

THE CONTROL OF HAZARDOUS CHEMICAL SPILLS IN THE UNITED KINGDOM*

R.F. CUMBERLAND

Manager, National Chemical Emergency Centre, Environmental Safety Group, Building 151, Harwell Laboratory, Oxfordshire, OX11 0RA (Gt. Britain)

(Received August 1, 1981; accepted October 14, 1981)

Summary

Progress in the safe transport of chemical products against a background of significant changes in legislation is discussed. The number of serious chemical incidents in the UK is low but nevertheless a need for adequate emergency response procedures is essential. Any organisation operating or involved with hazardous chemicals, which could accidentally be released, has a duty to establish an emergency contingency plan.

Good communications are a basic requirement for any emergency response capability. The marking of packages and vehicles with an appropriate telephone number, a statutory requirement for certain products, is also a fundamental principle in the Chemical Industry Scheme for Assistance in Freight Emergencies (CHEMSAFE). This voluntary scheme is being extended to cover all aspects of chemicals distribution — road, rail, sea and air ports, and transit warehouses. Apart from the response capabilities established by industry, an equally important role is played by Central and Local Government Organisations which include the Public Emergency Authorities. The co-operation between industry and government is a key factor in both reducing hazardous chemical spills and minimising their impact on the environment, should they occur.

Introduction

The manufacture, conveyance, storage or use of hazardous substances in any quantity must give rise to an accident potential which necessitates appropriate emergency contingency plans being established. Chemical spills can arise from a number of causes including accidental or malicious damage, fire or negligence in storage locations, as a result of a transport accident, or from containers being washed ashore.

The United Kingdom is the fourth largest chemical producer in the world and ranks second in Europe. Such a level of production results in some fifty million tons of chemicals being transported by road and by rail each year. Being such a relatively small country with many areas of very high density population, the greatest care is necessary in controlling the carriage and

*Presented at the 2nd World Congress of Chemical Engineering, Montreal, Canada, October 4–9, 1981.

storage of hazardous chemicals to avoid risks to the community. Much of this control is effected by the adoption of codes of safe practice and legislation drawn up in consultation with industry. The introduction of the Health and Safety at Work Act in 1974 has provided a means for overhauling outdated legislation particularly with respect to chemical transportation. The marking of chemical road tankers has already been introduced under the 1974 Act, and regulations covering packaged goods are underway. It is interesting to note that under this Act, a vehicle is defined as a place of work and as such is subject to the broad ranging provisions of that Act. Legislation pertinent to the Control of Chemical Spills in the UK is not discussed in detail here; a tabulation of such regulations has been published elsewhere [1].

Nature of chemical incidents

Until recently, the frequency and nature of chemical spills in the UK had not been determined in any detail, though it was generally considered that many of the incidents reported in the media involved relatively small quantities. The Department of the Environment's Water Data Unit has collated information received from Regional Water Authorities on spills which were considered by them to have water pollution potential. In over 90% of the reported cases, the material involved was of a hydrocarbon nature such as petrol, fuel oil, etc. A limited survey of chemical incidents occurring during transport was conducted by the Home Office in 1977. This was followed in 1980 by a twelve month survey [2] covering special categories of incidents involving hazardous chemicals to which county fire authorities were called. These categories consisted of:

- (a) Special service calls which involved dangerous chemicals,
- (b) Fires where dangerous chemicals were present which had a significant effect on fire fighting operations or behaved in such a way as to create a particular hazard,
- (c) Fires in which the effects of dangerous chemicals resulted in members of the public or fire service receiving medical treatment. The criteria adopted to determine which chemicals should be regarded as dangerous, and hence reportable, were those substances which have been allocated a United Nations identification number, or those having similar properties. In consequence, the survey did not include spills, etc., of unknown chemicals such as proprietary products where these were later proved to be of low hazard.

