# TWO PUBLIC WARNING SYSTEMS for EMERGENCY PLANNING at MAJOR CHEMICAL SITES

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The Advisory Committee on Major Hazards (ACMH) was set up by the Health and Safety Executive (HSE) towards the end of 1974 when the HSE itself was in its infancy. It was recognised (and reinforced by incidents such as Flixborough and Beek) that industry had a potential to cause major upheavals and disruption to itself and its neighbours. The ACMH proposed that mitigation of major accidents could be addressed in three stages, namely:

- identify the installation which may require special attention
- ensure that the existing installation and any additions are made as safe as possible
- ensure that the consequences of an incident if it occurred affect as few people as possible

The strategy is thus

***identify the problems,***
***control the hazards,***
***mitigate the residual risk.***

This was an important concept and it has been adhered to in the UK since that time. It requires first of all that the sites with major accident potential are known. This was achieved by the introduction of the Notification of Installations Handling Hazardous Substances Regulations 1982 (NIHHS).

Having found the sites, the next task was to achieve a level of safety. This was to have

been done by some form of hazard survey and identification regulations and by the application of the Health and Safety at Work etc. Act 1974 (HSW) and various statutory instruments made under it. Regulations have since been made which are particularly aimed at increasing safety in this area, for example the Control of Industrial Major Accident Hazards Regulations 1984 (CIMAH) (amended 1988 and 1990) and the Management of Health and Safety at Work Regulations 1992. The underlying principle of HSW legislation is that steps to ensure health and safety are taken if they are reasonably practicable (Section 2, HSW). Even so, there is bound to be some form of residual risk from an industrial activity. So finally this residual risk is mitigated by effective land use planning so that the numbers of persons at risk off-site from activities on-site may be limited. This is achieved by legislation (controlled by the Department of the Environment), which includes the Planning (Hazardous Substances) Act 1990 which requires those who hold quantities of dangerous substances to seek the consent of the local authority. In this process the HSE is a statutory consultee, as it is also for land use planning around hazardous installations. Adequate knowledge of the presence of potential hazard is therefore the key to being able to take effective action.

The provision of information is partly a preplanning exercise and partly a reactive action. The Advisory Committee on Dangerous Substances (ACDS) Report 1991[1] noted (page 43) that, obviously, until the emergency services had been told there was an emergency they could do nothing. They went on to say that thought needed to be given to rapid methods of advising the emergency services in the event of an incident. The emergency services response time is therefore dependent on the time taken to alert them, but their response is highly conditioned by the prior information which they have been given.

In the UK only the NIHHS Regulations were introduced before the Seveso Directive came into being. This Directive was promulgated by the European Community following the disastrous leak of dioxins from the Icmesa plant in Italy in 1976, which caused extensive damage to the environment and severe illness to a large number of persons although no-one was killed. A revised Directive (the Seveso II Directive) entitled "Council Directive on the Control of Major Accident Hazards Involving Dangerous Substances"[2] has now been agreed.

It is envisaged that the Directive will be given the force of law in the UK by the introduction of the Control of Major Accident Hazards Regulations - COMAH.

There is no duty under current UK regulations (made following the first Seveso Directive) to test the adequacy of the emergency plans. Neither is there a specific requirement to alert the public off-site that an emergency is imminent or indeed is actually taking place.

The Seveso II Directive has addressed these points. Member States will be required to ensure that internal and external emergency plans are reviewed, tested and, where necessary, revised and updated at intervals. The Directive also requires that the public is consulted on off-site emergency plans, as provision has to be made for informing the public and supplying information to the competent authority for the preparation of external emergency plans. Member States are also to ensure that emergency plans are implemented without delay if a major accident were to occur. The objectives of these plans would be

- the containment and control of incidents so as to minimise their effects
- the implementation of response measures
- the communication of necessary information to the public, the services and authorities
- the provision of restoration and clean-up of the environment after a major accident

The exact meaning of the phrase "communication of necessary information" and whether it is intended to require the provision of a warning system may well be a matter for legal interpretation. The external plan itself is required to contain details of the arrangements for receiving early warning of incidents and call-out procedures, as well as arrangements for providing the public with specific information relating to the accident and the behaviour which it should adopt.

