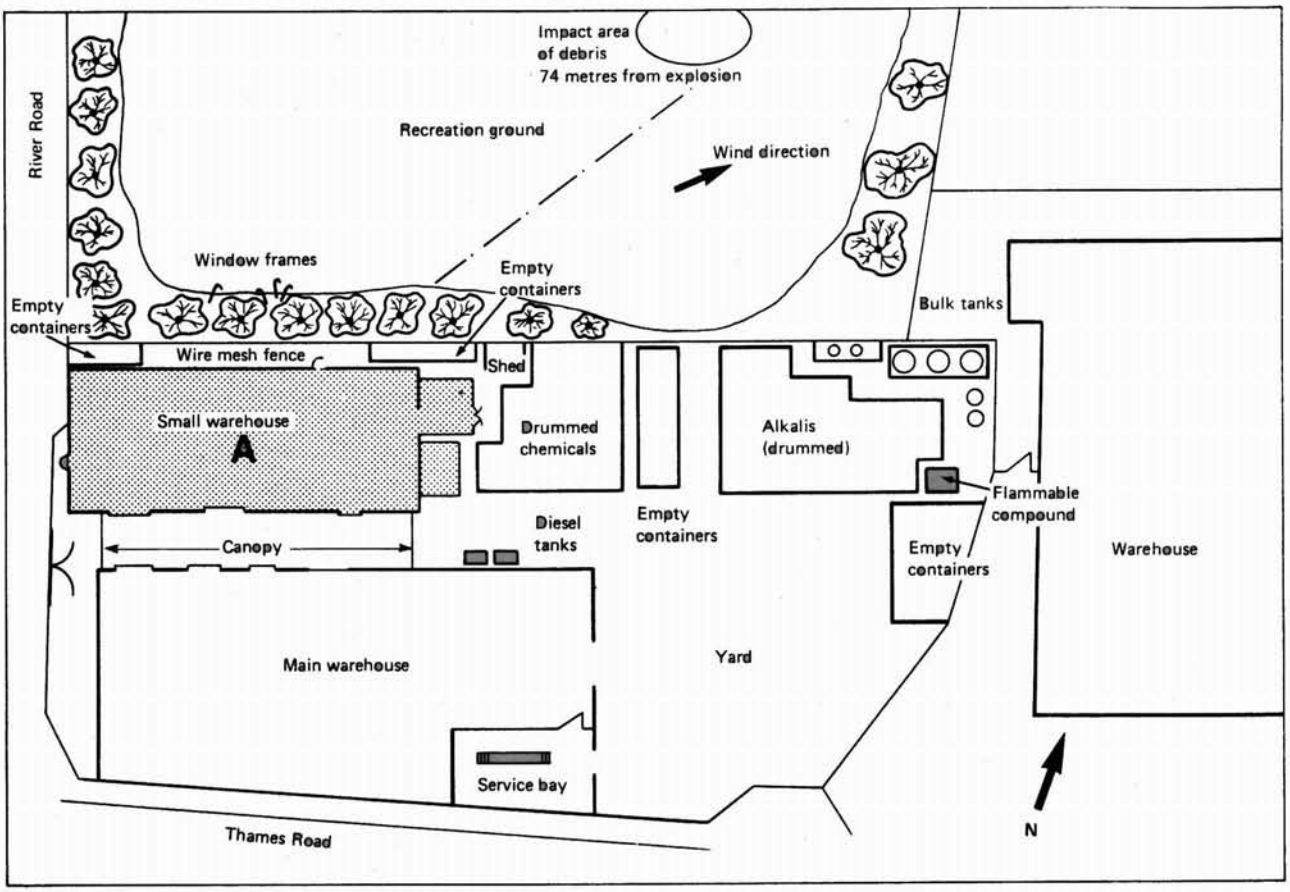
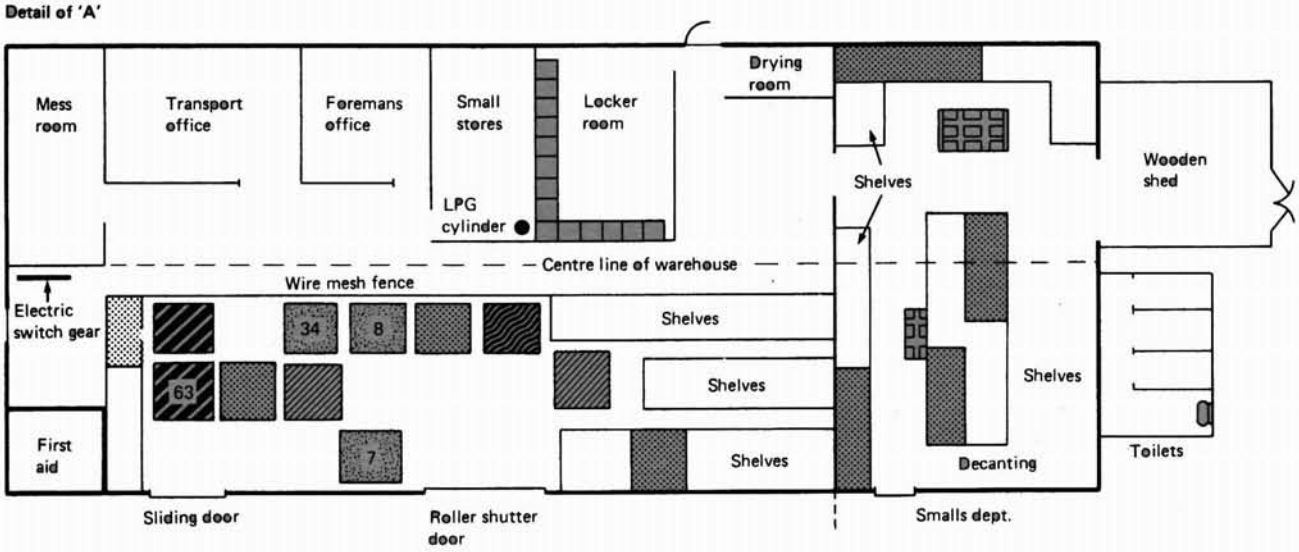
The fire and explosions at River Road, Barking, Essex, 21 January 1980