A total of 1158 incidents were reported during the survey of which 609 involved chemicals in transit, as distinct from static occurrences. Of these 'in transit' incidents, 190 were reported due to chemicals being washed ashore. The remaining transport incidents according to mode of transport are shown in Table 1.

The survey also showed that the majority of road accidents (37%) involved smaller packages of chemicals, whilst 23% concerned bulk single tank loads.

During 1980 new regulations under the Health and Safety at Work Act were

TABLE 1

Transport mode	Incidents reported
Road	336 (80%)
Rail	42 (10%)
Water	32 (8%)
Air	2
(Unrecorded)	5

introduced concerning the Notification of Accidents and Dangerous Occurrences. These regulations came into effect on 1 January 1981 and include a requirement to notify the Health and Safety Executive of any incident in which a road tanker (to which the 1978 Tanker Marking regulations apply) overturns or suffers serious damage to the tank conveying the substance.

Organisation of emergency response

Emergency response to major accidents and natural disasters, which go beyond the capabilities of individual emergency services themselves, is undertaken by Local Authorities within their various responsibilities under Home Office guidance. Each County Council has appointed an Emergency Planning Officer who ensures that appropriate steps are taken to maintain essential services and co-ordinates the many organisations who would have a vital part to play in major incidents.

Response to emergencies arising from chemicals and other substances washed ashore is also the responsibility of Local Authorities. Appropriate guidance for the preparation of such emergency plans, as an extension of existing oil pollution schemes, has been given by the Department of the Environment [3]. Such emergency plans require co-ordination with adjacent Local Authorities, and the Coast Guard. Appropriate chemical expertise may be provided by a local chemical company, County Scientific Adviser or through the national scheme for handling chemical transport accidents (CHEMSAFE) discussed later.

Regional Water Authorities established under the 1973 Water Act have responsibilities which include sewage treatment, pollution control, water resources and supply. Since a chemical spill can result in potential harm to water services, there is a need for a swift and effective response to be available at all times. Such response is normally organised from an emergency control room whose senior officer establishes close contact with police and fire services in his region.

Some waste disposal contractors operate a 24 hour emergency service for the removal and safe treatment of chemical materials involved in a spill.

Chemical spills arising from static incidents within the curtilage of company premises are generally handled by company personnel. Assistance from County Fire Authorities may, however, be sought, as the Home Office Survey showed, particularly in the event of fire.

Every organisation concerned with handling chemical products, from the manufacturer through delivery and warehousing to the user, has a statutory duty under the Health and Safety at Work Act, 1974, to adopt safe practices. There is also a need for suppliers of chemical products to make appropriate safety and handling data available to users. In the event of a spill within company premises, specialist advice ought therefore to be readily available, with staff both equipped and trained for dealing with such situations.

Transport incidents

Chemical spills, or the potential of a spill arising from a transport accident, can of course create a totally different situation from a static incident. For example:

- (a) A company specialist is rarely on the spot.
- (b) The company emergency team may not be immediately available.
- (c) The effects of even a small spillage may create a serious health or environmental effect.
- (d) Appropriate information may not be so readily available to assist the public emergency authorities who may be called to the scene.

In order to overcome such difficulties the Chemical Industries Association in consultation with Central Government established the Chemical Industry Scheme for Assistance in Freight Emergencies (CHEMSAFE). The scheme formalised existing response schemes provided by major UK chemical producers and encourages all chemical companies to participate. The Chemsafe principles apply equally to rail movements as well as road transport.

It is considered by the Chemical Industries Association (CIA) that any company causing hazardous goods to be conveyed must satisfy itself that suitable arrangements are made for their safe movement and also for minimising the damage or injury that could arise should an incident occur during transportation. Companies are required therefore to provide information about the potential hazards of products being transported, and to provide a supporting role in dealing with emergencies when requested to do so by the emergency authorities.

