

IV Environmental Protection in the Distribution of Hazardous Chemicals

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Whether it is in a chemical manufacturing unit, a user factory, or in part of the distribution process of transport and storage, any incident or accident is likely to receive some degree of public attention.

Previous speakers have outlined some of the work going on to improve protection of factory workers when handling chemicals and of measures to protect us all against ill effects from waste products. What is less well known, except to those directly involved, is the considerable effort that has been going on, in recent years, to improve the safety aspects of the movement and handling of chemicals as such.

I suggest that this work has significant relevance to environmental protection in that its primary underlying concepts are, firstly, retention of chemicals within their conveying units and, secondly, operational systems to deal quickly and properly with such escapes as may occur.

Because of the international nature of the Chemical Industry, much of the work is carried out under the auspices of International agencies, such as the United Nations Economic Commission for Europe (ECE), the European Economic Community (EEC) and the Intergovernmental Maritime Consultative Organization (IMCO), as well as the various National Authorities. To all of these the Chemical Industry contributes its expertise, as well as to those procedures which it adopts internally and voluntarily.

Basic to International agreement on the handling and transport of hazardous substances is the definition of this term by defined parameters for each class of hazard, *e.g.* flammability, toxicity, corrosivity, *etc.*, and the recognition that within each hazard class there can be varying degrees of greater, medium, or lesser hazard. Hopefully, this will eventually lead to equivalent standards of hazard recognition throughout Europe and the maritime countries and thence to uniform requirements and measures of control.

The safety aspects can be summarized into two general groups: prevention and cure.

Measures to prevent accidents include those concerned with:

(1) Packaging — The United Nations Group of Experts package-performance tests, related to operational requirements, already adopted by IMCO and now the basis for U.K. approval for marine shipment; constructional specifications such as for International Road and Rail (ADR/RID) now being re-examined and possibly to be replaced by standards based on the U.N. tests; codes of

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practice for packaging, for conveyance by road in the U.K.; systems of certification of compliance with test standards; package identification labelling systems, including after loss overboard at sea.

(2) Tanks and Containers — Constructional and operational standards existing for road, rail, and sea use, and full intermodal standards are near agreement.

Intermediate bulk container (IBC's) requirements in draft for U.K. domestic use and expected to be considered internationally before long.

(3) Vehicles — Constructional and operational requirements for international road and rail which have been considerably tightened up, while U.K. domestic legislation deals in detail with some hazard groups and others are under discussion.

IMCO standards which now exist for construction of bulk ships and operational requirements for tanker washing to minimize pollution.

(4) General Instructions — Stowage segregation and unit size restrictions which already apply, while designated routing and controlled parking are under discussion. Marking systems including harmonized danger symbols and product identification. Codes of practice for loading and offloading bulk vehicles are normal in the industry, with driver training increasingly required.

(5) Handling Methods — Reduction of damage, where modern handling methods use pallets, unit loads, and containers, has correspondingly reduced the proportion of chemical loss to the environment. Codes of practice exist for loading freight containers and are in preparation for handling packaged and bulk chemicals in ports and harbours.

Nevertheless, and even if all standards and codes were fully applied everywhere, it is an axiom that accidents will occur from time to time, so measures to minimize their ill effects include:

(6) Safety Instructions — Detailed instructions in writing on product hazard, identification, safety, and emergency procedures to deal with spillage and hire. The International Chamber of Shipping's bulk cargo product sheets and the European Chemical Industries (CEFIC) Tremcards cover a wide range of products, with manufacturers using similar formats for their speciality products.

(7) Hazard Coding — Abbreviated coding systems for use by Emergency Services are near adoption for primary identification of hazard (Kemler code) or action (U.K. Hazchem or U.S.A. HI). A common international scheme does not appear likely at this time.

(8) Emergency Aid — Major companies' individual schemes, some of Pan-European scope and now linking voluntarily into national mutual-aid systems such as the U.S.A. Chemtrec and the U.K. Chemsafe schemes, for emergency advice and assistance.

This list is by no means comprehensive, but even so it would be impossible in the time available to deal with each item thoroughly. So I have selected a few, as examples of the extent of their scope and the detail involved.

Firstly, packaging standards. The aim of the U.N. Rapporteurs is to ensure that package contents are retained despite relatively poor handling. Hence the new standards are those of operational efficiency, not of detailed construction.

