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THE HARWELL CHEMICAL EMERGENCY CENTRE

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INTRODUCTION

Emergency situations involving chemical substances can result from a wide variety of causes, with perhaps road transportation accidents and warehouse fires being the most frequent. The United Kingdom Atomic Energy Authority has been concerned for more than 25 years (Bromley, 1974; Hamilton, 1974a and 1974b) with the safe handling and disposal of hazardous wastes, which includes all kinds of toxic, flammable and potentially explosive substances. It was therefore logical that in the years before national arrangements were made in the U.K. for dealing with chemical incidents, Harwell was consulted by the public emergency authorities (police, fire services) and others for advice and assistance. Chemical companies, especially those with established emergency teams were also contacted in a similar way.

The movement and storage of hazardous chemical products has increased considerably in recent years throughout most of the world. Problems in the identification of hazards associated with chemical names and trade name mixtures have added to the difficulties facing the public emergency authorities when called to incidents involving such materials.

Considerable advances have been made to minimise hazards, particularly in the transport field (Feates and Cumberland, 1974) by introducing improved labelling schemes and more demanding legislation. It is to the credit of the chemical industry and associated transportation organisations that few serious incidents involving chemicals occur. Nevertheless it was widely felt that the time had been reached for formalising existing emergency arrangements into a unified national scheme for dealing with such incidents. At the same time additional encouragement should be given to improve still further the general standards of safety in carrying hazardous loads, with emphasis on driver training, throughout the chemical industry.

In 1972, the Chemical Industries Association (C.I.A.), which represents most of the chemical producers in the U.K., set up a working party in consultation with Central Government to study this problem. This resulted in the formation of the Chemical Industry Scheme for Assistance in Freight Emergencies 'CHEMSAFE' (C.I.A., 1973) in January 1974. The Chemical Emergency Service provided by Harwell became formally established by the Department of the Environment as a National Chemical Emergency Centre and integrated into the Chemsafe scheme, providing a 24-hour service, in addition to its original activities.

The role of the Chemical Emergency Centre can be conveniently divided into two principal

areas:

1. A National Advice Centre in collaboration with Chemsafe:

(a) providing advice to the emergency services on a round-the-clock basis, when such advice cannot be obtained directly from the manufacturer or trader.

(b) provision of assistance at chemical incidents within a 50 mile radius of Harwell. Outside this area the Centre will alert teams from other locations nearer to the scene.

2. An emergency disposal service to industry and others in possession of chemicals which have become potentially explosive or otherwise hazardous by prolonged storage, e.g. peroxides in solvents, polymerisable materials, badly corroded gas cylinders. Each of these activities will now be considered in more detail.

NATIONAL ADVICE CENTRE

The need for identifying the hazards associated with trade name chemical products has always been one of concern for the emergency services. Sometimes containers labelled only with 'Brand X' leak, perhaps as a result of a transportation accident. Immediately on arriving at the scene, the emergency authorities normally need to know if the material is hazardous, what precautions they should take in handling it and if it can be safely flushed into drains or ditches.

A national scheme has recently been introduced in the U.K. to provide this 'first aid' information by means of a simple code (Hazchem) displayed at the rear of a vehicle. At the moment its use is being confined to bulk loads of hazardous chemicals conveyed in road and rail tank vehicles but will eventually be extended to cover individual items in mixed loads. It will of course, in any event, be essential to follow up such first aid measures with more detailed advice, normally from the manufacturer.

Rarely can such information, particularly on trade name products, be found in standard reference books. These may indicate the manufacturer's name but this is of little value if he cannot be contacted, which may be the case outside normal working hours, and especially so with imported chemicals. This was the dilemma facing the emergency services prior to Chemsafe. Now they can contact the Chemical Emergency Centre at Harwell using an ex-directory telephone line, the number of which has been given only to the emergency services.