The Public Emergency Authorities (Police, Fire, Ambulance) have a primary role in dealing with all transport emergencies. Highway authorities have a statutory duty under the 1974 Control of Pollution Act to remove any spillage from the highway where such removal is necessary for the maintenance of the highway or the safety of traffic. The Fire Service has a statutory duty under the provisions of the Fire Services Acts 1947 and 1959 to attend incidents when there is fire or potential of fire. In consequence, because of their expertise and specialised equipment, the service normally responds to calls to attend chemical incidents, whether or not fire is threatened. Such 'Special Service' calls are provided under the enabling powers of the 1947 Act.

The routing of road vehicles conveying hazardous chemicals is of particular importance in urban areas where population density or traffic congestion is

high [4]. The Highways Miscellaneous Provisions Act 1969 includes provision for vehicle routing where this can be justified. Such a scheme has been introduced for chemical tankers in Cleveland.

CHEMSAFE

The CIA Manual "Road Transport of Hazardous Chemicals" [5] describes good practice which companies are encouraged to adopt to ensure high standards of safety. The CHEMSAFE Manual [6] is concerned with the handling of an incident should it occur.

CHEMSAFE, a scheme which gives advice based on tried and proven practices consists of two basic procedures: The "Company" emergency procedure and the "Longstop" procedure. These procedures apply to both industry and the authorities and are designed to provide the best possible assistance in the shortest time. If an accident to a vehicle carrying dangerous goods occurs, the Emergency Authorities would normally be alerted by the driver or anyone else at the scene. Upon their arrival there becomes an immediate need for essential information in order to take appropriate action to safeguard life and property and to protect the environment. Such information would include:

- (a) Is the material hazardous?
- (b) Is it safer to dilute or contain any spillage?
- (c) What personnel protection is necessary?
- (d) Is there a need to consider evacuation beyond the incident area?

Dependent on the quantity and nature of the substance being conveyed, the vehicle, if a road tanker, would display U.K. Hazard Information System (UKHIS) warning panels, an example of which is shown in Fig. 1. Such panels are required to be displayed on domestic journeys for certain chemicals in bulk under "The Hazardous Substances" (Labelling of Road Tankers) Regu-

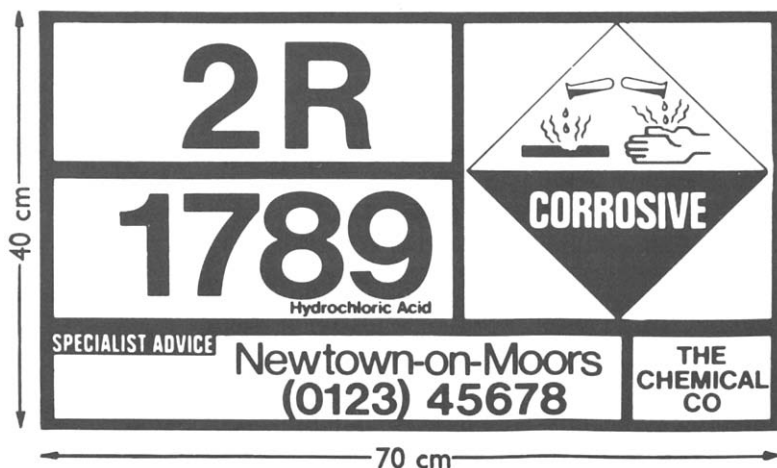


Fig. 1. UKHIS hazard information panel.

lations 1978. These regulations are shortly to be revised to include tank containers and a wider schedule of chemicals. The UKHIS panels include the hazard warning diamond, a substance identification number, emergency action (Hazchem) code and a telephone number for specialist advice. Figure 2 shows the scale carried by emergency service personnel for decoding Hazchem.

