recommendation relating to the underground pipe. It appeared to have no corrosion protective tape where it went underground, and might be vulnerable to rusting, leading to a gas release. The recommendation was to dig part of it up, and examine its condition.

Calor became involved, but their role was not clear. In correspondence direct with HSE they appeared in part to be proposing actions they could take to make their facility safer, but many of the actions needed to be implemented by ICL not Calor.

Eventually in June 1991, the 2t gas tank was exchanged for two 1t tanks, but there is little documentation recording what else happened at that time. Certainly, there is no detailed record concerning actions taken in respect of the underground pipe.

In 1997 after the Management of Health and Safety at Work Regulations came into force (HMSO 1992), a director's son during a summer holiday job prepared some written risk assessments for the factory, but none related to the LPG. In 1998, J Gas took over the contract to supply gas, and put in their own 1t tank. Records suggest they pressure tested the system after linking up the tank to the old pipeline, but other details are lacking.

KNOWN RISKS

With that brief background, we can look at what was known about the risks, what sources of advice were available, what was not done, and the lessons.

The risk that an underground pipe could fail, allowing gas to seep through the soil into basements and poorly ventilated parts of buildings resulting in an explosion had been known for many years. A public inquiry into gas explosions was held in 1977, (HMSO 1977) but by the nature of the gas supply industry, most of these were mains gas, supplied to domestic premises.

HSE took over responsibility for enforcement of relevant legislation in January 1985, and found within the first 2 weeks that gas explosions were high profile incidents that could produce multiple fatalities. Serious incidents happened regularly, and statistics were available. The HSE report into an explosion at Putney in 1985 (HMSO 1985) listed gas explosions year by year over a 14 year period. Ten were recorded in 1982/3 and 16 the following year, producing respectively 0 and 10 fatalities. The number of casualties per incident is very variable and unpredictable.

The cause of leaks were also known, mainly overstressed pipe which fractured, but also corrosion although almost all buried pipe was Denso wrapped to keep it dry. At this time almost all pipework outside buildings had been laid by the nationally owned gas industry, and standards of installation were relatively uniform. A second glossy report was published by HSE on a gas explosion in November 1985 in Rutherglen, Glasgow (HMSO 1986), but in reality this and the Putney report contained little technically new. Between them, the two incidents had caused 13 fatalities.

Often at the site of gas explosions there was no recent work activity, and the application of health and safety legislation was minimal.

ICL was then different in some important respects. It was a workplace, with regular input from HSE. The pipe had been installed by a contractor who may have had little experience in this work. Prime responsibility for the underground pipe lay with ICL and not the gas supplier. Supply came from a tank, not a gas main outside the premises, and the pipework operated at relatively high pressure. Two gas companies had been involved at different times.

Because the gas was LPG, different codes and standards would be expected to be used, by anyone who chose to look at them.

Once the technical cause of the explosion was clear, it obvious that other LPG pipework was similarly vulnerable, but the numbers of sites and locations could not be easily identified. Instead of making an immediate start on replacing the oldest pipes they knew about, Calor and HSE set up a research project, to try and prioritise the work.

WHAT ARE THE LESSONS?

There are lessons here for many individuals and organisations here. The following are not in any priority order.

Even quite small amounts of flammable gas, released to the wrong place can produce a devastating explosion, and large loss of life.

There is no simple correlation between the inventory of LPG on site and the risk. All who work in this field know how easily masonry buildings are destroyed by low explosion pressures. It is simple to calculate that you need less than 10 kg of gas to fill a typical room in a house to the explosive range. If this explodes and pushes the walls out, further collapse is likely. In my view, a disproportionate amount of time is spent looking at large LPG storage installations, when there are many more small tanks, where the hazards that arise from usage may be completely unrecognised, ignored or underestimated.

Even where a technical topic is heavily codified, that produces no assurance that the codes will be followed, particularly if they are not provided to those who control or inspect the facility.

Over the last 20 years, there has been a tremendous amount of codification of many aspects of safety. Some of this is driven by trade associations, some by professional institutions, some by the standards bodies, and some from HSE. What we don't know, is how effective these different sources of guidance are at influencing improvements in standards. We can measure copies sold, but that tells you little, if the book sits in the office of a safety officer, and never reaches the designer, maintenance engineer, plant manager, HSE inspector or anyone else who has a role in ensuring safety.

The risks from gas carrying underground pipe were well known, but the best analysis of those risks and the controls required for those risks came from the mains gas industry.

There is a tendency for many who have worked in a single industry, to look from within for answers to technical questions. Sometimes those problems have been solved before, in a different setting. Particularly when we are looking for the causes of low frequency high consequence events, we may need to draw data from sources which are not immediately obvious. Sometimes it is important to read across advice from different industry sectors.

Technology moves on. Codes and standards are updated, to address these changes, and lessons learnt from experience. When this happens, it is necessary to consider what should be done with legacy systems, that perhaps cannot be improved quickly, but should not automatically be assumed to be acceptable indefinitely.

Codes and standards very rarely give advice about upgrading old equipment. HSE tends to say that what is reasonably practicable can change with time, as technology moves on, and each case must be judged on its merits. The standardisers have recently been forced by the EU Commission to identify positively where 'the state of the art' described in EN standards has moved on. Equipment built and certified to old standards cannot now be sold indefinitely. Galvanised unwrapped underground pipework might have been acceptable in 1969, but problems emerged within 15 years. However, no one seriously thought about replacing it at every location until the ICL disaster. At the time of writing (April 2009) the LPG industry trade association had however not yet updated their pipework code published in 2002.

