16th March 2018

McCrindle Group Ltd

126 Meadowfoot Road
West Kilbride
Ayrshire KA23 9BZ

Tel: 01294 822142

W R McCrindle Mobile: 07810 304600
e mail: wmccrindle@aol.com

Barbara D Kerr Mobile: 07810 304601
e mail: barbarakerr3@aol.com

Mr. Neil Stevenson
Chief Executive
Scottish Legal Complaints Commission
The Stamp Office
10 – 14 Waterloo Place
EDINBURGH
EH1 3EG

Dear Neil

It was quite a rush to make the 5.00 p.m. deadline on Tuesday 13th March and consequently I did not get the opportunity to closely check the text of my response to your Draft Operating Plan for 2018 / 2019.

I have now done so and discovered several typo errors and a few other minor issues. Please see final version attached.

I tried to contact you today but you were busy, and one of your staff kindly checked for me that your Board meeting is not until next week. Consequently you can now pass this clean copy to them.

I have also attached the article from The Law Society of Scotland online journal dated 6th June 2008 which I refer to on Page 11 and the report on the Flixborough Disaster.

Clearly you may wish to edit some aspects of my 11-page report before posting on your website. Assuming, of course, you are minded to do so.

Good luck with your Board meeting.

Kind regards

Bill.

William R. McCrindle M.B.E.
Chairman
McCrindle Group Limited

Atta.

W.R. McCRINDLE COMMENTARY ON THE S.L.C.C. DRAFT OPERATING PLAN FOR 2018 TO 2019

I would like to make the following comments on your above Operating Plan.

1. **Introduction**

Bullet Point 6

The Law Society of Scotland's legal challenges against the S.L.C.C. are designed to test the powers and the resolve of the S.L.C.C. They must, in the interests of the General Public, be resisted. In any event, any incurred litigations costs will simply be met by increasing the following year's levy.

2. **Our Operating Focus**

Bullet Point 1

I have been dealing with the S.L.C.C. since 2008 and observed their complaints process has become much more professional and indeed aggressive. A development that has to be lauded.

Bullet Point 4

The Client Protection Fund and the Master Policy are nowhere near adequate or fit for purpose. I will comment on these two issues later. However, I will refer you to the policy of non-cooperation that Marsh, the Master Policy brokers (no doubt fully supported by Royal & Sun Alliance, The Law Society of Scotland and The Faculty of Advocates) adopted when responding to the review of the Master Policy carried out by Professor Frank Stephens and Dr. Angela Melville on behalf of the S.L.C.C. in 2009.

The letter of response that was eventually received from Marsh was banned from any distribution whatsoever. Therefore, the whole review process was invalidated and they got away with it.

Bullet Point 7

Relative to the consumer's awareness of the important service of the S.L.C.C., I suggest several of your staff walk along Princes Street with clip-boards and carry out a poll on the consumer's awareness of the S.L.C.C.

Outwith tourists, I suspect it will be nowhere near 50%. Yet very few people get through life without having to depend on the services of a solicitor. Solution: Some serious advertising and Public Relations exposure on the S.L.C.C.'s services.

3. **The Environment we are working within - Drivers of cost**

Bullet Point 2, 3, 4, 5 and 6

The increase in complaints of the total consumer base in Scotland could be due to the fact that the message of the services of the S.L.C.C. is gradually getting through to the general consumers.

I predict there will be a much bigger increase when your new three-year prescription rule begins to bite.

I do recommend that any statistical database is matched up with the equivalent statistical databases of England and Wales to allow direct like-for-like comparisons.

Bullet Point 7 and 8

I would urge you not to overly criticise yourself for any time delays due to the litigation forced upon the S.L.C.C. by The Law Society of Scotland. The Law Society attempted to fence in your scope of work and activities. They failed and the consumer will consequently be better served by the S.L.C.C.

However, I am very pleased that The Law Society of Scotland and / or Scottish solicitors pay the costs of any litigation or court awards by subsequent increased levy fee rates.

Bullet Point 8

The additional £98,000 from the levy in 2018 / 2019 spread over 11,500 practitioners is only £85 additional levy per annum, which relates in a 46-week working year (after six weeks holiday's deduction) to less than £2 / week spread over a 38-Hour week is only 5 pence per hour. This cannot be construed in any way as a relative hardship to any solicitor, junior or senior.

Especially when the Complaints Process if properly operated should in time improve the quality of the profession's service and hopefully reduce complaints.

4. **Efficiency Savings**

Given the trying litigatious climate you have been struggling with, your stated Efficiency Savings seem very realistic to me.

5. **Headline Details of Budget**

These again appear very realistic to me.

6. **Append to Budget**

Again this seems to be a fair and transparent approach that realistically cannot be criticised.

7. **Expenditure**

Bullet Point 4

A £12,000 increase to costs equates to an average of slightly over £1 on each levy / annum. This cannot be deemed in any way a hardship.

Again, especially when the effective operation of the S.L.C.C. could and should allow the Scottish legal profession to learn from the outcome of valid complaints and improve the quality and professionalism of the Scottish legal fraternity.

I cannot overstate this philosophy. It is one that the Engineering, Mechanical and Civil industries have utilised over the past three hundred years.

8. **Reserves**

A solid, adequate reserve must be maintained to ensure the smooth operation of the S.L.C.C.; especially with possible further future litigations from the legal profession.

9. **Income**

I am confident that the important role of the S.L.C.C. in Scotland will ensure it has adequate resources from whichever quarter.

10. **Apportionment of the Levy**

Bullet Point 1 and 2

Given the vitally important role of the S.L.C.C. to the general consumer, many of whom are ordinary people with an average income in Scotland of £27,710

I really do find the faux laments of The Law Society of Scotland, The Faculty of Advocates and the Crown Office & Procurator Fiscal Service to be really quite amusing.

My case hardened twenty-six year experience of the legal profession suggests to me they are just postulating for effect and perhaps attempts to chip away at the confidence of the S.L.C.C.

The Current Position

Your seven Bullet Point explanation of the current position does not suggest to me that it requires radical surgery.

Overall Costs of Practice

Your seven Bullet Point explanation of the other costs that solicitor's face within their own societies proves how reasonable the cost base of the S.L.C.C. is in comparison.

The Issue of Risk

This section really takes us to the very heart of the vital importance of the *Legal Profession and Legal Aid (2007) Act* in setting up the S.L.C.C. and its past, current and future work which serves the consumer to redress outwith very expensive litigation is an area that I have perhaps almost unique experience. Please refer to:

(a) McCrindle Group Limited 'v' Maclay Murray & Spens – Opinion Lord Hodge

(b) McCrindle Group Limited 'v' Maclay Murray & Spens - Opinion Lord Hodge

(c) MacRoberts 'v' McCrindle Group Limited - Opinion Lord Tyre

(d) MacRoberts 'v' MCrindle Group Limited Appeal - Opinion Lord Brodie

(e) Petition against The Law Society of Scotland

(f) Petition against The Faculty of Advocates

I also have a whole raft of Complaints currently ongoing with The Law Society of Scotland and the S.L.C.C.