Packages are tested for sealing and pressure retention, resistance to dropping and stacking, and must resist reaction with or attack by their contents. Product type, density, and atmospheric temperature extremes must be taken into account and drops must normally be made in at least two specified positions, including those stressing weak points of construction.

The standard drop test is 1.2 metres — the height of the back of a lorry — with 1.8 and 0.8 metres for products of greater or less hazard than standard. Already this has entailed constructional improvements in the standard steel drum to meet the drop requirements. A stamp of type and test approval will be required on each package, which should then assure acceptance of the package internationally.

U.N. tests have been accepted by IMCO for marine shipment, and the Department of Trade is already applying the standards to U.K. exports. U.K. home trade will have to conform to codes of practice issued by the Home Office under the 'Conveyance by Road Regulations', setting out types of package permitted for each listed product, and the next step will presumably be to adapt the U.N. test standards for packages for domestic transport, where handling standards are already better than average.

Proposals have been made for restriction of marine stowage and size of packages for certain highly pollutant substances, and the packages may be required to resist sea immersion for a period long enough to permit recovery, if lost overboard. Marine labelling standards are likely to be set, requiring adherence to packages for a minimum of three months under immersion conditions, and affecting, therefore, the adhesive, the material of the label, the ink used, and the surface to which it is applied.

Bulk shipments, by land or sea, are generally presumed to present the larger hazard. U.K. domestic legislation for inflammables and corrosives sets out design requirements for road-tanker construction on such matters as shell thickness and position, type and protection of venting, valves and other fittings, as well as labelling and operational matters. Similar regulations for peroxides and toxic substances will follow. In general, U.K. regulations are intended to fit in with international requirements to facilitate movements by common standards, in what is a very international industry. The Chemical Industries Association manual 'Safe Transport of Hazardous Chemicals' provides a review of legislative requirements as well as a code of practice on other related aspects.

Control over parking of road tankers is also in hand. There is a shortage of suitably isolated parking places so, additionally, certain types of enclosed premises and approved places will be allowed. Other measures include keeping vehicles in sight when temporarily parked.

German efforts to force chemical movement onto rail are well known. For practical reasons of rail facilities, this is not readily acceptable to most other European countries but, in the U.K., a survey is in hand of product quantities, distances, and routes to see what transfers are feasible. Some companies already move goods by rail when long-distance, direct-route journeys are involved, but in the U.K. generally, transfer to rail is difficult because of the shortage of

sidings and of transfer equipment and the many cross-country routes involved. In any case, some form of route control is likely. Already this is the practice of some companies, while designated routing of all heavy lorries is common around many continental towns and could well be applied here, not just for chemical products.

The Design and Use regulations for portable tanks — ISO large tanks down to small sizes over 450 litres — are included in ADR/RID from 1974, while IMCO recommendations for various types of tanks are already agreed and to be implemented by DoT. Design features included designated minimum shell thickness (related to product vapour pressure at elevated temperatures), with additional thickness required for specially hazardous substances. Bottom outlets will be forbidden for the most toxic and corrosive products, and special attention is paid to protection of fittings, attachment to carrying vehicles, and resistance to G forces in transport. At present, standards for land and sea are somewhat different, and the U.N. Rapporteurs are attempting harmonization of the two standards to produce truly intermodal tank requirements.

Similar standards for glass-fibre tanks are in draft for international transport, and EEC have in mind a Directive to establish this as the standard for domestic transport.

Intermediate Bulk Containers, commonly called IBC's, are widely used for the carriage of $\frac{1}{2}$ —3 tons of solid and liquid chemicals. If these are pressure vessels they come under portable-tank regulations, but non-pressure types, whether metal, plastic, or expandable fibreboard, *etc.*, are under examination now for the establishment of suitable standards of design and transport.

Bulk ships, too, are subject to IMCO standards. Hazardous chemicals and others liable to cause pollution, whether through toxicity or general contamination risk, are designated to ship type. Type I and Type II ships set standards of tank size, tank equipment design, and collision absorption spaces between hull and tanks, as well as careful positioning of tanks and equipment in relation to engine room, crews quarters, and the like. Operational requirements to minimize pollution include controlled disposal of ship tanks' washings, either by landing for disposal at the user's site or a special disposal unit in the case of certain dangerous or difficult products, or by controlling the method and quantity of disposal at sea to minimize environmental impact for the majority of listed products. Inspection and certification methods are included to enforce the control.