Risk assessments are most commonly written for actual work activities, but important gaps can be left if they ignore equipment and facilities which generate little or no work activity from year to year.

Pipework was the example here, but it could equally well be an electrical installation, a structural part of a building, or a redundant tank that had not been emptied. It is tempting to hide behind a view that everything used at work may need maintenance, and that is the time to reassess safety, but this an issue where some more specific guidance would be helpful.

Commercial pressures do interfere with advice given, even where the codes are clear.

The bulk LPG tank provided by Calor fell far short of the standards set out in the LPGA codes, over a very long period, and probably from the day it was installed. Even when brought to their attention, they took 2 years to substitute smaller tanks and that achieved little. Obviously Calor did not want to lose a customer, but the advice given from their safety department was insufficiently independent.

When giving advice about the need for particular safety requirements, safety professionals should not assume that the recipient will understand the problem.

Advice is probably more likely to be followed, if real examples of the consequences of failing to adopt proper standards can be given. LPG Industry guidance does not provide details of actual fires, explosions and casualties, which might undermine confidence. Perhaps if the risks had been made clearer, ICL might have done more. However, HSE does little to assist with this. The details of comparatively recent incidents are now quickly lost. Glossy reports into notable incidents are no longer published. Freedom of information legislation has encouraged records to be dumped more quickly.

The division of responsibilities between different organisations can easily lead to danger, if the parties do not work together, or the dividing line is not clear.

J Gas knew reasonably well what they thought their responsibilities were, when they took over gas supply, but they clearly could have done more to establish the state of the pipework they were connecting to, and to check that ICL understood their responsibilities.

Roles and responsibilities must also be clear, when a supplier has more expertise than the customer. It is obvious that Calor knew more about the hazards of LPG than ICL, and they gave advice intended to make the installation safer. However, many of the actions needed were to be implemented by ICL. Calor blurred the roles of commercial supplier, technical expert, and independent safety advisor to ICL. By saying they would pressure test the underground pipework, they appeared to take on a responsibility that properly lay with ICL. Moreover, HSE probably assumed that once Calor safety staff were involved, they would ensure that all the necessary work was done, even if they did not expect to do it themselves.

Building Regulations are not an effective method of controlling many safety issues.

Many aspects of building regulations relate in some way or other to safety, whether it is electrical installations, fire precautions, or gas services. The building regulations are controlled under a regime that reacts to proposals received, but does not proactively visit premises for which no application has been submitted. Under this system, if you ignore the building regulations, and the work does not require planning permission, defective changes are most unlikely to ever attract attention from the authorities. HSE are most unlikely to report concerns to building control authorities, because their priorities are elsewhere.

Formal written advice from HSE may be remarkably ineffective, if it is not followed up.

This site had more than its fair share of attention from HSE, and lots of issues were raised with the company over the years. Endlessly ICL promised cooperation but delivered little and late or not at all. Despite this, they were never prosecuted, until after the explosion. Too many inspectors took too much on trust, were distracted by new problems or perhaps the enforcement management model used in recent years discourages robust action against reluctant occupiers when it is needed.

No attention was paid to the views of the workforce.

This was a site where the management cared little for their workers, were actively hostile to trades unions, and certainly never listened to concerns about health and safety that were raised. HSE has long known that good standards of health and safety can only be achieved where there is involvement of the workforce. Moreover, employers have a legal responsibility to consult their employees. The regulatory regime for worker consultation at non- unionised premises was clarified in 1996 (HMSO 1996) because earlier regulations under-implemented the framework directive, but the changes made no impact at ICL.

A few simple questions to employees from any of the inspectors who visited would have revealed that consultation at this site was non existent. If this observation had been linked to the steady flow of serious issues that HSE knew about, the need for a comprehensive review of health and safety, probably with specialist input and followed by robust action would have been obvious.

Research is no substitute for action.

By the time of the inquiry, on the ground very little progress had actually been made in dealing with the problem identified. Industry estimates suggested that there were around 140,000 domestic installations, that may have underground pipe, and no record about the type of pipe, or condition it was in. Calor estimated that perhaps 50,000 sites would need pipework replaced. They hoped to have made some better definition of the problem and the high risk sites identified by April 2009, nearly 5 years after the explosion. HSE had taken 22 months to produce a brief leaflet describing the problems.

In an ideal world, our efforts as safety professionals would always be accurately targeted based on risk. We all know the frustrations that come from inadequate knowledge or inadequate records, which mean that the risks cannot be properly assessed. It is truly unavoidable that sometimes fairly crude judgements have to be made. In the case of LPG pipework, that might mean replacing any metal pipe laid before 1980. Sometimes we have to work with inadequate data at the same time as trying to refine the data set.

CONCLUSION

Often following a major incident we are left wondering if the problem could have been identified in advance, and in time to take suitable preventive action. In this case, the key technical problem was highlighted 16 years before the pipe failed. The reality is however, much more than a technical issue. The whole saga reveals a health and safety system that was ineffective in every aspect.

REFERENCES

Most of the detailed facts are available on the inquiry website www.theiclinquiry.org.

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