The majority of which were discovered during the detailed Complaints Process of original Complaints.

I would not tamper with the current levy system as it will only complicate matters and allow the various sectors to manoeuvre against the S.L.C.C.

What would be possible 2018 / 2019

Bullet Point 3

Would seem fair if you continue with the current per head per annum basis of the levy.

Bullet Point 5

I would not lose too much sleep about Advocates given their very high daily and hourly rates.

11. **The Legal Service (Scotland) Act 2010**

I have no expertise whatsoever in the area and, therefore, I will decline to make a comment.

12. **Issues we would especially value feedback on**

Section 10

This is an area that could, if allowed to, could take up a great deal of S.L.C.C. management time (Brexit like). I would give the profession a chance to agree what they feel is fair and proportionate across the different areas of the profession as long as the required total annual levy payment to the S.L.C.C. ends up the same as the current simple per head per annum basis.

Section 12

Bullet Point 2

Complaints rising could well be due to the three-year prescription period if that has now starting to impact on your current caseload. It may also be a greater awareness of the operation of the S.L.C.C.

Bullet Point 3

I cannot as an outsider, but a frequent utiliser of the S.L.C.C. services, identify any other areas of efficiency outwith those already identified by the S.L.C.C.

Appendix 1: Draft Operating Plan 2018 / 2019

Item 6

This suggests to me a 'time and motion study' approach. This methodology was very popular in the Sixties / Seventies but became outdated as it simply caused more areas of potential conflict between management and the actual hands-on workforce.

I believe it should be resisted.

Good Managers just manage without too much dependence on outside consultants unless they are recognised specialists in their field.

Item 8

This two line entry is very important.

When I was working my way through my twenty-year battle with Maclay Murray & Spens, and whilst attending a mediation meeting chaired by Mr. John Sturrock, Managing Director of Core Mediation), Mr. Hugh Donald O.B.E. (then Chairman of Shepherd & Wedderburn and acting for Royal & Sun Alliance) apparently made a statement to the effect:

"I do wonder how the profession could learn from Bill's experience?"

I developed an excellent relationship with Mr. Hugh Donald and I am convinced if it had not been forcibly retired at 63 my legal battle with Maclay Murray & Spens would have concluded in an amicable extrajudicial settlement in the first quarter of 2011.

Instead it dragged on to a full proof before Lord Hodge in November / December 2012 and a Scottish legal precedent on how to value a "loss of chance".

My twenty-six year legal battle with the Scottish legal profession covering solicitors junior and senior, and very senior members of The Faculty of Advocates, and the Complaints Process would make an ideal case study - which if properly conducted could produce lessons that could only be for the

benefit of the general consumer in Scotland and indeed the Scottish legal profession.

Priority Objective

2. (a) Public Awareness

Firstly try the clipboard Princes Street approach; the consumer responses could be very interesting.

(b) More advertising in the form of Public Relations features in the National Press would be helpful plus some television and online advertising.

(c) I am not the slightest bit surprised that lawyers advising their client of your services was one of the least common ways.

Legislation that enforces all solicitors to advise all of their clients of the S.L.C.C. services if they have a complaint would solve this issue.

Another very important issue is just how many solicitors are aware of the new three-year prescription period?

Around 2008 / 2009 I surveyed at least 10 - 12 senior solicitors on this issue. Not one knew about the new prescription one-year term that the S.L.C.C. voluntarily imposed when they set up shop.

If the lawyers did not know of the then one-year prescription period, how did one expect the general consumer to know about it?

Editorial Coverage

This comes into the Public Relations area.

Question: Does the S.L.C.C. utilise the services of a Public Relations Officer or company? If not, you should perhaps consider doing so.

All five clauses, 8 -12, will no doubt assist in the very important issue of Public Awareness but more importantly it should stress the S.L.C.C's services are cost free apart from their time and that it is also very user-friendly.

Priority Objective (Page 18 of 30)

Item 1

Very important I have a suggestion to make to this process that will follow shortly.

Item 2 and 3

Also very important and if properly handled could actually improve the professionalism of the Scottish legal profession.

Remember Hugh Donald's words:

"I do wonder how the profession could learn from Bill's experience?"

It is my intention to offer my services as a part-time lecturer on my experiences to the Scottish Universities' Legal Faculties.

Item 4

This is an excellent way of getting the message across because most people are comfortable about approaching their M.S.P. or M.P. with an issue.

Your item states to only advise the M.S.P.s - it should also cover M.P.s and M.E.P.s.

Item 5

Interesting but . . . ?

Item 6

The solution is simple: The Master Policy should be abolished, and the English and Welsh system adopted.

Any compensation should be proportionate to the costs incurred by the consumer, not capped at an unreasonable level.

4 A new Approved Regulator would be a major sea change and I dare say a shock to the Scottish legal system. However, overall it will actually be to the benefit of the consumer and, if the resultant lessons are learned, and adopted, it will be equally beneficial to the Scottish legal profession.

I suggest your Board study how The Flixborough Disaster at an I.C.I. plant led to major improvements to the quality and safety of the Mechanical Construction industry.

Item 1 – 4 are all appropriate and pertinent.

6 A Handling Complaints Process is vitally important given the "in-built" bias of The Law Society of Scotland and The Faculty of Advocates.

Hopefully it will become an issue that should not arise too often with a new Approved Regulator.

7 No comment.

This Year's Perspective

Item 8, 9 and 10

I have had no access to the material basis to in this section, therefore, I am not on any position to comment upon it.

Item 11

Again I would urge the utilisation of a good Public Relations company.

Item 12

The Master Policy and its operation is a subject I can major upon. I suggest your Board study:

(a) Lord Hamilton's Opinion - Debate between McCrindle Group Limited and Willis Corroon.

(b) The exposure of a 'panel system' by Eliot Spitzer, the New York Attorney General in 2004.

To me the Master Policy is almost certainly a 'panel system' which does not serve the profession, let alone the consumer.

The most obvious serious issue is the Master Policy does not cover any conduct issues whatsoever.

Now let me give you a comparison between the Master Policy cover and life in the real world.

A seventeen-year-old boy who just passed his driving test will get full comprehensive including the mandatory Third Party cover. It may cost him £1,000 - £1,200 per annum but he can pay it in monthly instalments in advance. So he purchases his car, pays his initial £100 monthly fee, signs up to the insurance company's documents and starts driving.

In a possible worst case scenario he drives recklessly and runs into a queue of people at a bus stop and causes multiple deaths and injuries. All the victims would receive full compensation through the young man's mandatory Third Party cover.

Now would someone explain to me how it is that solicitors who, as a whole earn well above the national average wage, can be allowed to practice without having full insurance cover of any conduct issue?

This is not the case in England and Wales where there is no Master Policy monopoly.

Furthermore, I have been advised that the only exceptions to the normal cover in England and Wales are criminal fraud and money laundering.