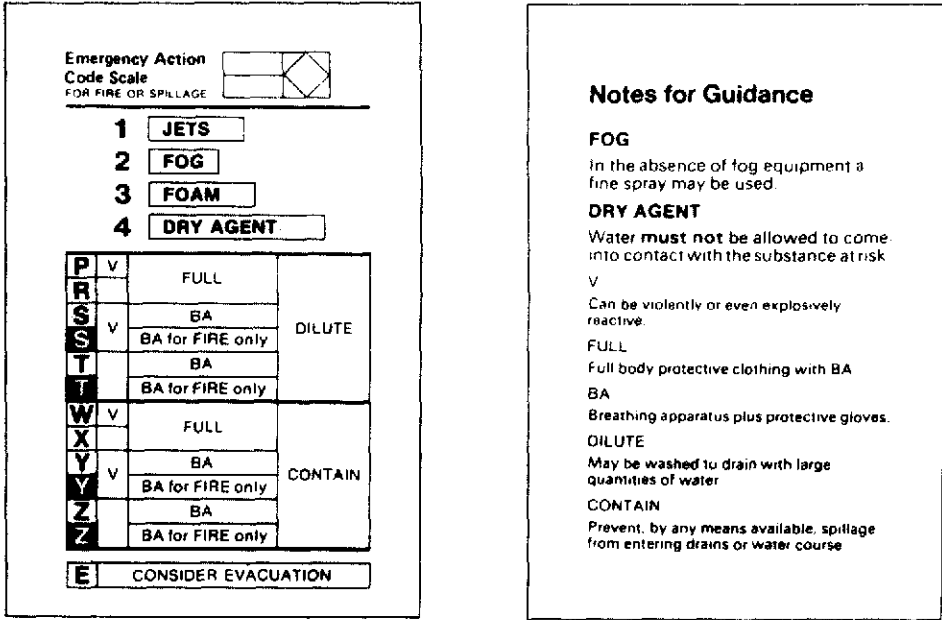


Fig. 2. Hazchem scale card.

Hazchem

The Hazchem code consists of a single digit with one or two letters which, when decoded, enable immediate action to be taken when the first appliance arrives at the scene, whilst specialist advice is sought via the telephone number displayed. Hazchem codes are produced by a Home Office Technical Committee which includes representatives of the Chemical Industry, National Water Council, Government Departments and the Fire Service.

Transport emergency cards

Additional emergency information may be available to the emergency services in the form of Transport Emergency Cards (See Fig. 3) which are intended to be conveyed in the vehicle cab. These cards are developed by the European Council of Chemical Manufacturers Federations (CEFIC) and launched in the UK by the Chemical Industries Association. The carriage of such written instructions is a requirement under international (ADR) regula-

TRANSPORT EMERGENCY CARD (Road)		CEPIC TEC (R)-1 May 1971 Rev. 1 Class Id ADR Marg. 2131, 5 ^a
Cargo	<h1>AMMONIA</h1>	
	Liquefied pressure gas with perceptible odour	
Nature of Hazard	<p>Heating will cause pressure rise, severe risk of bursting and explosion The gas is suffocating Reaction with moist air produces mist which has strongly irritant effect on eyes, skin and air passages Contact with liquid causes skinburns Spilled liquid has very low temperature and, unless contained, evaporates quickly</p>	
Protective Devices	<p>Suitable respiratory protective device Goggles giving complete protection to eyes Plastic or rubber gloves, boots, suit and hood giving complete protection to head, face and neck Eyewash bottle with clean water</p>	
EMERGENCY ACTION — Notify police and fire brigade immediately		
	<ul style="list-style-type: none"> • If possible move vehicle to open ground • Stop the engine • Mark roads and warn other road users • Keep public away from danger area • Keep upwind • Put on protective clothing 	
Spillage	<ul style="list-style-type: none"> • If vapour cloud drifts towards populated area, warn inhabitants • Contain leaking liquid with sand or earth; allow to evaporate • If this is not practicable use waterspray to "knock down" vapour 	
Fire	<ul style="list-style-type: none"> • Keep containers cool by spraying with water if exposed to fire 	
First aid	<ul style="list-style-type: none"> • If the substance has got into the eyes, immediately wash out with plenty of water for at least 15 minutes • Remove contaminated clothing immediately and wash affected skin with plenty of water • Seek medical treatment when anyone has symptoms apparently due to inhalation or contact with skin or eyes • Persons who have inhaled the gas must lie down and keep quite still • Keep patient warm • Do not apply artificial respiration if patient is breathing 	
Additional information provided by manufacturer or sender		
TELEPHONE		
<small>Prepared by CEPIC (CONSEIL EUROPEEN DES FEDERATIONS DE L'INDUSTRIE CHIMIQUE, EUROPEAN COUNCIL OF CHEMICAL MANUFACTURERS' FEDERATIONS) Zürich, from the best knowledge available; no responsibility is accepted that the information is sufficient or correct in all cases Obtainable from NORPRINT LIMITED, BOSTON, LINCOLNSHIRE Acknowledgment is made to V.N.C.I. and E.V.O. of the Netherlands for their help in the preparation of this card</small>		
Applies only during road transport		English

