

From Seveso to Mexico and Bhopal: Learning to Cope with Crises

P. Lagadec

1.1. Introduction

A well-defined failure not unknown to statistical series, codified emergency procedures, a limited number of people involved, a breakdown brought rapidly under control, press releases drafted with no great difficulty by the press offices concerned, and relatively easy coverage by insurance: these are the features of the accident, the province of safety specialists. Major technological hazards explode this system of reference (Lagadec, 1981a,b).

The very large-scale event, extremely serious in its immediate effects and disturbing in its long-term consequences, causes sudden immersion in a universe quite different from that of the "conventional" emergency. Enormous and unexpected difficulties that defeat or wrong-foot the operational arrangements in force; agonizing and paralyzing uncertainty; a critical phase that goes on and on and is therefore wearing on mechanisms, men, and organizations, and an extraordinary increase in the number of people involved: these are some of the features of the post-accident dynamic following a major accident.

The logic is scaled up from that of the "ordinary" accident to that of the crisis. Disproportion, hypercomplexity, and strongly destabilizing tendencies are the hallmarks of the crisis phenomenon which we must now learn to understand better and bring under control.

The chemicals sector can no longer ignore this problem in all its different dimensions – technology, organization, decision-making, and social policy.

Some organizations have been violently confronted with the problem in recent years and have often had to invent – on the spot and with the storm at its height – new tools, new behaviors, and new policies. It is possible to learn lessons from these (often painful) experiences, to shed a little light on the problem, and to carry out research that may help all concerned (industry, the authorities, the organizations involved, and the general public) to enhance their skills in this respect.

Events show there is no time to be lost. During the 1970s Flixborough, Seveso, and Mississauga were so many "warnings" whose cost, fortunately, was not too high, but 1984 brought large-scale disasters:

- (1) Cubatao, Brazil, 25 February: oil spillage and fire in the middle of a shanty town – 500 deaths.
- (2) Mexico City, 19 November: gas explosions with a domino effect in an industrial site plumb in the center of a densely populated area – 452 deaths according to official sources; 1000–2000 according to the press; perhaps more.
- (3) Bhopal, 2–3 December: release of poisonous gas affecting one quarter of the population of the capital of Madhya Pradesh (800 000 inhabitants) – over 2000 immediate deaths.

These three events overtook all the statistics compiled since the Second World War. The accident in India rocked America's third largest chemical company to its foundations. The problem of the major hazard – the structural vulnerability of our industrial systems – has become an urgent strategic question.

Our purpose here is simply to signpost the field of study and clarify the many different aspects of the problem to be defined. This will be done under three headings, in this order:

- (1) Reminders of actual cases to illustrate the complexity and severity of the subject.
- (2) Points of reference to facilitate the approach to and understanding of the crisis phenomenon.
- (3) Pointers to help formulate responses or make them more effective.

1.2. The Shock of the Events

The first aspect of a crisis is the ordeal of the "black-out" – a stunning and oversudden change of state, the unthinkable event that overwhelms and destabilizes. The functions, relations, and missions of the system or systems it strikes seem to have no relevance. Language itself seems incapable of naming the ordeal that has begun. The organizations

concerned are thrown into an unfamiliar universe. If the presence of these phenomena is only faint the crisis may be described as "incipient", but if they fill the stage and structure the course of events then that is a crisis situation.

But let us not go too fast. For a start, the crisis does not take the form of an ordered series of isolatable difficulties. Rather it is a global phenomenon where the usual analytical approaches find no purchase. The nature of the problem with which everyone is suddenly faced – compact, elusive, and all-embracing – is a powerful destabilizing factor.

Before we go on to a more analytical study of the crisis phenomenon, therefore, we need to dwell for a moment on this immediate and inescapable challenge: the shock of the event viewed overall. A few significant cases will take us straight into this world of crisis.

1.2.1. Seveso

Today, some comfort is rightly derived from the fact that the consequences of the accident on 10 July 1976 were limited, but we should not forget the ordeal that those responsible and the populations concerned went through in the weeks and months following the dioxin leak.