Health &
Safety
Executive

Site plan (not to scale)



Detail of 'A'



Sodium chlorate

Sodium & potassium cyanide

Chlorination compounds

Phenol

Flammables

Dry acid

34 No of drums in stack

LPG cylinder

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Contents

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Summary

A series of explosions which occurred at a chemical storage depot at 27 River Road, Barking on 21 January 1980 was probably caused by the rapid thermal decomposition of sodium chlorate in an intense fire. About 4000 people were temporarily evacuated from nearby housing estates when large quantities of smoke were blown in their direction.

The storage of sodium chlorate in quantities as low as 2·45 tonnes was not considered, prior to this incident, to be potentially dangerous. All previously recorded incidents involved quantities of 20 or more tonnes of the material.

This report emphasises the need for occupiers of similar premises to pay attention to:

– segregating various chemicals into different categories with regard to their relevant properties;

– obtaining advice on fire precautions from authoritative sources;

– preparing adequate emergency procedures in conjunction with the emergency services.

The report recommends that all users of liquefied petroleum gas should ensure that cylinders when in use be secured in an upright position and, where reasonably practicable, be transferred from workplaces into lpg storage compounds at the end of each working day. In addition, it recommends that discussions should take place between the Health and Safety Executive and the chemical industry on the advice that manufacturers should give on the segregation of chemicals during storage. The Executive and the Home Office should also consider ways in which the exchange of information between fire authorities and the Executive can be improved.

The fire occurred at a depot, operated by Womersley Boome Chemicals Ltd, where over one hundred different chemicals were stored in a variety of containers.

The Fire Brigade were at the scene within minutes of receiving a 999 call at 2018 hours. The fire gutted one of the two buildings on the site and partially damaged the other.

The source of ignition for the fire was in all probability radiant heat from a domestic three bar electric fire which ignited combustible materials, (probably wet weather clothing being dried overnight within the locker room in the smaller building). The fire spread through packaging materials stored nearby to involve an lpg cylinder and numerous chemicals including sodium chlorate. Three explosions resulted, the first probably caused by the rupture of the lpg cylinder, and the second and third explosions by drummed sodium chlorate. These explosions caused minor damage to residential properties situated about 200 metres from the centre of the blasts, and debris was hurled more than 70 metres.