Fig. 3. CEPIC Transport Emergency Card.

tions for certain substances and is expected to become a statutory requirement in the UK for domestic traffic in the near future.

The vehicle marking schemes or Transport Emergency Cards are not intended to replace the drivers' knowledge of the product. Training of vehicle drivers in this respect, particularly those carrying bulk chemicals, is regarded as an essential feature in the safe transport of hazardous chemicals and is likely to be featured in proposed legislation. At the present time six nationally approved centres have been established in collaboration with the Chemical Industries Association and Road Haulage Association for providing standardised training programmes.

Specialist advice availability for incidents involving non-scheduled chemicals, in bulk or packaged, is not a statutory requirement at the present time, though many chemical companies provide this and also practical assistance as accepted CHEMSAFE Company procedures. These procedures can operate at one of three levels throughout the 24 hour period:

- (i) Advice by telephone.
- (ii) Advice at the incident scene.
- (iii) Advice and assistance at the incident scene.

A mutual aid arrangement has also been initiated by CIA whereby participating companies undertake to help each other so far as is practicable and within their range of expertise. Additionally a number of local consortia arrangements between chemical companies have been established. Such an arrangement enables one of a group of companies to act as the emergency response centre with other members of the consortium holding specialist equipment for spill clean up.

CHEMSAFE "Longstop"

In the event of a company emergency procedure failing, perhaps due to communication difficulties, or to the manufacturer of a product not being identified, a longstop procedure has been established. This is provided in collaboration with the National Chemical Emergency Centre (NCEC) [7] at the Harwell Laboratory of the United Kingdom Atomic Energy Authority.

The Centre has a continuously manned emergency telephone through which the public emergency authorities can ask for technical advice on the nature of chemical hazards of a product involved in an incident. In order to readily identify hazards and emergency action for the numerous products being marketed, a computerised chemical data bank has been established. This can be accessed by the NCEC duty officers who are also scientifically qualified and experienced in handling hazardous materials.

Information on all chemical products is continually sought, through the Chemical Industries Association, for inclusion in the data bank using specially designed questionnaires. The data requested is based on meeting the needs of the Fire Services and is stored on an IBM3033 computer as discrete documents. An example of a document is shown in Fig. 4. Searching is carried out

PERMANATE (DEMONSTRATION DOCUMENT ONLY)
#DOC 1261

SEC2
TRADE_NAME:
PERMANATE (UN 1490)
PERPOTATE

SEC1
COMPANY_NAME:
TONPAR CHEMICAL CO. LTD.,
NORTHERN ROAD, TONPAR, GLAMORGAN.
MANUFACTURER AND MARKETER.

SEC3
CODE_MARKS:
PC-9057(21A).

SEC5
FORM:
SOLID, CRYSTALS, DARK PURPLE WITH METALLIC SHEEN.

SEC6
PACKAGING:
SACK(S) : 25 KILOGRAM, PAPER.