This telephone is manned continuously and a team of technically qualified staff is always available. During normal hours an emergency duty officer is available at the Centre. Outside these hours he is obliged to remain 'on call' to receive any calls referred to him by the Emergency Centre and be prepared to immediately attend if required.

The Centre holds information on chemical substances, particularly trade name products, which has been obtained direct from the manufacturers, traders or importers by the Chemical Industries Association, using specially designed questionnaires (see Appendix I). This information is stored in the Harwell Chemical Data Bank (Cumberland and Hebden, 1975) on an IBM 370 computer. The computer program employed, 'Status' (Price et al., 1974), enables the data bank to be searched on a free text principle to identify any substances matching a description provided by an enquirer. This description could be a trade name, colour of the substance or its container or even part of a name existing perhaps on a torn or corroded label. Clearly, the more precise the description provided by an enquirer, the fewer the number of substances match that description, until ideally only one is retrieved – the correct one. This would provide the information being sought.

Information retrieved by the computer is read on a Visual Display Unit (VDU) located in the Chemical Emergency Centre (see Fig. 1). The system used is capable of being extended

to allow direct 'dial in' facilities from remote stations such as Police or Fire Control rooms or even individual fire appliances using Post Office telephone lines and existing radio links. Information can either be displayed on a VDU or linked to a teletype for permanent copy. The data held could also be extended to suit the requirement of other users. Parts of the data bank are already being augmented in this way under a contract from the E.E.C. as part of the Environmental Chemicals Data Information Network (ECDIN), which will provide more extensive data on chemicals of environmental importance.

In the event of information sought not being held in the computer bank, duty emergency officers have immediate access to a substantial reference library adjacent to the control desk. This contains numerous reference books on chemical hazards including foreign trade directories.

The range of incidents in which the Harwell Centre has been called includes:

Bags of white 'crystals' bearing a trade name only, washed ashore on the Scilly Isles which were causing concern about possible pollution of the beaches. The material was rapidly identified as high density polythene granules, non-toxic and harmless. Such an incident illustrates the need for holding information on trade name products whether they have toxic properties or not.

On another occasion the Centre was asked to identify the hazards of a chemical substance contained in a blue polythene drum found on the roadside. The container had obviously fallen from a vehicle and only a small section of a purple label remained bearing the words 'speed' and 'etch'. This information together with a description of its container enabled not only its contents to be identified as 'ferric chloride solution' but also its manufacturer who was duly invited to collect his product!

Not all situations of course, involve chemical spillages. A fire in a warehouse containing large stocks of pesticides in polythene containers created a serious situation. The Emergency Centre was able to identify the hazards associated with the trade name products involved and advise the fire crews of the neces-