Solution: Remove the monopoly of the Master Policy. And adopt the English and Welsh system. Or at the very least ensure the Master Policy covers full compensation for conduct issues.

As for the Client Protection Fund, I would be grateful if I could be advised the level of financial cover it provides.

Item 16

2. Wherein you propose a development session which would pilot a "case review" of a complaint case. There must be very few litigations against the Scottish legal profession more complex and long-running than my twenty-six year battle against Maclay Murray & Spens, The Law Society of Scotland, The Faculty of Advocates and MacRoberts.

   I would be prepared to allow my twenty-six year legal odyssey to be put to good use for the benefit of consumers and even the Scottish Legal Profession.

   It may encourage them to seriously look at the Quality Assurance / Quality Control Schedules.

Please refer to the article in The Law Society of Scotland online journal dated 6th June 2008 entitled:

"It ain't what you say . . .
6 June 08
Whether the legal profession can learn good risk management practice from other sectors – notably oil and gas, which had to learn from the Piper Alpha disaster

by Louise Robb "

Additional Personal Comments

1 I was advised by Professor Alan Paterson in late-August 2007 that he had initiated an ethics section into the Strathclyde University law degree I believe around the turn of the century. I believe Strathclyde was the first university in Scotland to do so.

He also advised me when he was a Director of the S.L.C.C. he had persuaded the Board to ensure that any complaint against a solicitor or firm of solicitors could not be set aside whilst litigation against the solicitor and / or firm of solicitors was ongoing.

If so I can advise that MacRoberts' Client Relations Partner did not adhere to this policy.

I might also add The Law Society of Scotland and The Faculty of Advocates utilised their joint notorious phrase ***"knew or ought to have known"*** about Maclay Murray & Spens' negligence and the resultant concealment, misconduct and bad faith to prescribe all of my complaints in 2008 / 2009. Yet Maclay Murray & Spens, Shepherd & Wedderburn and Royal & Sun Alliance did not agree to a Joint Admission of Liability for these offences until November 2012.

The question I would put to your Board is: How was it that an 11 Plus failure ***"knew or ought to have known"*** about serious offences between 2005 and 2006 when Maclay Murray & Spens and his two Advocates were unaware of and denied it for twelve years (September / October 2000 - November 2012)?

I have created a legal precedent on how to value a "loss of a chance". In some respects a form of legal immortality. However, I am far from finished with the Scottish legal profession.

W.R. McCrindle
16th March 2018

You are here:

It ain't what you say...

6 Jun 08

Whether the legal profession can learn good risk management practice from other sectors - notably oil and gas, which had to learn from the Piper Alpha disaster

by Louise Robb

In this climate of increasing claims and the impending introduction of the Scottish Legal Complaints Commission, it might be interesting to take a sideways look at another major industry in Scotland to find out how they manage risk and, in fact, lead the world in their culture of managing risk.

Could we learn from another industry even though they may at first seem to have very different problems from those we face in the legal world?

Recent roadshows by Phillip Yelland of the Law Society of Scotland and Alistair Sim of Marsh have shown how claims do not necessarily result from the places we expect them to. Human error is the main risk factor for solicitors whatever the area of practice, and most claims could have been prevented – mostly by improved communication. So how do we do this?

One starting point is to look at what caused the oil and gas industry to wake up and take risk seriously.

Lessons from disaster

In the global oil and gas market, health, safety and the environment and their associated risks have been going through major transformation since the time of the Cullen report which followed the Piper Alpha disaster, in which 167 people lost their lives on 6 July 1988. (The financial losses which ensued were estimated at £1.7 billion.)

This single incident was caused by the communication, from one shift to the next, about a maintenance job which was not complete. Also the culture at the time meant that the focus was on production of barrels of oil, not on safety. The root causes of the incident lay in communication and behaviour: seemingly simple causes, but resulting in catastrophic consequences.

In our industry, it is unlikely that we would experience a catastrophe on this scale, but it is worth considering what the real impact of any major risk incident would be to

- reputation;
- profits;
- ability to attract and retain quality people;

- our subsequent insurance costs.

It is certainly worth considering what the future impact would be if we failed to view the impending introduction of the Scottish Legal Complaints Commission recommendations as our wakeup call to manage risk in a more enlightened way. In the medical field, 8.9% of the NHS budget is currently being spent on claims. Will spending on that scale reach our industry soon, or are we perhaps even there already?

A model for culture change

Let us consider for a moment what the oil and gas industry has been doing that we could learn from? First, they recognise that safety, both of people and of the environment, is culturally driven and if you don't work on the culture (i.e. the norms, attitudes, beliefs and values – in short, "the way we do things around here"), you are unlikely to change behaviours, since studies have shown that it is culture that drives behaviours.

The oil and gas industry worked together to create a model of what culture looks and sounds like, and this model is used to help people have conversations about where they are on this cultural ladder and where they think their team and business are placed on it. Specific tools and programmes can then be implemented to aid the business to move up the ladder, and create a culture which incorporates habits for the good management of health and safety that in time become a matter of course for the business.

This process takes time and the job never ends. However the benefits can be substantial. After implementing a cultural habit change programme in a UK plant after a very serious accident, Coca Cola found that quality and productivity improved by 16%. Extraordinary results by any measure, simply achieved by taking the time to work more safely!

Steps to safety

At the time of the Piper Alpha tragedy, the oil and gas industry had a very casual attitude to health, safety and the environment, which would now fall into the "pathological" category in the diagram. Typically, the thinking that this exemplifies would be, "Who cares as long as we're not caught, just get on with the job. It's a risky business we're in. Sack the idiot who had the accident!"

So, the questions we might wish to ask ourselves now could be, "Are we still at this level at times with our reaction to claims? Do we still blame the solicitor who dealt with the client or, even worse, the client?"

The next stage on from the "pathological" stage in the cultural ladder is what we call "reactive". In the oil and gas industry this means that every time an accident occurs and someone is hurt, all the managers make themselves busy making safety the highest priority. However, as soon as the dust settles, they are back to business as usual with risk being put way behind production.

The question here for the legal sector could be, "Do we still give high attention to risk issues when we have claims but put it on the back burner when the dust settles?" This creates a rollercoaster type of culture around risky behaviour which does not

give a good message to our people about our attitude to intelligent management of risk.

Next in the cultural ladder comes the "calculative" stage. In oil and gas this meant the industry took safety seriously by creating lots of management systems to manage processes and procedures. Again however this culture still resulted in fatalities; we now know that it is only through people that good systems are delivered and at this stage companies were still not paying attention to human behaviours.

Our equivalent is our case management systems and file reviews. These have really helped us manage cases, but they don't take out the risk element – the main reason why claims arise in the legal world – that is, delays and inadequate communication with the client. Put simply, it takes a person to do this, not a case management system or a safety rule.

Step 4 of the cultural ladder is called "proactive". At this stage, we have the systems in place to manage all hazards. We are still concerned with statistics but we are involving the workforce in all areas of concern. We are working on the "at risk" behaviours so that they don't become an accident statistic. Money is available to fix things.