SEC7
HAZARDS:
POWERFUL OXIDISING MATERIAL. SPONTANEOUSLY FLAMMABLE.
IN CONTACT WITH GLYCEROL (GLYCERINE), OR ETHYLENE GLYCOL.
EXPLOSIVE IN CONTACT WITH SULPHURIC ACID OR HYDROGEN
PEROXIDE. REACTS VIOLENTLY WITH FINELY DIVIDED EASILY
OXIDISABLE SUBSTANCES. INCREASES THE FLAMMABILITY OF
COMBUSTIBLE MATERIALS. A STRONG IRRITANT TO SKIN, EYES
AND RESPIRATORY TRACT, DUE TO OXIDISING PROPERTIES.
AVOID BREATHING DUST OR INGESTING MATERIAL.
BREATHING APPARATUS AND PROTECTIVE CLOTHING SHOULD
BE WORN.
BEWARE HAZARD OF CONTAMINATED CLOTHING DRYING OUT.

SEC8
INITACT: (HAZCHEM; PROTECTION; HAZARDS; PRECAUTIONS; FIRE)
HAZCHEM CODE: 2Y
PROTECTION : BA; CHEM.PROT.SUIT (CODE -)
HAZARDS : OXIDISING AGENT. IRRITANT. COMBUSTIBLE.
SUBSTANCE IS LIABLE TO SPONTANEOUS IGNITION.
MAY REACT VIGOROUSLY WITH ACIDS CREATING EXPLOSION HAZARD.
PRECAUTIONS : AVOID DUST. CONTAIN. DO NOT ABSORB IN SAWDUST
OR OTHER COMBUSTIBLE MATERIALS. USE RECOMMENDED CONTAINERS
ONLY-SEEK SPECIALIST ADVICE. AVOID ANY PERSONAL CONTACT.
FIRE : EXTINGUISH WITH WATER.
UN SER. NO. : 1490
UN HAZ CLASS: 5.1.0
KEMLER CODE : ***
TREM CARD : TEC(R)-51G03

SEC9A
SPILLAGE:
WEAR BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING
WHEN DEALING WITH A SPILLAGE OF THIS MATERIAL.
TRANSFER SPILLED MATERIAL TO 'CLEAN' CONTAINERS PENDING
DISPOSAL. FLOOD CONTAMINATED AREA WITH WATER.
BEWARE HAZARD OF CONTAMINATED CLOTHING DRYING OUT.

SEC9B
FIRE:
FLOOD WITH WATER.

SEC10
FIRST_AID:
INHALATION : SEEK MEDICAL ATTENTION.
INGESTION : SEEK MEDICAL ATTENTION.
EYE CONTACT : IRRIGATE WITH WATER.
SKIN CONTACT : WASH WITH SOAP AND WATER. REMOVE
CONTAMINATED CLOTHING.

SEC11
KNOWLEDGE:
MR W HESTON, TONPAR CHEMICAL CO. LTD.

EMERG_PHONE:
TONPAR 21517. AVAILABILITY: MONDAY-FRIDAY, 0800-1730 HRS.
PARTON 75621. AVAILABILITY: AT ALL OTHER TIMES.

SEC12
DECNTM: (RECOMMENDED DECONTAMINATION PROCEDURE)
REMOVE BULK OF MATERIAL, THEN WASH WITH WATER/DETERGENT.

SEC13
REFERENCES:
PARTON TECHNICAL DATA SHEET 13(A).

SEC14
COMPILER:
MR J JONES, PARTON 49312, EXT.230.
DATE:
8.7.81.

Fig. 4. HAZFILE document.

'on-line' on a free text principle using the Harwell designed Status Retrieval Programme [8]. 'Status' enables any identifying characteristics of a product to be used to retrieve the appropriate document. These characteristics could be a trade name, or even part of a name if that is all which is available, a code number, or a description of the product or its container.

Interest shown in the data bank by the Fire Services has led to many individual brigades having direct access to a non-confidential version called HAZFILE for the past three years. More recently, widespread interest in the potential of the data bank has resulted in proposals to make the HAZFILE data widely available as a commercial package.