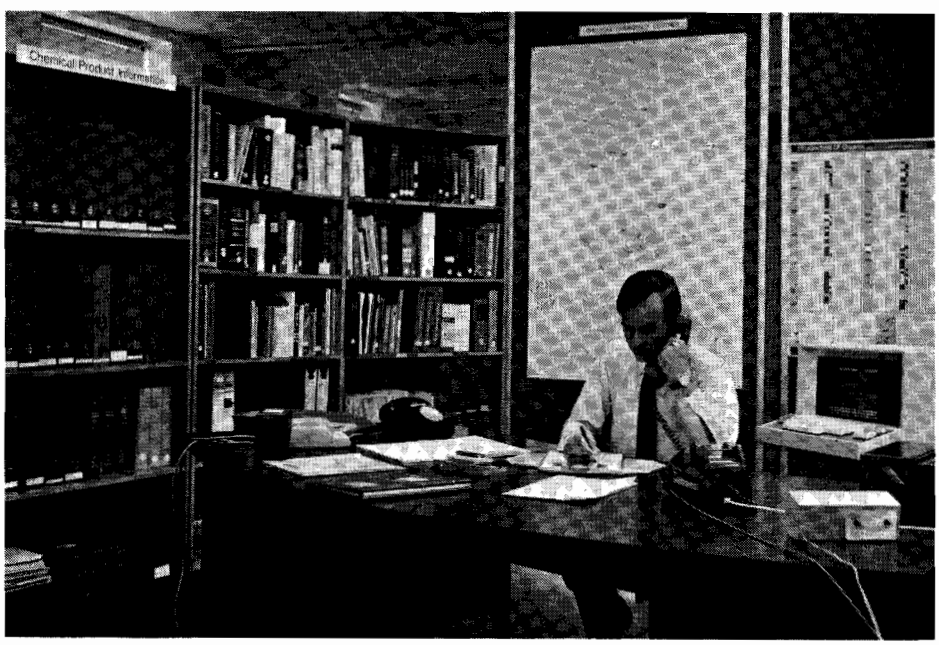

Fig. 1. Chemical Emergency Centre

sary precautions whilst the fire was being contained. On this occasion it was also proved necessary for the Centre to make available heavy duty PVC suits to supplement the fire brigade's own protective clothing, which was being adversely affected by the highly concentrated pesticide solutions. This illustrates the way the Emergency Centre at Harwell is also able to provide practical assistance at incidents in addition to technical advice; as part of the Chemsafe Scheme it holds specialised equipment. This aspect of the Centre's activities is now discussed in more detail.

ASSISTANCE AT CHEMICAL INCIDENTS

The Harwell Chemical Emergency Centre has a Land Rover vehicle equipped to provide assistance at local chemical incidents (up to about 50 miles away). In other areas, similar emergency services, operated by the chemical industry, can be contacted by Harwell to provide assistance when required. A mobile laboratory is also maintained in a permanent state of readiness for use at chemical incidents where more detailed chemical analysis is necessary.

The CEC vehicle (see Fig. 2) is fitted with a hydraulic winch for the recovery of heavy containers and a 4 kW generator providing power to operate a variety of electric tools and lighting equipment. It also carries breathing apparatus, personal VHF radios, additional protective clothing to supplement the duty officers' personal kit, and a VHF radio for communication. A range of non-sparking implements (hand tools and shovels) are included for use in potentially flammable areas and portable monitoring equipment such as an explosiometer and gas detectors.

The mobile laboratory can be towed by the vehicle and is intended for use at incidents where laboratory facilities are required, possibly in remote locations for an extended period. The laboratory is a self-contained unit which has, in addition to sophisticated analytical equipment, VHF radio, shower and cooking facilities and the capacity to accommodate one or two people. These facilities make the unit sufficiently flexible to be

Fig. 2. C.E.C. Vehicle

employed in a wide variety of situations and for it to serve as a control centre if required.

All of the duty officers at the Emergency Centre are trained to use the specialised equipment in the mobile laboratory whenever it is needed. One frequently occurring incident is the recovery of chemical drums fallen from lorries and subsequently found on the roadside. Whenever possible the manufacturer or distributor of such materials is identified and invited to collect his wares from the Emergency Centre. Costs are recovered from the company concerned.

Other situations requiring attendance have ranged from dealing with leaking chemical road tankers to clearing a spill of mixed chemicals following the collapse of shelves in a school laboratory. The latter incident involved flammable, corrosive and toxic liquids; personnel from the Chemical Emergency Centre, wearing self contained breathing apparatus throughout the operation, took several hours to clear it up.

An unusual incident occurred when 30 or so firemen called to extinguish a fire on a refuse landfill site, were overcome by fumes and taken to hospital. It was thought that this may have been due to toxic materials deposited on the site. Concern was being expressed whether a nearby village, down wind, should be evacuated. A call was made to the Emergency Centre in the late evening and within 30 minutes two duty officers were on their way. After carrying out an inspection of the site no evidence of toxic materials could be found though the burning refuse was decidedly unpleasant. The firemen concerned recovered shortly afterwards and it was considered that they were merely affected by the dense smoke.