A warning should be of such character that persons who may be imperilled and who may be able, and know how, to take palliative action are made aware that there is an emergency. This requires there to be prior instruction or education relating to the emergency action, even where the emergency warning is itself used as the vehicle for giving instructions. There is

little point in warning those for whom no action may be possible (for lack of time or in some circumstance where no action would be likely to lead to a diminution of danger) or those so remote from the point of the emergency that the risk of harm approaches a level which is vanishingly small. Nor is there any great value in warning those who have no inkling of what the warning may presage. This implies that for a prolonged toxic release, a scenario which gives the warning system the greatest chances of success, the distance over which the warning should be given may in practice run to tens of kilometres in length.

The Directive also requires the consideration of domino effects and that groups of sites exchange information between themselves to take account of the overall major accident hazard. The first of these requirements has cross-border implications likely to be of less consequence in the UK than in other member states, but the second will involve certain areas of the UK where there are a number of sites in reasonably close proximity to each other. One of these areas is the south bank of the river Severn to the north west of Bristol between Avonmouth and the Severn bridge: this area will be referred to later.

Warning systems have been studied for effectiveness by a number of authors [3][4][5] and their conclusions have been used in attempts to design warning systems which actually do warn. It is not the time taken to warn people which measures warning system effectiveness but the time with respect to the materialisation of the hazard. Where there is a lead time of some hours there is some evidence[4] that almost all of the population which is at risk can be effectively warned without the need for highly complex and specialist equipment. An off-site warning is generally less easily achieved because of the limited time available in which to act.

One system with the potential to be both effective and efficient is a suitably designed siren-based system, such as that proposed[6] for the Avonmouth area of the UK. This system comprises a number of high efficiency sirens mounted at strategic points within an area and able to be activated from a central control point. The sirens are to be sited at points identified by an acoustic survey as being those points from which the greatest coverage may be achieved. The sirens will be activated by radio or land-line link which is microprocessor controlled. This allows individual sirens or numbers of sirens to be activated sequentially or

on an area basis, making possible the operation of some sirens preferentially over others. This would be a valuable feature in the event of, for example, a toxic release, where the area at risk would be dependent upon weather conditions. When activated the sirens produce a tone or series of tones at 130 dB and are likely to be heard for some distance. The authority to sound a warning will be invested in all the emergency services though the control room itself will be under the supervision of the police. The introduction of this system is currently awaiting the resolution of certain financial considerations and there have been calls for it to be resolved without delay as a consequence of the recent incident at one of the premises in the area. A performance criterion has been devised for the system which requires that each siren should be capable of warning 75% of the population within a given radius. An extensive education programme is to be implemented, with local schools and community groups being heavily involved and committed. The local authority are also proposing the introduction and local distribution of an annual calendar which will bring all the necessary information into an easily available format, whilst an annual exercise will reinforce the message to the public.

A system such as this, which is based on modern electronic loudspeaker sirens, has significant advantages over systems employing older electromechanical or pneumatic sirens. One advantage is that there is the capability either to produce a different signal tone in different areas (to avoid confusion with existing sources of noise) or to generate a standard tone which can be understood by all without ambiguity. Additional advantages include a larger coverage, the ability of self diagnostics to be incorporated into the design for testing purposes, possible multiple toning and the use of the system to broadcast as a public address system. The capability of the warning system to convey a complex message in intelligible text should be weighed against the ability of site personnel or the public to comprehend and understand that message and take effective action as a result of it. There is evidence[6] that the response of the public to an intelligent message would not be panic and mayhem but is likely to be such that the use of such a message would be regarded in hindsight as justifiable. Conversely, if information is provided prior to the event through, for example, mail shots, then in emergency only a relatively small proportion of persons may be expected to respond in accordance with these prior instructions[7], many having forgotten their content or even their existence.

Another potential candidate for a warning system is the Public Warning and Information by Telephone (PWIT) system under development by BT Tallis in the UK. This system is as yet very much in its trial stages. There has been no agreement as yet to conduct even a limited full scale pilot study and certain details have not yet been made available as there are logistic and legal hurdles to surmount if the system is to go ahead. It appears however to offer some significant features which could be of great value in emergency planning and management. It is based around a geographical information system (GIS) imported from the Ordnance Survey and which is linked to a voice platform and multiple access system which allows a large number of telephones to be addressed in a short time and a message delivered to each.