The duty officers of the NCEC are trained and equipped to assist at the scene of chemical incidents within a 50 mile radius of Harwell. Outside that area assistance by a more conveniently located chemical company can be organised by the Centre.

Another important activity of the NCEC is the operation of an agency scheme for chemical companies who are unable to provide emergency response themselves. Such companies, including many chemical traders, provide the centre with detailed product information which enables the NCEC to respond directly on the companies' behalf in any transport emergency in the UK. This service is provided on an annual subscription basis and participating companies display the centre's telephone number on their vehicles and chemical containers.

Practical considerations of spill control

The decision to contain, dilute or neutralise a chemical spill on the highway will depend on many factors. These will include the physical, chemical and toxicological properties of the material and the spill location in relation to water courses, etc. Specialist advice is available to the Senior Officer of the Emergency Services from various organisations which include the manufacturer, a local chemical company, Scientific Advisor, Harwell, or Regional Water Authority. Solid spills would normally be contained as a matter of course and either repackaged or removed for disposal. Liquid spills may be contained and absorbed using sand, generally provided by the Local Authority Highways Department, or by using earth from the road-side in rural areas. Neutralisation of acid spills may require significant quantities of soda ash, lime, etc. In order to ensure that the location of adequate stocks are known, the Chemical Industries Association has compiled a register which is held by those organisations concerned with spill response.

It may be necessary to use special materials in certain cases to treat particularly hazardous substances. Such materials are generally held by specific manufacturers who make known their availability. Typical examples include polyacrylamide for suppressing the fume of corrosive liquids such as chlorosulphonic acid or oleum, and a two pack system recently developed by a chemical company for immobilising liquid spills.

In a transport accident resulting in a tank vehicle overturning, it may be necessary to transfer the load to another vehicle. The Road Haulage Association in collaboration with CHEMSAFE operates an emergency load transfer scheme (ELTS) for hazardous liquids. This scheme aims to provide a vehicle and ancillary equipment suitable for the recovery of a hazardous chemical cargo in the event of an emergency, together with competent personnel. Many specialised tanker operators co-operate in this scheme and their locations and emergency telephone numbers are included in the CHEMSAFE Manual.

The CHEMSAFE Scheme applies to road and rail transport and is featured in emergency plans for ports and airports dealing with chemical freight movement. Although considerable effort is directed into the safe carriage of chemical products there is no justification for relaxing the CHEMSAFE spill response system. The very low number of serious chemical spills, and the effective response available should one occur, is due in no small way to the excellent co-operation which exists between the chemical industry, Government and the Public Emergency Authorities.

© UKAEA, 1981.

References

- 1 A legislative round up of UK road regulations, *Hazardous Cargo Bulletin*, 2 (1) (1981) 6-7.
- 2 A.D. Maclean, 1980 Chemical incidents survey: Statistical analysis Home Office Scientific Advisory Branch Report 4/81.
- 3 Emergencies arising from chemicals and other substances washed ashore, Dept. of the Environment Circular 123/74.
- 4 W.G. Ashton, Routing of hazardous substances moved by road, *Proc. 1977 Transport of Hazardous Materials Symposium*, Institute of Civil Engineers, London, pp. 87-97.
- 5 *Road Transport of Hazardous Chemicals - A Manual of Principal Safety Requirements*, Chemical Industries Association, London, 1976.
- 6 CHEMSAFE - A Manual of the Chemical Industry Scheme for Assistance in Freight Emergencies, 3rd. edn., Chemical Industries Association Ltd., London, 1979.
- 7 R.F. Cumberland, Role of the National Chemical Emergency Centre at Harwell UK, *Proc. 1978 National Conference on Control of Hazardous Material Spills*, Miami, April 11-13, 1978, pp. 60-64.
- 8 N.H. Price, C.Bize and B. Niblett, On-line searching of European Conventions and Agreements, *Infor. Stor. Retr.*, 10 (1974) 145-154.