Let us return to the peak of the crisis when uncertainty was so high, as can be seen from the following calendar of statements (*D* = day of the accident):

- D* + 1: The manufacturer releases the information that a product used in making herbicide has been accidentally discharged and that precautions are advisable (Pecorella, 1977, p 106).
- D* + 3: The public health authorities write to the mayors of Meda and Seveso as follows: "According to the inquiries that have been made there is no fear of any danger to the people living in the areas surrounding the plant" (Pecorella, 1977, p 106).
- D* + 12: The prefecture is reassuring: "At this time there is no cloud of toxic gas" (Conti, 1977, p 15).
- D* + 13: The prefecture again: "Other health measures should not be considered necessary or urgent" (Conti, 1977, p 16).
- D* + 13: Speaking on television, the Regional Health Director claims: "Everything is under control" (Cerrutti, 1977, p 13).
- D* + 13: The Medical Research Board Director (G. Reggiani) of the industrial group concerned (Hoffmann-La Roche) declares: "The situation is very serious and drastic measures are called for. 20 cm of earth needs to be removed, the works buried and the houses destroyed" (Cerrutti, 1977, p 13).

D + 14: The Regional Health Director replies: "This man has been parachuted in: nobody was expecting him. It does not follow that he is an official spokesman or speaks on behalf of the firm. I have confronted him with the seriousness of his statements and I have the impression he is bluffing. He will have to answer for what he has said" (Conti, 1977, p 15).

D + 14: Change of tone. Official communiqué: "179 people will have to leave their homes within 24 hours" (Cerrutti, 1977, p 13).

During the six months that followed, many of the people in authority remained caught up in this confusion. Uncertainty about the effects of the contamination and the inability to find effective decontamination methods were combined with confrontations of a sociopolitical nature (central versus regional government, Milan versus Seveso, Christian Democrats versus Italian Communists, the Church versus advocates of abortion, the authorities versus the manufacturer, etc.). All this produced a situation of complete helplessness.

Whence the conclusion of the Regional Health Director in Milan: "If the steps taken do not produce positive results within three months, we will let nature take its course" (Conti, 1977, p 100). A new reality governed the situation: the major chemical risk.

1.2.2. Mississauga-Toronto

Here too the ordeal was severe because it was general. No one knew what was in the inferno: the train's manifest was illegible, the freightcars were unapproachable, the information given by railway officials was incorrect (they said there was no chlorine), the presence of polychlorinated biphenyls (PCBs) was rumored, and there was a succession of explosions, one tank being blown a distance of nearly 700 m. Finally, it was decided to act on the assumption that there was a chlorine tankcar in the blaze.

Arrangements had to be made to evacuate on an unprecedented scale - 220000 people - and, more particularly (an underrated detail), for over 24 hours, so that the social fabric was broken apart with consequences of many kinds. The problems included the hospitals. They did, of course, have emergency plans enabling them to receive an inflow of victims but what they were asked to do was completely different, i.e. evacuate as well - and they had no plan for that. They could be given 20 minutes' warning whereas they needed over 4 hours to evacuate their patients. At the site of the accident the propane cars needed spraying with water, whereas water had to be kept away from the chlorine car, also in the fire.

And, apart from the specific problems to which answers had to be found, there were policy questions such as whether the police emergency plan should be applied or that of the region. There was more experience of the former (for lower-level incidents at least) but the latter, with more involvement of policymakers, was reportedly "safer" in terms of responsibility in the case of serious problems (Burton *et al.*, 1983).

1.2.3. Taft, Louisiana

At 11 PM on 10 December 1982, the management of Union Carbide ordered part of its workforce to leave. There was a temperature surge problem in one of the acrolein tanks. The tank exploded, 17000 people were evacuated and river traffic on the Mississippi was brought to a halt. The case would be of little interest except it is an illustration of how crisis conditions can be created by a blatant lack of communication between those responsible.

Neighboring towns had very well equipped and experienced emergency centers but the information reaching them about the seriousness of the event was too late and too indirect. Hence their surprise, for example, at receiving calls from residents in the zone concerned asking them what evacuation routes to take (what evacuation?) and at suddenly being asked by the factory to shut off all roads up to 8 or 10 km out (when it was only a question of a minor incident representing "no danger"). "No-one told us anything," said a public official.

Sophisticated emergency systems were in place (e.g. direct telephone lines between crisis centers and the dangerous plants in the area). Specialized emergency teams were available, but when they arrived in the plant they were taken under the wing of the public relations people and not allowed to attend the technical meetings. The whole structure was cut off at the base by a single factor: mistrust (Quarantelli, 1983).