EMERGENCY DISPOSAL OPERATIONS

The disposal of chemical products which have become unstable and potentially explosive through age has often created difficulties. Prolonged storage of ether can give rise to peroxide formation and monomers such as acrolein, liable to spontaneous polymerisation; this is a typical danger of such products.

The Chemical Emergency Centre has provided advice and assistance to a wide range of organisations which have these disposal problems, including industry, government departments, teaching establishments and hospitals. Considerable experience has been gained in this field which is now nationally recognised. For some disposals, specialised equipment such as remote handling apparatus must be developed – an area in which the U.K. Atomic Energy Authority has considerable expertise. Other situations exist where a material may be highly toxic as well as unstable and necessitate additional handling precautions. Such a situation is illustrated in the following example.

A substantial quantity of an explosive chemical, thought by its owner, a dealer in Government surplus materials, to be harmless, was discovered in a warehouse located beneath a major road. This material, believed to have been manufactured about 25 years previously, originally contained about 30% water and was packed in rubber bags inside wooden crates. With the passage of time, the rubber had perished and the chemical had become dry, making it shock-sensitive. In addition it presented a high toxic risk. Many of the crates needed to be repacked before they could be safely moved to a nearby disposal site for safe burning. Its movement became a major operation involving a bomb disposal unit, the police, fire and ambulance services and other Government departments. Fig. 3 shows some of the crates being repacked by the Chemical Emergency Centre staff who advised on the toxic aspects of the operation.

In another case, a small quantity of acrolein about 4 years old was reported to have exploded in a refrigerator causing substantial damage (B.C.I. Safety Council, 1973). The explosion was attributed to the acrolein's spontaneous polymerisation caused by the hydroquinone inhibitor becoming ineffective through age.

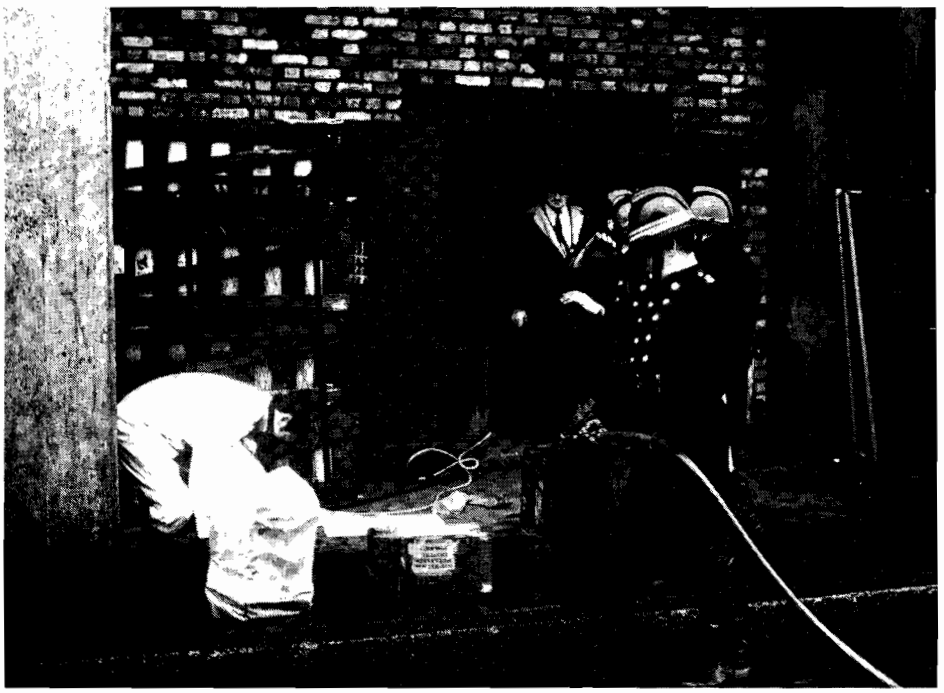

Fig. 3. Repacking hazardous material on location

Acrolein is also highly toxic and flammable. The suppliers of this material subsequently warned users of the inherent dangers of prolonged storage. Within a short period many drums of aged material were traced in various parts of the United Kingdom. In one case a large quantity had lain undisturbed for 14 years and was remotely moved from its location by lifting through the roof of its storage building. It was subsequently conveyed to a nearby safe area in a specially designed steel container (see Fig. 4), then opened by means of an explosive charge and the acrolein allowed to burn away harmlessly.