Following the explosions the amount of smoke generated increased so substantially that the senior fire brigade officer present decided to evacuate the nearby residential properties. Evacuation was swift and smooth, and was virtually completed by 2300 hours. People were allowed to return to their homes at 0630 hours the next day. Nine firemen had to be treated for minor cuts and bruises, but no member of the public was affected by fumes from the fire. The cost of the damage has been estimated at about £200,000.

Action was taken following the fire by HM Factory Inspectorate to ensure the safety of the workforce and to enable the residual mixture of chemicals to be disposed of safely.

The site

The company is a member of the Durham Chemical Group of Companies and a subsidiary of Harrisons & Crossfield Ltd Group. They own several other depots in other parts of the country. Some sixteen people were employed, on two shifts, together with a number of lorry drivers. In the main the business was that of storage of drummed and pre-packaged chemicals and the re-filling of returned empty containers from bulk tanks of chemicals, principally sodium hypochlorite or bleach; they broke down from bulk and supplied minor amounts of special mixes to customers requirements.

The premises have been continuously occupied by chemical firms since before the second world war, during which they were used as a flare-making factory. They were registered with HM Factory Inspectorate in September 1973 as Robert Womersley Limited. An amalgamation with another local firm Geo F Boome & Son Ltd of Rainham took place in 1974 and the firm's title became Womersley Boome Chemicals Limited.

The land immediately surrounding the premises is zoned for industrial use and is heavily industrialised. The further-

most estate affected (Scratton's Farm) was developed between the wars, whilst the Thames View Estate was developed between 1940 and 1961.

The site had two warehouses and an open yard. The main warehouse was 43·6 m long by 16 m wide with a multi-pitched roof on steel pillars. It had steel reinforced and brick pillared 23 cm bricks walls, with an underdrawn timber roof on metal trusses. The overall height was 3·9 m to the eaves and 6 m to the apex of the roof. Apart from some structural damage to a gable wall, this warehouse and its contents were not seriously damaged. No chemicals stored in this warehouse were involved in the fire. There was a canopy between the warehouses constructed of PVC translucent sheeting on a timber framework supported by steel trusses.

The small warehouse was almost totally destroyed by the fire. It was 31 m long by 12·8 m wide and constructed of 23 cm brick walls within a steel frame with two bays running East-West. The roof was of corrugated iron sheeting covered in bitumastic sealant, underdrawn with close boarded timber on the southern pitch, with glazed north roof lights. The building was sub-divided by a brick wall running North-South across the building to make two compartments 23·5 m and 7·5 m long. The doorway in this wall was not fitted with a door. The 23·5 m eastern part was known as the 'smalls department'; it was sub-divided into a mess room, offices, small stores containing packaging, a locker room and drying room along the northern wall. A wire mesh security fence running East-West divided the building into two halves. Quantities of chemicals and packaging materials in various containers, were stored in the building. At the rear of the small warehouse was a 5 m x 5 m wooden storage shed. The rest of the premises consisted of an open yard in which were several bulk tanks containing corrosive liquids. There were also numerous drums and other containers, of all sizes, which stored a variety of other chemicals, and a large number of empty containers in the yard.

Storage of chemicals

Over one hundred different chemicals were stored in a variety of types of containers including metal drums, tins, plastic bags, sacks, carboys, buckets and tubs; cardboard kegs, drums and boxes; and paper sacks. These were in a range of sizes from 500 grammes up to 200 litres, stored either in stacks on wooden pallets, on the floor, or on three-tier wooden and metal shelving.

The most hazardous chemicals in the small warehouse were some 2450 kg of sodium chlorate in 50 kg steel drums, some 3900 kg of water chlorinating chemicals stored in cardboard boxes and bags, 300 kg of phenol crystals stored in polythene tubs and 3100 kgs of sodium and potassium cyanide crystals and ovoids stored in steel drums. The location of these chemicals within the affected warehouse is shown in the site plan. The warehouse also contained small quantities of other chemicals and a variety of detergents, which had little effect on the fire or explosions. None of the liquid mineral acids or alkalis stored were in proximity to the cyanide or other materials with which they might have reacted.