When the PWIT is initiated, the area of the emergency or area at risk is identified by the GIS and its boundaries delineated. The system then identifies the telephone numbers for all addresses within that area. By the characteristics of the software it is possible to ensure that individual phones are recognised and therefore multiple numbers at a single address are ignored. These numbers are then contacted over a period of time measured in seconds. The system can recognise if the phone is answered by an answering machine, Fax machine or public call boxes and may be instructed to take certain actions in these cases. If the phone is engaged, it will be put to the end of the queue and then rung again. Upon answering, the listener may be asked to make some response to indicate that the message has been understood. This response could be, for example, either by saying, "Yes" at some prompt or by keying in the # sign on the telephone keypad. All the attempts by the system to ring a number are automatically recorded, as is the time of any response, so that it is possible afterwards to analyse the success rate for a particular message.

The ringing tone of the subscriber's phone may be altered by the PWIT - perhaps to a continuous ring - in order to alert the subscriber to an impending message. When the subscriber answers the phone the responses which are made (if called for) will be logged and the PWIT will deliver those messages which are requested. If the subscriber is a child the system may be configured to recognise this and trigger some additional action. If no answer is received after a number of attempts, this fact is recorded too. The inference may be that no-one is at home and therefore there isn't going to be any need to warn them anyway.

For certain types of incident, for example, flooding of a low-lying area, the areas at risk may be known well in advance. Careful planning could then ensure that pre-recorded messages were transmitted in sequence. These messages could first alert, then inform and keep informed, and finally, stand down, the persons at risk. For a chemical release, where the time scale is generally much shorter, the system could still alert persons in a predetermined sector (chosen on the basis of meteorological data) and is sufficiently fast to get a message to people within such a short time that palliative action may be taken.

There are effectively three participants in the process. The notifier of the emergency either prepares a message for delivery or authorises the delivery of a pre-recorded message. This message can be spoken into a telephone or can be keyed into some modem-linked word processor so that it can be transmitted to the PWIT operator. Access to the PWIT operator would require some form of prearranged identification and a level of security for the protection of the public against hoax messages, but it is envisaged that this access would be available to all the blue light services.

The PWIT operator is not necessarily anywhere near the scene of the incident and could indeed be a nationally available service operated from a single geographical location. The operator causes this message to be processed into electronically generated speech, if necessary, and sets into motion the contacting of the telephone subscribers. The technical capability exists to deliver the message in any of half a dozen common European languages. The feasibility study demonstrated the capabilities of both a professional speaker reading a predetermined text and an electronically generated speech. The telephones identified as being within the GIS envelope generated by the circumstances of the hazard are then contacted sequentially and the message is relayed.

The warning systems described above could have been of value in the incidents described below, in which deficiencies in the emergency arrangements played a significant part.

The official HSE report following the fire at Allied Colloids[9] on 21 July 1992 found that in this instance there was a site siren but that there had been delays in its employment which

meant that members of the public were not alerted as soon as perhaps they might have been. The emergency services which were in charge of managing the emergency did not have the authority to order the siren to be sounded. When it had been finally sounded, it was prematurely cut off when the site power supply was isolated. The HSE report recommended that agreement be reached at all major hazard sites between the occupier and the emergency services on the circumstances in which the alarm can be sounded and who can order its operation. This procedure should be written into the emergency plans. The safety report or safety case for the site would be the obvious repository for information intended to demonstrate that the emergency plan is sound and that the persons and equipment to be employed are of a sufficiently high standard.

Further messages are contained in the official HSE report following the fire and chemical release at Associated Octel[10] in February 1994. Here the written arrangements for the emergency plan were not sufficiently site specific and the major effort was directed to addressing a toxic release. There was difficulty in warning persons off-site: persons upwind did not hear the warnings (being upwind they would not, but they were not at risk) and overloaded telephone links attempting to find out what was happening. Persons downwind heard the sirens and confused them with those for a nearby chemical installation. Some residents who were outside the public information zone were alarmed and thought that they too should have received prior information about the site.

The message to industry is clear. The legislation will require those affected to make certain changes and arrangements to achieve compliance. The emergency planning arrangements will demand that additional resources and greater attention are given to this aspect than has sometimes been seen in practice. These arrangements will involve not only individual sites but possibly their neighbours and not only the local authorities but the public. For affected sites it would be prudent, if not essential, to begin the processes of consultation, discussion and organisation of amended emergency planning arrangements without delay. After all, a disaster may occur only once in a thousand years, but it might be tomorrow.

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