However much care is taken with design of vehicles, tanks, and packages in transport we are, in the end, dependent on the skill and behaviour of people. ADR/RID have long required suitable instructions, in writing, to be given to drivers. Revised U.K. regulations will require this too for U.K. domestic traffic. In addition to the product name, hazard symbol, and supplier's name and address, 'instructions in writing' require details of the nature of the hazard, safety measures to be taken, and action — including what not to do — in the case of fire or spillage. Additionally, it is the policy of the Chemical Industry to include a telephone number to contact in emergency. The instructions may be in the form

of separate sheets given to drivers, or, for packaged goods transported in the U.K., the information will be acceptable on the package labels, provided the driver is told about them and understands them.

For bulk vehicles, information cards like the CEFIC Tremcards are a good way to meet these requirements. Several hundred cards are now available, and the international working party will complete the list of 600—700 chemicals known to move in bulk fairly soon. Hazard symbols are well known. The U.N. Diamond style, sometimes with additional words, is now common for sea, air, road, and rail transport — ADR/RID having recently changed over from the old black on yellow rectangles to this style. There will thus be a uniformity of hazard recognition which will be publicized by the Government shortly, with the general warning to the public — Danger — Keep Away — Ring 999.

Improved handling also helps safety.

Codes of practice for handling bulk and packaged chemicals in ports and harbours are being prepared to include aspects such as separation of vehicles parked at ports, prior notification to port officers of the arrival of hazardous products so that proper provision can be made, and improved standards of safety and training in those areas.

Vehicle equipment such as self-sealing connectors, composite bursting disc/relief valve fittings, enclosed loading and discharge systems to and from storage tanks, antistatic equipment and techniques, level and failure alarms are in increasing use as part of the Industry's general safety programmes.

The now widespread use of mechanical equipment and unitization of packaged goods considerably reduces damage and hence spillage, especially at ports or transfer points. Pallet covers, strapping, and shrinkwrap can further increase resistance to casual damage in handling.

The use, for good commercial reasons, of roll-on, roll-off vehicles, especially to Europe, and of through-containerization worldwide (containers also have a joint CIA Chamber of Shipping code of practice for hazardous goods), minimizes package handling and can limit it entirely to sender and receiver, both of whom should have good standards of handling under their direct control.

Segregation of hazardous products from food and clothing and from other chemicals likely to interact is already required for sea, air, and land transport, and similar practices are commonly applied in warehouses to minimize danger and facilitate the work of the emergency services. Packaging itself can help, studies showing, for instance, that shrinkwrapping reduces the rate of fire spread in stacks of packages. It is increasingly common practice on the Continent for warehouse operators to require ADR or IMCO classification of products before acceptance, so they can be suitably stored (and charged for accordingly). Chemical warehouses are being built to better standards with wide aisles, product separation, and fire-hose or sprinkler systems. The bigger companies set quite high standards — encouraged by insurance costs as well as by safety policies. Some manufacturers already co-operate with local fire services by providing information on products and on emergency hazards and by setting apart

designated storage areas, clearly marked, for different types of hazardous products.

So far I have spoken of regulations and practices to prevent hazardous chemicals causing problems. These may be summarized as better design, to eliminate failure of containers in collision, and good practices, to minimize careless handling.

Some of the things I have spoken about will work both ways:

Segregation of Chemicals

Establishment of fire equipment

Packages and labels resistant to exposure or immersion to facilitate subsequent recovery and identification *etc.*

Incidents will occur, however much we try to prevent them. CIA's other efforts are toward preventing a minor incident becoming a major accident. In the event that an incident does occur, actions have to be taken, usually in emergency conditions, to limit the effects.

Especially for bulk vehicles in transit, urgent recognition of the nature and hazard of the product is essential. Marking the vehicle externally with the name of the product and the hazard symbol is a first step only.

Having Tremcards or other instructions in writing with the driver is fine, provided the driver is not injured or otherwise incapable of delivering the instructions to the would-be rescuer. CIA recommends that Tremcards should also be on the outside of the vehicle in at least two places.