Picric acid is another material with which the Centre has been concerned. In one case six reagent bottles were discovered in a laboratory store and found to be in a dry condition and therefore potentially explosive. Some of the bottles had been standing close to a steam pipe and were thought to be more than 30 years old. The laboratory staff concerned were unaware of its hazardous nature. The material is normally kept in a wet state when it is relatively harmless. This picric acid was disposed of by the Chemical Emergency Centre by remote handling and was conveyed under police and fire service escort to a disused quarry and electrically detonated. The crater, produced by two 100 g. bottles, was more than 12″ deep.

Gas cylinders which have become corroded through age and neglect, have in the past created disposal problems to companies and local authorities. In most cases such cylinders are unsuitable for re-use and can present extreme hazards for anyone attempting to open them. A national need for such a disposal service was recognised and consequently the Chemical Emergency Centre, in collaboration with an army bomb disposal unit, extended its activities into this field.

Cylinders which are safe to transport, and which would have been in doubtful cases radiographed, are conveyed to an army firing range and opened explosively. Many of the

Fig. 4. Emergency disposal of Acrolein

Fig. 5. Safe destruction of industrial gas cylinders

cylinders safely destroyed in this way have flammable contents and Fig. 5 illustrates the effect of detonation.

CONCLUSION

The Chemical Emergency Centre at Harwell fulfills a national role covering all aspects of chemical emergency situations. It is probably unique in providing a sophisticated national advice service combined with the ability to give practical assistance when required. This has been made possible by the extensive back-up facilities and expertise available throughout the United Kingdom Atomic Energy Authority and the excellent relations which have been maintained with the chemical industry and emergency services.

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APPENDIX I

CHEMICAL INDUSTRIES ASSOCIATION LIMITED
CHEMSAFE – CHEMICAL PRODUCT EMERGENCY INFORMATION

1. NAME OF COMPANY . . . . . .

   ADDRESS . . . . . .

   . . . . . .

	Manuf'd.	Marketed	Imported
2. PRODUCT NAME (i.e. NAME GIVEN ON LABEL/PACKAGE)			
ALTERNATIVE NAMES USED			
(IF ANY)			

Please √ box

3. CODE MARKS (if any)

4. APPROVED CHEMICAL NAME OF CONSTITUENTS (with approx. concn. if mixture)	%

5. PHYSICAL FORM

SOLID	
LIQUID	
GAS	

Please √ box

COLOUR:
OTHER FEATURES:

6. TYPE OF PACKAGING

	size and description
SACK	
DRUM	
BULK	
OTHER	

7. HAZARDS (Brief description and handling precautions)

Flash Point (if flammable)

8. PRODUCT/HAZARD CLASSIFICATIONS (if known)

U.N. SERIAL NO.
U.N. HAZARD CLASSIFICATION (Division & Subdivision)
KEMLER CODE
HAZCHEM CODE

9. RECOMMENDED EMERGENCY ACTION IN EVENT OF:

a) SPILLAGE

b) FIRE (eg. extinguishing media)

10. FIRST AID TREATMENT

11. NAME OF INDIVIDUAL/ORGANISATION WITH SPECIALIST KNOWLEDGE

. . . . . .

EMERGENCY TELEPHONE NUMBER

AVAILABILITY (days and hours)

12. PRINCIPAL TRANSPORT ROUTES:

13. LITERATURE REFERENCES (eg. Technical data sheets giving additional information)*

14. NAME AND TELEPHONE NUMBER OF COMPILER (in event of any queries)

. . . . . .

*Wherever possible such publications should be included with this completed form.