In the legal world this might look like: we involve all our people in risk management, both in terms of systems and of training to use them appropriately, but we also train in client care and communication at all levels. Our claims are steadily decreasing over the years.

Finally we reach stage 5, "Generative". At this step of the ladder we are striving for continuous improvement. We recognise it's a constant job. Safety and risk are managed from the top down and bottom up. All ideas are listened to.

In the legal world this might translate as: "We now recognise that it is human behaviour and communication which causes the "at-risk" behaviours which could result in claims. We have created an atmosphere to work in where all staff are encouraged to contribute to the way we manage risk here. Aggressive, pressurised behaviour is unacceptable as it leads to mistakes being made. The way we manage and treat our staff has a direct impact on the way the client eventually receives the service."

So, where are you on this ladder and where is your firm?

Communication as a tool

In oil and gas a myriad of different measures are required to move up from the bottom of the ladder towards the top. "Engineering out" risk by designing tools and equipment – safety by design – is one approach that has been popular in the past. The creation of sophisticated health and safety management systems and procedures, and training for all staff, have helped reduce incidents too. However, even with these two measures, injuries and fatalities were still occurring. Furthermore, incident rates had plateaued.

At this stage the industry began to take account of the human factors which it was found, after investigation, were involved in 96% of all incidents. As a consequence of this new way of thinking, staff at all levels have been trained in communication and

intervention tools, so that they have the skills to coach each other and manage those around them to take responsibility for their own and each other's safety. These skills include the psychology of understanding why people decide to take risks, the way we communicate, and the impact of that communication on the behaviours of others. The fact is that there is now an army of skilled communicators out there drawing our oil out of the ground, and they are hurting themselves much less than they used to.

Is the job ever over, you might ask? The answer is a resounding "No!" Is oil and gas at the generative level? Again, regrettably, the answer is no. However, are they getting there? Is there steady improvement in the right direction? This time, happily, the answer is "Yes"!

In the legal profession words are our forte. Could we learn from another industry in Scotland which is leading the world in its risk management? To adapt the old Bananarama song, they know that "It ain't what you say, it's the way that you say it. That's what gets results."

To find out more about managing risk through intelligent communication, please contact Alistair Sim at Marsh.

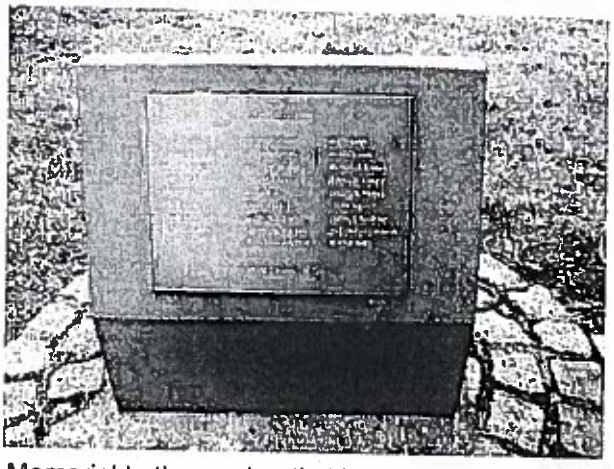
Louise Robb is managing partner of Louise Robb Associates LLP. She is a qualified accountant and was an accountant and director of finance for 12 years in the legal profession in Scotland, before setting up her own consultancy in 2002, concentrating on training, facilitation and mentoring in the UK, Europe and Africa across many industry sectors. www.louiserobb.co.uk .

WIKIPEDIA

Coordinates: 53.62°N 0.70°W

Flixborough disaster

The **Flixborough disaster** was an explosion at a chemical plant close to the village of Flixborough, North Lincolnshire, England on Saturday, 1 June 1974. It killed 28 people and seriously injured 36 out of a total of 72 people on site at the time. The casualty figures could have been much higher, if the explosion had occurred on a weekday, when the main office area would have been occupied.[1][2] A contemporary campaigner on process safety wrote "the shock waves rattled the confidence of every chemical engineer in the country".[3][A]



Memorial to those who died in the disaster

The disaster involved (and may well have been caused by) a hasty modification. There was no on-site senior manager with mechanical engineering expertise (virtually all the plant management had chemical engineering qualifications); mechanical engineering issues with the modification were overlooked by the managers who approved it, nor was the severity of the potential consequences of its failure appreciated.

Flixborough led to a widespread public outcry over process plant safety. Together with the passage of the Health and Safety at Work Act in the same year it led to (and is often quoted in justification of) a more systematic approach to process safety in UK process industries, and – in conjunction with the Seveso disaster and the consequent EU 'Seveso directives' – to explicit UK government regulation of plant processing or storing large inventories of hazardous materials, currently (2014) by the Control of Major Accident Hazards Regulations 1999 (COMAH).

Contents

Overview

The chemical works, owned by Nypro UK (a joint venture between Dutch State Mines (DSM) and the British National Coal Board (NCB)) had originally produced fertiliser from by-products of the coke ovens of a nearby steelworks. Since 1967, it had instead produced caprolactam, a chemical used in the manufacture of nylon 6.[a] The caprolactam was produced from cyclohexanone. This was originally produced by hydrogenation of phenol, but in 1972 additional capacity was added, built to a DSM design in which hot liquid cyclohexane was partially oxidised by compressed air. The plant was intended to produce 70,000 tpa (tons per annum) of caprolactam but was reaching a rate of only 47,000 tpa in early 1974. Government controls on the price of caprolactam put further financial pressure on the plant.[2]


Another view of the memorial

It was a failure of this plant that led to the disaster. A major leak of liquid from the reactor circuit caused the rapid formation of a large cloud of flammable hydrocarbon. When this met an ignition source (probably a furnace at a nearby hydrogen production plant[B]) there was a massive fuel-air explosion. The plant control room collapsed, killing all 18 occupants. Nine other site workers were killed, and a delivery driver died of a heart attack in his cab. Fires started on-site which were still burning ten days later. Around 1,000 buildings within a mile radius of the site (in Flixborough itself and in the neighbouring villages of Burton upon Stather and Amcotts) were damaged, as were nearly 800 in Scunthorpe (three miles away); the blast was heard over thirty miles away in Grimsby and Hull. Images of the disaster were soon shown on television, filmed by BBC and Yorkshire Television filmstock news crews who had been covering the Appleby-Frodingham Gala in Scunthorpe that afternoon.

The plant was re-built but cyclohexanone was now produced by hydrogenation of phenol (Nypro proposed to produce the hydrogen from LPG;[7] in the absence of timely advice from the Health and Safety Executive (HSE) planning permission for storage of 1200 te LPG at Flixborough was initially granted subject to HSE approval, but HSE objected[8]); as a result of a subsequent collapse in the price of nylon it closed down a few years later. The site was demolished in 1981, although the administration block still remains. The site today is home to the Flixborough Industrial Estate, occupied by various businesses and Glanford Power Station.