The fire

The local fire brigade were at the scene within minutes of receiving a 999 call at 2018 hours (the station is only half a mile from the site). They forced an entry through the front wire mesh gates and removed the three lorries parked under the canopy between the two warehouses which could have acted as a fire bridge between the two buildings. An immediate call for assistance was made. Fire fighting began at the rear of the small warehouse and the wooden shed, but the fire had a good hold and spread rapidly through the rest of the small warehouse. Within 25 minutes ten fire appliances were in attendance.

At about 2030 hours the brigade established that quantities of unknown chemicals were present, and because of this and the speed of the spread of the fire, the crews were withdrawn from the immediate area of the fire and special chemical incidence units were requested to attend.

The first, and smallest, explosion occurred at 2044 hours, which blew open the corrugated roof of the warehouse, and this was accompained by an increase in the fire intensity Within about 30 seconds a second and larger explosion occurred which blew debris into the roadway and the adjacent recreation ground. Several firemen were blown over by the blast wave. Almost immediately a larger explosion occurred. The fire crews were further withdrawn, for roll call, and when this had been completed, fire fighting recommenced. Several firemen were injured following these explosions and taken to hospital because of deafness, cuts and bruises. One man was detained but was released before morning. Fire fighting was continued by crews equipped with breathing apparatus and the specially equipped London Fire Brigade chemical incident units. These units have special fire fighting appliances, manned by firemen specially trained to fight chemical fires, who are equipped with fully enclosed chemical resistant suits and breathing apparatus.

Following the explosions the amount of smoke being generated increased to a point where the senior fire brigade officer decided to evacuate the nearby residential properties. The reasons for this decision included the following:

- The premises contained chemicals that had produced several explosions and further, more violent explosions were possible.
- The type and quantity of smoke had initially been similar to that normally seen issuing from a domestic fire, but following the explosions, if had changed to a thick yellowish plume, being kept close to the ground by a high wind blowing from the South West.
- The direction of the wind was rolling the smoke into a housing estate where damage to windows could be expected to have occurred.
- It was estimated that it would take three to four hours to bring the fire under control.
- The GLC's scientific advisers, when they arrived at 2125 hours, confirmed the brigade's judgement of risk and advised that the area of evacuation should be extended to about a mile down wind.

The evacuation, once started, proceeded swiftly and had virtually been completed at 2300 hours, although a few people were still being removed to the evacuation centres at 0030 hours. The police remained in the area overnight to ensure the safety and security of the evacuated houses and people were allowed to return at 0630 hours the next day.
By 2300 hours fire fighting was confined to ground monitors, a form of fixed jet that can be placed in position to play on an area of fire, and the employment of the CIU teams equipped to fight deep seated fires under the debris. The fire brigade maintained a watching brief overnight and continued to visit the site to cool off hot spots for two days after the incident.

Small warehouse

This was completely gutted and extensively damaged in the southernmost bay, approximately 10 m from the eastern gable end. A substantial section of 23 cm thick brick wall and a wooden sliding top hung door had been blown into the canopy-covered area. Some roof trusses in this southern bay, in the area immediately adjacent to the missing wall section were severely bent and twisted upward. Sections of the roof were missing as were several northlight window frames. Other internal brick walls, including the cross wall, were cracked and bulging, and the brickwork displaced.

The steel shelving units were severely affected. The wooden shelves had been burnt away and the material stacked on them fallen to the ground. The majority of vertical and horizontal steel structural members were apparently unaffected except for two horizontal beams in the area adjacent to the foreman's office. A split and bulging 19 kg capacity liquefied petroleum gas cylinder, used by the company in the process of shrink wrapping small containers, was found adjacent to these beams.

Numerous metal containers were found, the majority of which had split or blown. Large numbers of plastic containers had been burnt and the contents spilled. The warehouse was up to 1m deep in fire debris. Wooden window and door frames had been severley charred and wired glass panels had melted.

Main warehouse

The gable end wall immediately adjacent to the missing brickwork of the small warehouse, was badly damaged and the 23 cm wall with 30 cm piers had been pushed into the warehouse. Sections of damaged wall were overhanging the walkway and 1·5 cm to 3 cm wide horizontal cracks were visible in the remaining brickwork of the gable end. Minor damage to the roof lights and roof was apparent. The canopy between the warehouse was severely affected and the translucent sheeting had melted.

Numerous metal drum fragments weighing anything from a few grammes to 1 kilogramme were found throughout the premises and on the nearby recreation field. These were traced to the missing 49 x 50 kg drums which had contained sodium chlorate. All of these drums had disintegrated. Several roof light window frames were also found in the recreation field.