Several companies already placard their tankers with large permanent plates carrying emergency information. German practice is to put the Tremcards in special holders behind the compulsory orange plates, front and rear. However, even if available, written instructions may be difficult to understand correctly under difficult visual conditions and the extent of the emergency may require immediate action. Current thinking, therefore, is toward a system of marking vehicles with a simple code, in letters large enough to be read under poor conditions and understood by the emergency services at once, so that preliminary action can be taken to get the incident under control.

The U.S.A. has come up with HI, a coding system indicating by two digits the action which should be taken in the first 15 minutes. In that time, and with the facilities available to the Police or Fire Brigade, obviously there are only limited actions which can be taken, so that complicated or obtuse instructions would be useless. HI therefore offers only a choice from a limited range of actions. The London Fire Brigade's Hazchem system can be condensed on to a pocket card giving the code for action. This scheme can cope with a wide range of products, not only hazardous chemicals, but again restricts actions to those readily available. Unfortunately, for political reasons the ADR amending Committee could not agree on either the HI or Hazchem system, and they have come up with a third code — Kemler Number — which condenses information about the product hazard but leaves the actions to individual judgement.

So for international traffic on the Continent, the symbol, U.N. number of the product, and Kemler Code will be required. In the U.K., the symbol,

U.N. number, and modified Hazchem number will be required. Maybe harmonization will come eventually, but not yet. In either case, however, a large vehicle plate seems likely, of defined size, lettering, and colour, to simplify the problem of the Emergency Services in the first few minutes.

Even when a coding system is in use there will still be a need for expert advice and information from Industry, whether on subsequent actions for highly dangerous products, or action for products not hazardous enough to warrant classification but unpleasant enough in an emergency.

A dozen major companies have internal emergency arrangements linking offices and factories to provide advice and assistance in transport/storage emergencies, and various moves are in hand to link these into more comprehensive schemes. In the U.S.A. the major companies under MCA set up the Chemtrec office two years ago in Washington, giving 24 hour availability of first-help advice and with communication links to all major suppliers for follow-up. An area system also exists in Canada.

In the U.K., informal intercompany area arrangements have existed for some time on a good-neighbour basis, but CIA has now, with the support of Government Departments and the emergency services, arranged the consolidation of these into a countrywide emergency-call system — Chemsafe — whereby an initial 32 factories with 24-hour telephone cover undertake to give advice on a range of products and to provide as much help as they can. Other companies are being brought into the area contact scheme. Harwell will act as a backup centre for the Emergency Services, for which a data bank will be organized to include many unclassified, as well as classified, hazardous chemicals. The aim is to have on file, for rapid retrieval, fire, spillage and first-aid advice like that on Tremcards for as many products as possible, with the name and telephone number of the supplier.

The scheme, together with CIA manuals and codes on the labelling of hazardous chemicals, use of freight containers, safe transport of hazardous chemicals, *etc.*, shows that Chemical Industry members recognize the need for good and improving standards of practice, and that they are willing to share their knowledge and expertise with other chemical manufacturers.

Detailed regulations are not the whole answer. Much of the present adverse publicity is due to the past slowness of the U.K. to introduce regulations (despite ADR/RID being in existence for years as a potential groundwork) and the detail which had to be argued out in almost every case. It could save time in future if legislative emphasis is placed more on definitions and described parameters of hazard, on general requirements for design and operational safety, and clearly placed onus of responsibility, but if it leaves the detail to codes of practice that are given the backing of the law and flexible enough to take account of technical change and progress.

I hope that what I have said will show that, far from the gloomy picture sometimes painted, there is from much of the industry a substantial expenditure of effort, expertise, time, and money on distribution safety, and hence on environmental protection. The problem that remains is not so much that of estab-

lishing suitable standards, though of course much remains to be done for some groups of products. It is rather that the Chemical Industry as a whole should bring itself up to the standards of design and operational practice already established, and should use its commercial leverage to ensure that transport, package, equipment, and chemical suppliers also do so when dealing with hazardous chemicals.

Publicity within the Chemical Industry is one way to encourage compliance with the codes that already exist, which is why we regard meetings such as today's as extremely important, so that CIA's work in establishing good standards of distribution safety will be followed more quickly and closely by the Industry as a whole.