The foundations of properties severely damaged by the blast and subsequently demolished can be found on land between the estate and the village, on the route known as Stather Road. A memorial to those who died was erected in front of offices at the rebuilt site in 1977. Cast in bronze, it showed mallards alighting on water. When the plant was closed, the statue was moved to the pond at the parish church in Flixborough. During the early hours of New Year's Day 1984, the sculpture was stolen. It has never been recovered but the plinth it stood on, with a plaque listing all those who died that day, can still be found outside the church.

The cyclohexane oxidation process is still operated in much the same plant design in the Far East.[4]

The disaster

The plant

In the DSM process, cyclohexane was heated to about 155 °C (311 °F) before passing into a series of six reactors. The reactors were constructed from mild steel with a stainless steel lining; when operating they held in total about 145 tonnes of flammable liquid at a working pressure of 8.6 bar gauge (0.86 MPa gauge; 125 psig).[b] In each of the reactors, compressed air was passed through the cyclohexane, causing a small percentage of the cyclohexane to oxidise and produce cyclohexanone, some cyclohexanol also being produced. Each reactor was slightly (approximately 14 inches, 350 mm) lower than the previous one, so that the reaction mixture flowed from one to the next by gravity through nominal 28-inch bore (DN 700 mm) stub pipes with inset bellows.[c] The inlet to each reactor was baffled so that liquid entered the reactors at a low level; the exiting liquid flowed over a weir whose crest was somewhat higher than the top of the outlet pipe.[9] The mixture exiting reactor 6 was processed to remove reaction products, and the unreacted cyclohexane (only about 6% was reacted in each pass) then returned to the start of the reactor loop.

Although the operating pressure was maintained by an automatically controlled bleed valve once the plant had reached steady state, the valve could not be used during start-up, when there was no air feed, the plant being pressurised with nitrogen. During start-up the bleed valve was normally isolated and there was no route for excess pressure to escape; pressure was kept within acceptable limits (slightly wider that those achieved under automatic control) by operator intervention (manual operation of vent valves). A pressure-relief valve acting at 11 kg/cm^2 (156 psi) gauge was also fitted.

Reactor 5 leaks and is bypassed

Two months prior to the explosion, the number 5 reactor was discovered to be leaking. When lagging was stripped from it, a crack extending about 6 feet (1.8 m) was visible in the mild steel shell of the reactor. It was decided to install a temporary pipe to bypass the leaking reactor to allow continued operation of the plant while repairs were made. In the absence of 28-inch nominal bore pipe (DN 700 mm), 20-inch nominal bore pipe (DN 500 mm) was used to fabricate the bypass pipe for linking reactor 4 outlet to reactor 6 inlet. The new configuration was tested for leak-tightness at working pressure by pressurisation with nitrogen. For two months after fitting the bypass was operated continuously at temperature and pressure and gave no trouble. At the end of May (by which time the bypass had been lagged) the reactors had to be depressurised and allowed to cool in order to deal with leaks elsewhere. The leaks having been dealt with, early on 1 June attempts began to bring the plant back up to pressure and temperature.

The explosion

At about 16:53 on Saturday 1 June 1974, there was a massive release of hot cyclohexane in the area of the missing reactor 5, followed shortly by ignition of the resulting cloud of flammable vapour[D] and a massive explosion[E] in the plant. It virtually demolished the site. Since the accident took place at a weekend there were relatively few people on site: of those on-site at the time, 28 were killed and 36 injured. Fires continued on-site for more than ten days. Off-site there were no fatalities, but 50 injuries were reported and about 2,000 properties damaged.[d]

The occupants of the works laboratory had seen the release and evacuated the building before the release ignited; most survived. None of the 18 occupants of the plant control room survived, nor did any records of plant readings. The explosion appeared to have been in the general area of the reactors and after the accident only two possible sites for leaks before the explosion were identified: "the 20 inch bypass assembly with the bellows at both ends torn asunder was found jack-knifed on the plinth beneath" and there was a 50-inch long split in nearby 8-inch nominal bore stainless steel pipework".[e]

Court of Inquiry

Immediately after the accident, *New Scientist* commented presciently on the normal official response to such events, but hoped that the opportunity would be taken to introduce effective government regulation of hazardous process plants.

> Disasters on the scale of last Saturday's tragic explosion ... at Flixborough tend to provoke a brief wave of statements that such things must never happen again. With the passage of time these sentiments are diluted into bland reports about human error and everything being well under control – as happened with the Summerland fire. In the Flixborough case, there is a real chance that the death toll could trigger meaningful changes in a neglected aspect of industrial safety.[13]

The Secretary of State for Employment set up a Court of Inquiry to establish the causes and circumstances of the disaster and identify any immediate lessons to be learned, and also an expert committee to identify major hazard sites and advise on appropriate measures of control for them. The Inquiry sat for 70 days in the period September 1974 – February 1975, and took evidence from over 170 witnesses.[f] In parallel, an Advisory Committee on Major Hazards was set up to look at the longer term issues associated with hazardous process plant.

Circumstances of the disaster

The report of the court of inquiry was critical of the installation of the bypass pipework on a number of counts: although plant and senior management were chartered engineers (mostly chemical engineers) the post of Works Engineer which had been occupied by a chartered mechanical engineer had been vacant since January 1974 and at the time of the accident there were no professionally qualified engineers in the works engineering department. Nypro had recognised this to be a weakness and identified a senior mechanical engineer in an NCB subsidiary as available to provide advice and support if requested.[g] At a meeting of plant and engineering managers to discuss the failure of Reactor 5, the external mechanical engineer was not present. The emphasis was upon prompt restart and – the inquiry felt – although this did not lead to the deliberate acceptance of hazards, it led to the adoption of a course of action whose hazards (and indeed engineering practicalities) were not adequately considered or understood. The major problem was thought to be getting reactor 5 moved out of the way. Only the plant engineer was concerned about restarting before the reason for the failure was understood, and the other reactors inspected.[h][F] The difference in elevation between reactor 4 outlet and reactor 6 inlet was not recognised at the meeting. At a working level the offset was accommodated by a dog-leg in the bypass assembly; a section sloping downwards inserted between (and joined with by mitre welds) two horizontal lengths of 20-inch pipe abutting the existing 28-inch stubs. This bypass was supported by scaffolding fitted with supports provided to prevent the bellows having to take the weight of the pipework between them, but with no provision against other loadings.[G] The Inquiry noted on the "design" of the assembly:

No-one appreciated that the pressurised assembly would be subject to a turning moment imposing shear forces on the bellows for which they are not designed. Nor did anyone appreciate that the hydraulic thrust on the bellows (some 38 tonnes at working pressure) would tend to make the pipe buckle at the mitre joints. No calculations were done to ascertain whether the bellows or pipe would withstand these strains; no reference was made to the relevant British Standard, or any other accepted standard; no reference was made to the designer's guide issued by the manufacturers of the bellows; no drawing of the pipe was made, other than in chalk on the workshop floor; no pressure testing either of the pipe or the complete assembly was made before it was fitted.[9]

The Inquiry noted further that "there was no overall control or planning of the design, construction, testing or fitting of the assembly nor was any check made that the operations had been properly carried out". After the assembly was fitted, the plant was tested for leak-tightness by pressurising with nitrogen to 9 kg/cm²; i.e. roughly operating pressure, but below the pressure at which the system relief valve would lift and below the 30% above design pressure called for by the relevant British Standard.[j]

Cause of the disaster

The 20-inch bypass was therefore clearly not what would have been produced or accepted by a more considered process but controversy developed (and became acrimonious) as to whether its failure was the initiating fault in the disaster (the 20-inch hypothesis, argued by the plant designers (DSM) and the plant constructors; and favoured by the court's technical advisers[3]), or had been triggered by an external explosion resulting from a previous failure of the 8-inch line (argued by experts retained by Nypro and their insurers[3]).