Investigation

HM Inspectors of Factories attended the fire on the evening of 21 January 1980, but investigation could not begin until the following morning when the fire was extinguished. The whole of the small warehouse contained quantities of broken and damaged metal and plastic containers, some of which had suffered severe fire damage and the contents had spilled. All steel surfaces showed heavy rusting, consistent with sodium chlorate decomposing to release common salt. A pool of liquid immediately adjacent to a pile of damaged drums had turned pale blue, consistent with the presence of cyanide. Large amounts of charred packaging materials and labels were also present.

Initial investigations concentrated in the locker room area where eye witness accounts suggested that the fire had started. Examination of materials in the area indicated that a severe fire had been in progress, for some time prior to the explosions. Among the fire debris was a three-pencil-element type electric fire of about 3 kw rating. The electrical switches, and the fire, had virtually disintegrated except for the metal cover. This type of fire is one that, when connected to the supply has one radiant heater element 'ON' when the tumbler switch is in the 'UP' position. Operating the tumbler switch connects the other two elements into the circuit. The remnants of the flex were traced to the remains of a double switched, double outlet 13 amp socket which would normally have been situated on the wall behind the end locker. The right hand outlet of the socket had the remains of a 13 amp neutral pin still in the contact sleeve. The contacts for this switch were found in the closed or 'ON' position.

Further information indicated that the initial fire fighting efforts had been directed at the rear of the small warehouse or 'smalls' department and the wooden shed. An investigation of this area revealed numerous items of electrical equipment including a small domestic fan heater, a two tube black radiant heater, a drum heater band and the remains of a radio. Although substantial damage to electrical wiring had occurred it was possible to establish that the two bar heater and the drum heater band had also been left switched on, on the afternoon and evening of 21 January.

The most probable cause of the fire is thought therefore to be heat radiated from an electric fire igniting adjacent combustible materials such as clothing left to dry in the locker room. The involvement of the two bar black radiant heater cannot entirely be discounted.

Sequence of events

The fire probably started in the locker room area of the warehouse. It spread via the various clothing materials into the 'smalls' stores immediately adjacent, and involved the labels and chemicals on the shelving units. These contained quantities of combustible materials such as tallow, vanillin and plastic equipment. The smalls stores also contained the liquid petroleum gas cylinder and this was subjected to localised heat.

The fire then spread rapidly into the main part of the small warehouse and thence by the wooden underdrawing of the

roof to the plastic and other cardboard packaging materials stored on shelves and on the tops of the various offices.

Sometime later, the heat of the fire caused the pressure relief valve of the lpg cylinder to open, releasing a burning jet of vapour. It is known that a flame up to 10 m in length can be obtained from discharge of this type. The sagging of two horizontal beams immediately above this area suggests that the flame impinged on these beams, and they were subjected to intense heat. The position of the cylinder, located following the fire, also supported this assumption. The cylinder, before becoming empty, had evidently been knocked over due to falling debris, and while lying on its side had started to pass liquid propane. The pressure relief valve was designed for vapour and not liquid release, and the cylinder body eventually became over-pressurised and split, releasing the remainder of its contents. The release of up to 19 kg of lpg either as a flammable liquid or as a flammable vapour greatly increased the intensity of the fire througout the small warehouse and hence in the vicinity of the pallets of sodium chlorate.

The drums of sodium chlorate would commence to decompose thermally at an ever increasing rate until finally explosion occurred. The explosion would cause considerable scattering of drums, drum fragments and partially decomposed chlorate within the small warehouse resulting in a further increase in the intensity of the fire. The remaining drums of chlorate in the largest stack would then decompose and cause the third and largest explosion, fragmenting or consuming all the drums in the ensuing severe high temperature fire.

Photographic evidence showed quantities of burning materials present on the horizontal surfaces of the building and a very intense fire burning in the area of the mess room. This would correspond to the deposition of sodium chlorate causing enhancement of the fire, and supports the views expressed on the cause of the fire and explosions.

Explosions

The sodium chlorate was stored on wooden pallets in polythene lined 50kg steel drums in two main areas. The smallest pallet contained seven drums and was positioned adjacent to the small warehouse wall, between the wooden sliding door and the steel roller shutter door. The other drums were stored in the centre of the warehouse in two adjacent stacks, one stack containing a single pallet of eight drums and the other 34 drums, in a two-pallet high stack, as indicated in the plan on the inside front cover.