1.2.4. The case of the 41 drums of waste from Seveso

This is an example of another type: the "media accident". The affair had been brewing since September 1982 and came to a head in March 1983 with the publication of an article asking the question: where have the 41 drums of waste from Seveso gone? A symbolic word "dioxin", a very well documented press article, unwise management by several businessmen, and assurances given and accepted without double-checking: all this set the scene for a situation of acute social turbulence that kept the whole of Europe in suspense for two long months.

The Italian authorities asserted that the 41 drums had left Italy under official guard (as far as the French frontier) for a destination "somewhere" in the north. France stated that the cargo had also left French territory and let it be understood that Germany was the country of destination. The FRG issued a denial but started inquiries. The GDR denied information given in Rome. The Swiss firm (Hoffmann-La Roche) claimed that the cargo had already been buried in a controlled dump by the authorities of the host country who should, therefore, be fully informed. Suspicion grew and every government or agency with some responsibility quickly came up against formidable problems of credibility. Fingers were pointed at France, Germany, Belgium, the UK, the North Sea, Italy, and even ... the USSR.

In April, Hoffmann-La Roche learnt that the documents on which its information was based were false. The assurances it had given governments were therefore worthless, as were the statements that governments themselves had issued.

The questions became an obsession. Where were the drums? Who knew? Claims, insinuations, denials, and corrections from Milan, Rome, and elsewhere kept the excitement at fever pitch. A continent-wide hunt for the drums and for the "liars and dissemblers" went on at a vigorous pace, with extensive coverage in all the European dailies. The FRG organized a full-scale search in a suspect waste dump as a spectacular operation calculated to satisfy those with the strongest suspicions but also to set a precedent that was both of limited effectiveness and industrially suicidal - "break in everything, everywhere" could not be the most rational instruction.

The issue was serious. A generalized suspicion of governments developed but also, and above all, of the chemical firms. A strict boycott was mounted against the Swiss group, which said it knew nothing. Dumps of waste chemicals were systematically incriminated. In the end, suspect drums were being seen everywhere and the checks made (though always negative) regularly brought to light situations reflecting little credit on the dumps themselves or the firms concerned.

Seven countries and governments and over 40 organizations had the searchlights of the media thrown on them, for the case held the front page or another prime position throughout. The officials and businessmen concerned wondered just how far this unstoppable flood would spread ... (Lagadec, 1984b).

1.2.5. San Juan Ixhuatepec, Mexico City

This was not just a plant exploding (like Flixborough) but a whole industrial site going up in flames. The dreaded domino effect came into action. How far would it go? Large masses of flying metal prompted

fears of disastrous chain reaction effects. What is more, the site was in the middle, not of a country area (like Flixborough), but of a densely populated urban zone.

Pemex, the leading national oil and gas company, was confronted with one of the most serious industrial disasters in history. A searching light was thrown on everything that could have been a contributory factor. Industrial safety was remorselessly exposed to the probing of the press whose list of questions included such things as:

- (1) Problems of design: proximity of the different installations in the zone to each other and closeness of the industrial site to the conurbation.
- (2) Inadequate prevention measures: absence of any plans at all for the installation (*Proceso*, 26 November 1984) and highly inadequate maintenance, also mentioned, incidentally, in a report of the Pemex Health and Safety Committee dated 17 September 1984 (*Excelsior*, 23 December 1984).
- (3) No awareness of precursor accidents: "Everything is under control," as one municipal delegation was told that had expressed concern after an accident a few months previously (*Alarma*, No 1127).
- (4) Highly inadequate government supervision: laxity and incoherence (*Proceso*, 26 November 1984; *Por Esto*, 19 December 1984).
- (5) Corruption: installation of a bypass so that gas could be supplied to private distributors from the storage site without what was done being recorded (*Proceso*, 26 November 1984).

Apart from all this there were also the social problems – rural exodus, poverty belts, uncontrolled land use and speculation – which explain the worst effects of the disaster because of their partial responsibility for the settlement of populations in the immediate proximity of so dangerous a gas storage area. The questions seemed to be too serious: no (accurate) final accounts of the disaster were published (Lagadec, 1985).