The 20-inch hypothesis

Tests on replica bypass assemblies showed that bellows squirm could occur at pressures below the safety valve setting, but that squirm did not lead to a leak (either from damage to the bellows or from damage to the pipe at the mitre welds) until well above the safety valve setting. However theoretical modelling suggested that the expansion of the bellows as a result of squirm would lead to a significant amount of work being done on them by the reactor contents, and there would be considerable shock loading on the bellows when they reached the end of their travel. If the bellows were 'stiff' (resistant to squirm), the shock loading could cause the bellows to tear at pressures below the safety valve setting; it was not impossible that this could occur at pressures experienced during start-up, when pressure was less tightly controlled. (Plant pressures at the time of the accident were unknown since all relevant instruments and records had been destroyed, and all relevant operators killed).[k] The Inquiry concluded that this ("the 20-inch hypothesis") was 'a probability' but one 'which would readily be displaced if some greater probability' could be found.[l]

The 8-inch hypothesis

Detailed analysis suggested that the 8-inch pipe had failed due to creep cavitation at a high temperature while the pipe was under pressure. Failure had been accelerated by contact with molten zinc and there were indications that an elbow in the pipe had been at significantly higher temperature than the rest of the pipe.[m] The hot elbow led to a non-return valve held between two pipe flanges by twelve bolts. After the disaster, two of the twelve bolts were found to be loose; the inquiry concluded that they were probably loose before the disaster. Nypro argued that the bolts had been loose, there had consequently been a slow leak of process fluid onto lagging leading eventually to a lagging fire, which had worsened the leak to the point where a flame had played undetected upon the elbow, burnt away its lagging and exposed the line to molten zinc, the line then failing with a bulk release of process fluid which extinguished the original fire, but subsequently ignited giving a small explosion which had caused failure of the bypass, a second larger release and a larger explosion. Tests failed to produce a lagging fire with leaked process fluid at process temperatures; one advocate of the 8-inch hypothesis then argued instead that there had been a gasket failure giving a leak with sufficient velocity to induce static charges whose discharge had then ignited the leak.[n]

The inquiry conclusion

The 8-inch hypothesis was claimed to be supported by eyewitness accounts and by the apparently anomalous position of some debris post-disaster. The inquiry report took the view that explosions frequently throw debris in unexpected directions and eyewitnesses often have confused recollections. The inquiry identified difficulties at various stages of the accident development in the 8-inch hypothesis, their cumulative effect being considered to be such that the report concluded that overall the 20-inch hypothesis involving 'a single event of low probability' was more credible than the 8-inch hypothesis depending upon 'a succession of events, most of which are improbable'.[n]

Lessons to be learned

The inquiry report identified 'lessons to be learned' which it presented under various headings; 'General observation' (relating to cultural issues underlying the disaster), 'specific lessons' (directly relevant to the disaster, but of general applicability) are reported below; there were also 'general' and 'miscellaneous lessons' of less relevance to the disaster. The report also commented on matters to be covered by the Advisory Committee on Major Hazards.

General observation

- Plant – where possible – should be designed so that failure does not lead to disaster on a timescale too short to permit corrective action.
- Plant should be designed and run to minimise the rate at which critical management decisions arise (particularly those in which production and safety conflict).
- Feedback within the management structure should ensure that top management understand the responsibilities of individuals and can ensure that their workload, capacity and competence allow them to effectively deal with those responsibilities

Specific lessons

The disaster was caused by 'a well designed and constructed plant' undergoing a modification that destroyed its technical integrity.

- Modifications should be designed, constructed, tested and maintained to the same standards as the original plant

When the bypass was installed, there was no works engineer in post and company senior personnel (all chemical engineers) were incapable of recognising the existence of a simple engineering problem, let alone solving it

- When an important post is vacant special care should be taken when decisions have to be taken which would normally be taken by or on the advice of the holder of the vacant post
- All engineers should learn at least the elements of other branches of engineering than their own[n]

Matters to be referred to the Advisory Committee

No one concerned in the design or construction of the plant envisaged the possibility of a major disaster happening instantaneously.[o] It was now apparent that such a possibility exists where large amounts of potentially explosive material are processed or stored. It was 'of the greatest importance that plants at which there is a risk of instant as opposed to escalating disaster be identified. Once identified measures should be taken both to prevent such a disaster so far as is possible and to minimise its consequences should it occur despite all precautions.'[o] There should be coordination between planning authorities and the Health and Safety Executive, so that planning authorities could be advised on safety issues before granting planning permission; similarly the emergency services should have information to draw up a disaster plan.

Conclusion

The inquiry summarised its findings as follows:

> We believe, however, that if the steps we recommend are carried out, the risk of any similar disaster, already remote, will be lessened. We use the phrase "already remote" advisedly for we wish to make it plain that we found nothing to suggest that the plant as originally designed and constructed created any unacceptable risk. The disaster was caused wholly by the coincidence of a number of unlikely errors in the design and installation of a modification. Such a combination of errors is very unlikely ever to be repeated. Our recommendations should ensure that no similar combination occurs again and that even if it should do so, the errors would be detected before any serious consequences ensued.[p]

Response to Inquiry Report

Controversy as to immediate cause

Nypro's advisers had put considerable effort into the 8-inch hypothesis, and the inquiry report put considerable effort into discounting it. The critique of the hypothesis spilled over into criticism of its advocates: 'the enthusiasm for the 8-inch hypothesis felt by its proponents has led them to overlook obvious defects which in other circumstances they would not have failed to realise'.[q] Of one proponent the report noted gratuitously that his examination by the court 'was directed to ensuring that we had correctly appreciated the main steps in the hypothesis some of which appeared to us in conflict with facts which were beyond dispute'.[r] The report thanked him for his work in assembling eyewitness evidence but said his use of it showed 'an approach to the evidence which is wholly unsound'.[s]

The proponent of the 8-inch gasket failure hypothesis responded by arguing that the 20-inch hypothesis had its share of defects which the inquiry report had chosen to overlook, that the 8-inch hypothesis had more in its favour than the report suggested, and that there were important lessons that the inquiry had failed to identify:

> [T]he Court's commitment for the 20-inch hypothesis led them to present their conclusions in a way that does not help the reader to assess contrary evidence. The Court could still be right that a single unsatisfactory modification caused the disaster but this is no reason for complacency. There are many other lessons. It is to be hoped that the respect normally accorded to the findings of a Court of Inquiry will not inhibit chemical engineers in looking beyond the report in their endeavours to improve the already good safety record of the chemical industry.[6]

The Flixborough inquiry findings have not been accorded the normal respect; one critic of them was able to note after a flurry of articles on the 25th anniversary:

> In view of the Court of Inquiry's qualified conclusion, the cause of the accident has been the subject of considerable controversy, especially as to the actual failure process (e.g., Ball, 1975, 1976; Butler, 1975; Cox, 1976; Gugan, 1976; King, 1977; Warner, 1975; Warner and Newland, 1975); the amount of cyclohexane released, and whether the unconfined vapor cloud formed in the release detonated (e.g., Gugan, 1978, 1980; Ale and Bruning, 1980a, b; Fu and Eyre, 1980; Phillips, 1981). The debate and argument continue to this day (e.g.,Gugan, 2000; Hoiset et al., 2000; King, 2000; Kletz, 2000; Swan, 2000).[9]

The HSE website currently (2014) says "During the late afternoon on 1 June 1974 a 20 inch bypass system ruptured, which may have been caused by a fire on a nearby 8-inch pipe".[1] In the absence of a strong consensus for either hypothesis other possible immediate causes have been suggested.[K]

Post-enquiry forensic engineering – two-stage rupture of bypass

The enquiry noted the existence of a small tear in a bellows fragment, and therefore considered the possibility of a small leak from the bypass having led to an explosion bringing the bypass down. It noted this to be not inconsistent with eyewitness evidence, but ruled out the scenario because pressure tests showed the bellows did not develop tears until well above the safety valve pressure.[I] This hypothesis has however been revived, with the tears being caused by fatigue failure at the top of the reactor 4 outlet bellows because of flow-induced vibration of the unsupported bypass line. Finite element analysis has been carried out (and suitable eyewitness evidence adduced) to support this hypothesis.[9][17]

Post-enquiry forensic engineering – the 'water hypothesis'

The reactors were normally mechanically stirred but reactor 4 had operated without a working stirrer since November 1973; free phase water could have settled out in unstirred reactor 4 and the bottom of reactor 4 would reach operating temperature more slowly than the stirred reactors. It was postulated that there had been bulk water in reactor 4 and a disruptive boiling event had occurred when the interface between it and the reaction mixture reached operating temperature. Abnormal pressures and liquor displacement resulting from this (it was argued) could have triggered failure of the 20-inch bypass.[18][L][M]

Dissatisfaction with other aspects of the Inquiry Report

The plant design had assumed that the worst consequence of a major leak would be a plant fire and to protect against this a fire detection system had been installed. Tests by the Fire Research Establishment had shown this to be less effective than intended.[6] Moreover, fire detection only worked if the leak ignited at the leak site; it gave no protection against a major leak with delayed ignition, and the disaster had shown this could lead to multiple worker fatalities. The plant *as designed* therefore could be destroyed by a single failure and had a much greater risk of killing workers than the designers had intended. Critics of the inquiry report therefore found it hard to accept its characterisation of the plant as 'well-designed'.[N] The HSE (through the Department of Employment) had come up with a 'shopping list' of about 30 recommendations on plant design,[3] many of which had not been adopted (and a few explicitly rejected[V]) by the Inquiry Report; the HSE inspector who acted as secretary to the inquiry spoke afterwards of making sure that the real lessons were acted upon.[6] More fundamentally, Trevor Kletz saw the plant as symptomatic of a general failure to consider safety early enough in process plant design, so that designs were inherently safe – instead processes and plant were selected on other grounds then safety systems bolted on to a design with avoidable hazards and unnecessarily high inventory. 'We keep a lion and build a strong cage to keep it in. But before we do so we should ask if a lamb might do.'[21]

If the UK public were largely reassured to be told the accident was a one-off and should never happen again, some UK process safety practitioners were less sanguine. Critics felt that the Flixborough explosion was not the result of multiple basic engineering design errors unlikely to coincide again; the errors were rather multiple instances of one underlying cause: a complete breakdown of plant safety procedures (exacerbated by a lack of relevant engineering expertise, but that lack was also a procedural shortcoming).[5]

ICI Petrochemicals: 'A new world where new methods are needed'

The Petrochemicals Division of Imperial Chemical Industries (ICI) operated many plants with large inventories of flammable chemicals at its Wilton site (including one in which cyclohexane was oxidised to cyclohexanone and cyclohexanol). Historically good process safety performance at Wilton had been marred in the late 1960s by a spate of fatal fires caused by faulty isolations/handovers for maintenance work.[22] Their immediate cause was human error but ICI felt that saying that most accidents were caused by human error was no more useful than saying that most falls are caused by gravity.[4] ICI had not simply reminded operators to be more careful, but issued explicit instructions on the required quality of isolations, and the required quality of its documentation.[22] The more onerous requirements were justified as follows:

> Why do we need the HOC[O] rules on the isolation and identification of equipment for maintenance? They were introduced about 2 years ago, but Billingham managed for 45 years without them. During those 45 years there were no doubt many occasions when fitters broke into equipment and found it had not been isolated, or broke into the wrong line because it had not been identified positively. But pipe-lines were mostly small, and the amount of flammable gas or liquid on the plant was not usually large. Now pipe-lines are much larger and the amount of gas or liquid that can leak out is much greater. Several serious incidents in the last 3 years have shown that we dare not risk breaking into lines that are not properly isolated. As plants have got larger we have moved ... into a new world where new methods are needed.[23][P]

In accordance with this view, post-Flixborough (and without waiting for the Inquiry Report), ICI Petrochemicals instituted a review of how it controlled modifications. It found that major projects requiring financial sanction at a high level were generally well-controlled, but for more (financially) minor modifications there was less control and this had resulted in a past history of 'near-misses' and small-scale accidents,[26] few of which could be blamed on chemical engineers.[Q] To remedy this, not only were employees reminded of the principal points to consider when making a modification (both on the quality/compliance of the modification itself and on the effect of the modification on the rest of the plant), but new procedures and documentation were introduced to ensure adequate scrutiny. These requirements applied not only to changes to equipment, but also to process changes. All modifications were to be supported by a formal safety assessment. For major modifications this would include an 'operability study'; for minor modifications a checklist-based safety assessment was to be used, indicating what aspects would be affected, and for each aspect giving a statement of the expected effect. The modification and its supporting safety assessment then had to be approved in writing by the plant manager and engineer. Where instruments or electrical equipment were involved signatures would also be needed from the relative specialist (instrument manager or electrical engineer). A Pipework Code of Practice was introduced specifying standards of design construction and maintenance for pipework – all pipework over 3"nb (DN 75 mm) handling hazardous material would have to be designed by pipework specialists in the design office.[26] The approach was publicised outside ICI; while the Pipework Code of Practice on its own would have combatted the specific fault(s) that led to the Flixborough disaster, the adoption more generally of tighter controls on modifications (and the method by which this was done) were soon recognised to be prudent good practice.[R] In the United Kingdom, the ICI approach became a *de facto* standard for high-risk plant (partly because the new (1974) Health and Safety at Work Act went beyond specific requirements on employers to state general duties to keep risks to workers as low as reasonably practicable and to avoid risk to the public so far as reasonably practicable; under this new regime the presumption was that recognised good practice would inherently be 'reasonably practicable' and hence should be adopted, partly because key passages in reports of the Advisory Committee on Major Hazards were clearly supportive).