There were three explosions of increasing violence reported by various witnesses. The first explosion could be ascribed to the lpg cylinder and would have caused minor disruption in the small warehouse. A survey of the resultant damage to the steelwork of the roof of the warehouse correlated with a further two separate and fairly violent explosions, with their centres close to those of the two stacks of chlorate. The largest explosion took place in the vicinity of the larger stack, leaving little doubt that the sodium chlorate was involved.

The explosions probably arose from an extremely rapid thermal decomposition, of the drummed sodium chlorate, caused by its involvement in a sudden and intense fire. The heat losses to the surroundings through the roof and walls were minimised by the compact nature and the method of construction of the building. These factors made a critical contribution to the involvement of all the drums of sodium chlorate, and makes it improbable that mixtures of sodium chlorate were formed with incompatible substance such as fuel or sodium bisulphate.

Evidence for the explosive force involved in these two larger explosions was obtained from the cyanide drums, located some 3 m from the largest stack of chlorate, which had compressed at the ullage space becoming egg shaped and indicating overpressures between 2 to 4 bar (30 to 60 psi); the main warehouse gable wall which was pushed over, indicating an overpressure of 0·5 bar (7 psi); window damage to nine houses in a localised area of Thames View Estate at 220 m, indicating 0·003 bar (0·05 psi); and finally, with 95% of the fragments which were located in the centre of the recreational field at 74 m from the explosions. This evidence suggests an explosive yield equivalent to 3 to 5 kg (7 to 11lb) of TNT for the larger of the explosions with an average yield of 4 kg (9 lbs). The second explosion is impossible to quantify, except to say it would have been enough to fragment the drums involved. The evidence also confirms a deflagrative rather than a detonative event.

A detailed discussion on the mechanism of the explosive decomposition of drummed sodium chlorate is contained in Appendix 2 of the report on the fire and explosion at Braehead Container Depot, Renfrew, 4 January 1977* and although there were similarities to that incident, there were also some marked differences.

These were:

- No full or part drums of sodium chlorate were found. All the drums present before the fire and explosions had either been fragmented or had been consumed by the fire.
- No craters were found in the area of the small warehouse used to store the chlorate.
- The warehouse also contained other powerful oxidising agents which could have enhanced the fire. These were stored in containers made out of combustible materials, and their release in to the fire would have significantly increased the rate of development and temperature of the fire.
- An lpg cylinder was involved which, in releasing a flammable vapour or liquid, would have created an intense fire extremely quickly.

There is little doubt that drummed sodium chlorate in stacks of 1 ton in quantity can give rise to violent explosive effects, when involved in an intense fire and under confinement in a store.

* The Fire and Explosion at Braehead Container Depot 4 January 1977. HMSO £1.75

Toxic risks

In the engulfment of a mixed store of chemicals by fire there are several ways in which emissions to atmosphere, perhaps of a toxic nature, may result. Some materials may burn, adding their thermal decomposition products to the smoke of the fire, others may be carried unchanged in the smoke cloud as solid particles or as vapours. If reactive materials become intermixed in the fire, for example by explosion, or are brought into contact by fire-fighting water, gaseous reaction products may be formed.

Investigations were carried out when the fire was extinguished to give an indication of the extent to which these events may have occurred. Substances were identified, in sufficient quantity, in the stock of the small warehouse which by themselves or by chemical reaction might have been thought capable to contributing to a toxic hazard to the neighbourhood. These were sodium and potassium cyanides, trichloroisocyanuric acid and sodium dichloro iso cyanurate dihydrate (water chlorinating chemicals) and sodium bisulphate ('dry acid').

The stack of sodium and potassium cyanide drums, originally on wooden pallets, had collapsed during the fire and the contents of several drums had partly spilled. Many of the remainder were damaged and distorted but had retained their contents. Cyanide ovoids were seen to be partly fused together and powdered cyanide in other drums had become a fused mass. The containers of powdered sodium bisulphate which had been stored nearby had burned away leaving the contents between the sodium bisulphate and cyanide, which in wet conditions would have resulted in evolution of hydrogen cyanide. Had hydrogen cyanide been produced in any way in the heart of the fire it is reasonable to suppose that most of it would have been immediately destroyed by combustion.

Some of the granular and pelleted chlorine releasing materials were consumed in the fire but although the products of thermal decomposition include chlorine and other toxic substances, the quantities involved were small enough and the dilution effects large enough for it to be improbable that harmful concentrations spread out from the fire. Wetted heaps of the materials were lying on the ground after the fire, where they had spilled, and chlorine gas, produced by contact with water, was noticeable by smell. (The threshold of smell is about 5 ppm). Its concentration was insufficient to pose any danger to health in the neighbourhood. These chlorine releasing agents are strong oxidising agents. There was no evidence after the fire that they had become mixed with other substances with which they might have reacted.

Residual risks

After the fire had been extinguished the ruined warehouse contained numerous chemical residues, including sodium and potassium cyanide crystals and ovoids.

Initial efforts were directed at removing these especially hazardous materials. This was done by a recovery team provided by ICI Limited, Mond Division, who arrived on site in the afternoon of Tuesday 22 January. Because of a lack of electric power for lighting, work on clearing the debris and damaged drums could not begin until the next day. Full chemical resistance suits and compressed air breathing apparatus were worn because of the known contents of the drums. Disposal of recovered cyanide drums was completed on the 25 January. Some pools of liquor on site which were possibly contaminated by cyanide remained.

After demolition of the dangerous overhanging brickwork and shoring of the gable end of the main warehouse a Prohibition Notice was issued to prevent further clearing up of the site until the cyanide-affected areas had been decontaminated. An investigation showed that only one pool of liquor had a significant level of cyanide contamination, and this was disposed of after it had been treated with hypochlorite solution to neutralise the cyanide.

Information was obtained from the company and employees about where in the building the various chemicals had been stored. The related safety data sheets produced by the many manufacturers and suppliers of the chemicals involved were obtained. This information showed that chemical residues remaining after the removal of the cyanides could be hazardous. There had been stored over 3·75 tonnes of chlorinating and oxidising agents capable of producing chlorine, and substantial quantities of other miscellaneous chemicals, including dry acid (sodium bisulphate), phenol, phosphoric acid, and sodium thio-sulphate.

The company was advised that the disposal of the remaining residues in the ruined small warehouse and the demolition-affected brickwork, should be carried out by a firm of specialist contractors using appropriate precautions for toxic chemicals, and this advice was followed.

Legal considerations

The premises constituted a factory and warehouse subject to the Factories Act 1961. The premises were first visited in September 1973 and registered under their present name in February 1979. The offices in the small warehouse were subject to the Offices, Shops and Railway Premises Act 1963. The premises were also subject to the Electricity (Factories Act) Special Regulations 1908 and 1944 and the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972. No people were at work at the time of the fire. The fire and explosions were reportable dangerous occurrences under Section 81 of the Factories Act 1961.

The Health and Safety at Work etc Act 1974 also applied including the provisions of Section 3(1) that, so far as was reasonably practicable, persons not in the company's employment, such as the members of the public, were not exposed to risks to their health or safety. Very little damage outside the curtilage of the premises was sustained and members of the public were not affected by fumes from the fire.

The storage of small amounts of flammable liquids, some 200 to 300 litres of acetone, was in steel cans and Winchester containers situated in an open storeroom which was not of

fire resisting construction. Regulation 5(1)(c) of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 requires that such a quantity be kept in a suitably placed fire resisting structure or storeroom. However the storage is not considered materially to have affected the outcome of the fire.

Regulation 7 of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 requires that the number of lpg cylinders present in any workplace shall be as small as is reasonably practicable having regard to the processes or operations being carried on. The single cylinder involved in the fire was connected to the shrink wrapping gun for which use it was intended. The regulations do not require the disconnection and removal of cylinders from such equipment at the end of the working day.

Conclusions and recommendations

The source of ignition for the fire was, in all probability, radiant heat from a domestic three bar electric fire which ignited combustible materials, probably wet weather clothing being dried overnight within the locker room. The fire spread through packaging materials, stored nearby, to involve the chemicals and an lpg cylinder in the small warehouse.