Advisory Committee on Major Hazards

Dissatisfaction with existing regulatory regime

The terms of reference of the Court of Inquiry did not include any requirement to comment on the regulatory regime under which the plant had been built and operated, but it was clear that it was not satisfactory. Construction of the plant had required planning permission approval by the local council; while "an interdepartmental procedure enabled planning authorities to call upon the advice of Her Majesty's Factory Inspectorate when considering applications for new developments which might involve a major hazard"[27] (there was no requirement for them to do so), since the council had not recognised the hazardous nature of the plant[3] they had not called for advice. As the *New Scientist* commented within a week of the disaster:

> There are now probably more than a dozen British petrochemical plants with a similar devastation-potential to the Nypro works at Flixborough. Neither when they were first built, nor now that they are in operation, has any local or government agency exercised effective control over their safety. To build a nuclear power plant, the electricity industry must provide a detailed safety evaluation to the Nuclear Inspectorate before it receives a

> licence. On the other hand, permission for highly hazardous process plants only involves satisfying a technically unqualified local planning committee, which lacks even the most rudimentary powers once the plant goes on stream. ... The Factory Inspectorate has standing only where it has promulgated specific regulations[13]

Terms of Reference and personnel

The ACMH's terms of reference were to identify types of (non-nuclear) installations posing a major hazard, and advise on appropriate controls on their establishment, siting, layout, design, operation, maintenance and development (including overall development in their vicinity). Unlike the Court of Inquiry, its personnel (and that of its associated working groups) had significant representation of safety professionals, drawn largely from the nuclear industry and ICI (or ex-ICI)

Suggested regulatory framework

In its first report[28] (issued as a basis for consultation and comment in March 1976), the ACMH noted that hazard could not be quantified in the abstract, and that a precise definition of 'major hazard' was therefore impossible. Instead[w] installations with an inventory of flammable fluids above a certain threshold or of toxic materials above a certain 'chlorine equivalent' threshold should be ' *notifiable installations* '. A company operating a notifiable installation should be required to survey its hazard potential, and inform HSE of the hazards identified and the procedures and methods adopted (or to be adopted) to deal with them.

HSE could then chose to – in some cases (generally involving high risk or novel technology) – require[x] submission of a more elaborate assessment, covering (as appropriate) "design, manufacture, construction, commissioning, operation and maintenance, as well as subsequent modifications whether of the design or operational procedures or both". The company would have to show that "it possesses the appropriate management system, safety philosophy, and competent people, that it has effective methods of identifying and evaluating hazards, that it has designed and operates the installation in accordance with appropriate regulations, standards and codes of practice, that it has adequate procedures for dealing with emergencies, and that it makes use of independent checks where appropriate"

For most 'notifiable installations' no further explicit controls should be needed; HSE could advise and if need be enforce improvements under the general powers given it by the 1974 Health and Safety at Work Act (HASAWA), but for a very few sites explicit licensing by HSE might be appropriate;[y] responsibility for safety of the installation remaining however always and totally with the licensee.

Ensuring safety of 'major hazard' installations

HASAWA already required companies to have a safety policy, and a comprehensive plan to implement it. ACMH felt that for major hazard installations[z] the plan should be formal and include

- the regulation by company procedures of safety matters (such as: identification of hazards, control of maintenance (through clearance certificates, permits to work etc.), control of modifications which might affect plant integrity, emergency operating procedures, access control)
- clear safety roles (for e.g. the design and development team, production management, safety officers)
- training for safety, measures to foster awareness of safety, and feedback of information on safety matters

Safety documents were needed both for design and operation. The management of major hazard installations must show that it possessed and used a selection of appropriate hazard recognition techniques,[S] had a proper system for audit of critical safety features, and used independent assessment where appropriate.

The ACMH also called for tight discipline in the operation of major hazard plants:

> The rarity of major disasters tends to breed complacency and even a contempt for written instructions. We believe that rules relevant to safety must be everyday working rules and be seen as an essential part of day-to-day work practice. Rules, designed to protect those who drew them up if something goes wrong, are readily ignored in day-to-day work. Where management lays down safety rules, it must also ensure that they are carried out. We believe that to this end considerable formality is essential in relation to such matters as permits to work and clearance certificates to enter vessels or plant areas. In order to keep strong control in the plant, the level of authority for authorisations must be clearly defined. Similarly the level of authority for technical approval for any plant modification must also be clearly defined. To avoid the danger of systems and procedures being disregarded, there should be a requirement for a periodic form of audit of them.[aa]

The ACMH's second report (1979) rejected criticisms that since accidents causing multiple fatalities were associated with extensive and expensive plant damage the operators of major hazard sites had every incentive to avoid such accidents and so it was excessive to require major hazard sites to demonstrate their safety to a government body in such detail:

> We would not contest that the best run companies achieve high standards of safety, but we believe this is because they have .... achieved what is perhaps best described as technical discipline in all that they do.
>
> We believe that the best practices must be followed by all companies and that we have reached a state of technological development where it is not sufficient in areas of high risk for employers merely to demonstrate to themselves that all is well. They should now be required to demonstrate to the community as a whole that their plants are properly designed, well constructed and safely operated.[11]

The approach advocated by the ACMH was largely followed in subsequent UK legislation and regulatory action, but following the release of chlordioxins by a runaway chemical reaction at Seveso in northern Italy in July 1976, 'major hazard plants' became an EU-wide issue and the UK approach became subsumed in EU-wide initiatives (the Seveso Directive in 1982, superseded by the Seveso II Directive in 1996). A third and final report was issued when the ACMH was disbanded in 1983.

See also

- Buncefield fire
- Health and Safety Executive
- List of disasters in Great Britain and Ireland by death toll

Notes

A. Various authors[4][5] have compared it with the Tay Bridge disaster in one aspect or other

B. the conclusion of the official Inquiry, but this has been queried, given the pattern of deposition of soot from the explosion [6]

C. i.e. the fatal modification did not introduce the bellows (a point not always appreciated by popular retellings)

D. or of that part of it within flammability limits Visualisations of the output of CFD modelling of the release showing the upper and lower flammable limit envelopes can be found in[9] for both the Inquiry's favoured failure scenario and Venart's