The larger explosions are believed to have been caused by the rapid thermal decomposition of 49 drums of sodium chlorate, each of 50 kg capacity after they became involved in the extremely rapid and severe fire. The intensity of the fire was increased by the presence of liquefied petroleum gas and the storage of various oxidising agents.

The storage of sodium chlorate in quantities as low as 2·45 tonnes was not considered, prior to this incident, to be potentially dangerous, all previously recorded incidents having involved quantities of 20 or more tonnes of the material.

The circumstances of the fire emphasises the need for occupiers of similar premises to pay attention to:

- The segregation of various chemicals into different categories with regard to their relevant properties.
- The acquisition of advice on fire precautions from authoritative sources.
- The possibility of removing lpg cylinders at the end of the working day to a storage compound.

As the premises were situated some 200 m from the nearest residential properties, the effects of the explosions including the blast and pressure wave were attenuated to a level where damage was minimal. The evacuation of the Thames View and Scratton Farm housing estates was carried out quickly and effectively by the emergency services and no member of the public was affected by fumes from the fire.

The quantities of substances that were stored at the premises were not such as to bring the premises within the definition of notifiable quantities of hazardous substances as contained in current proposals for new legislation.

Recommendations

1 *Storage and use of sodium chlorate* The guidance note to be issued by HSE on the storage and use of sodium chlorate as a consequence of the Braehead Report should take account of the lessons learned from this incident.

2 *General storage of chemicals* Discussions should take place between HSE and the chemical industry on the advice that manufacturers of chemicals should give on the segregation of chemicals during storage.

3 *Information about storage and use of chemicals* HSE and the Home Office should consider ways in which the exchange of information between fire authorities and HSE can be improved. Although initial consideration has been given to the introduction of legislation to require occupiers to submit lists of the contents of buildings, it is thought that any comprehensive system would be unworkable because it would be impossible to keep up to date. It would require a considerable increase in administrative and specialist staff to evaluate the changes so notified and is thought not to be reasonably practicable. Other ways are currently being examined to communicate information about the storage and use of chemicals. A feasibility study on the sign marking of buildings has been undertaken by the Central Fire Brigades Advisory Council's Standing Panel on Dangerous Substances in co-operation with the Confederation of British Industry and HSE. The results of the study are expected shortly and should be studied by all concerned.

4 *Liquefied petroleum gas* All users should be fully aware of the hazards associated with the use of lpg and particularly the danger when a cylinder becomes involved in a fire. Cylinders of lpg and associated portable apparatus should, where reasonably practicable, be removed from workplaces at the end of each working day into the lpg storage compound. In other cases where this is not reasonably practicable the cylinders and equipment should be left after work has finished in a ventilated position away from flammable materials and all valves on both cylinders and equipment closed.

When in use lpg cylinders should be secured in an upright position. Although such cylinders have a broad base, and do not easily fall over, this will not be sufficient, in all circumstances, to prevent a cylinder falling over and subsequently discharging liquid through its pressure relief valve in the event of a fire.

5 *Emergency procedures* Industry using or storing chemicals in bulk and in comparable circumstances should be encouraged to examine their own emergency procedures and be reminded of the need to liaise with the relevant emergency services.

6 *Evacuation decisions* The decision to evacuate any occupied premises in the vicinity of such an incident is properly left to the discretion of the fire brigade, seeking the advice of HSE where appropriate. Consideration should be given to the criteria upon which fire brigades make their decisions.

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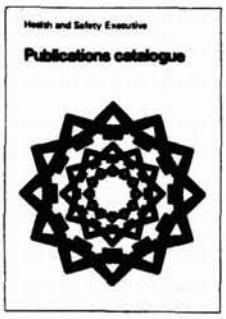

A catalogue of HSE publications is available on sale from government bookshops, Indexed by subject headings, the catalogue is an invaluable source of reference for anyone who needs access to advice and information on the requirements of the 1974 Health and Safety at Work Act and related legislation and publications issued prior to the formation of the Health and Safety Executive.

£1.00 net

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ERRATUM

Health and Safety Executive

The fire and explosions at River Road, Barking, Essex

Page 5, para 3; fourth sentence is incomplete.

Sentence should read 'The containers of powdered sodium bisulphate which had been stored nearby had burned away leaving the contents exposed, but there was no evidence that there had been any contact between the sodium bisulphate and cyanide, which in wet conditions would have resulted in evolution of hydrogen cyanide.'