1.2.6. Bhopal

The shock for Union Carbide (a foreign company for the country concerned, unlike Pemex in Mexico) was on the same scale as the event. It had to cope with immediate problems and at the same time safeguard the future. It had to give a great deal of information to save what it could of its image but it had only limited access to the Indian data. Lastly, each of its statements was likely to impair its case in the courts. The crisis turned every question into a trap:

- (1) Were the safety measures at Bhopal the same as at the other Union Carbide methyl isocyanate (MIC) plant at Institute (West Virginia)? If the answer were "no", that opened the door to charges of exploiting the Third World. If the answer were "yes", it could generate a panic or at least serious trouble at the United States (US) location.
- (2) Was the firm intending to take immediate steps? To mitigate the effect of an affirmative answer to the preceding question, all MIC production could be halted until what happened at Bhopal was fully understood, but could such a decision take the place of policy, the collection of information being difficult and lengthy?
- (3) Was Union Carbide's safety policy on a level with what was required for such hazards? The reply could only be "yes". But then, how could one account for the avalanche of problems uncovered - "revealed" - at Bhopal: design faults, maintenance deficiencies, inadequate preventive measures and insufficient staff training? In its inquiry, the *New York Times* (28 January 1985) identified ten violations of rules that ought to have been followed. While it was right to point out that the Indians were responsible for the operation of the plant, it could not be pretended that headquarters at Danbury (Connecticut) were not keeping serious watch on these problems which Union Carbide said were a top priority. Nor could there be any question of laying everything at the door of the Indians. Interests in India (and elsewhere), now and in the future, ruled that out.
- (4) Was the company in a position to pay? Here, too, the answer had to be "yes", but the path to be trodden was a hairline. Overassurance could tempt applicants (and their lawyers of which there were plenty) to step up their claims, which could change the group's financial situation. The big question was that of the basis of compensation. If North American standards were used, that could raise some doubts about the firm's ability to pay. Taking a yardstick with more affinity to the country concerned could again spark off the polemic about multinationals and the Third World, strategically a rather dangerous question. A further point was that the firm had also to contend with attacks from within: its own shareholders had filed a court action against the management that had jeopardized their profits in this way.

Vicious circles and perverse effects colored the scene which - it has to be said - hardly favored nuanced declarations, even though everything was done to avoid the simplified logic that emotion and the media both tended to demand.

On the Indian side, the situation was not easy either. The responsibility of the local subsidiary was unquestionable, but the Americans

could hardly be blamed for urban planning (except on the score of not giving enough information about the product). Certain efforts to inform the public would have helped to save a very large number of lives (H'rouda, 1985). Links between managerial staff and senior local political officials were also rather embarrassing: the officials were in the same party as the Prime Minister and the elections were in the offing.

The various illustrations – from Seveso to Mexico City and Bhopal – clearly show the general and variform nature of present and potential crisis situations. They present a challenge to customary Cartesian logic because the dynamic of crisis does not lend itself to breakdown into independent subproblems. That said, we shall now take a more analytical approach to the crisis phenomenon and endeavour to define its principal dimensions.

1.3. The Crisis Dynamic

For the sake of simplicity we can identify three dimensions to the extreme turbulence characteristic of the crisis situation:

- (1) Crisis has the features of an *unfurling wave*. It overwhelms the usual instruments of management, rendering them useless and even counterproductive. It strips bare and leaves its stamp, that of incapacity.
- (2) Crisis throws things *out of order*, reducing operational mechanisms to uselessness. Worse, the mechanisms help to aggravate the situation. The result is helplessness.
- (3) Crisis causes a complete *break*. The missions and goals of the system have to be reconsidered, too. The break – a fault line through which many different eruptive manifestations may break out – calls for revisions that are not simply tactical or organizational but more fundamental, i.e. strategic and "political".

In combination, these three factors not only produce difficulties rather more serious than the norm but generate a very special phenomenon – the crisis dynamic.

1.3.1. Crisis as a tactical breakdown: when tools no longer work

The ordinary tools of routine management are basically characterized by their frame of reference, which is confined to the usual rules and patterns. The unexpected, the improbable, and, more still, the abnormal are not generally included (and it is best that this should be so for

the satisfactory running of stable systems). Before the event, questions that might call for radical changes to the system are not put. Of themselves, these facts explain why a crisis – consisting largely of the unexpected and the abnormal – will find the system at a loss. Operationally, these structural limits express themselves as serious constraints. Straining the analysis a little (though this is justified because processes become rigid in crisis situations), the conventional response systems may be said to be capable – but only capable – of:

- (1) Dealing with a limited number of difficulties at one and the same time.
- (2) Working at overload within fairly narrow margins and for a limited span of time.
- (3) Coping with relatively slow developments, not with complete breaks.
- (4) Acting within the framework of predefined regulations.
- (5) Operating within stable homogeneous units, not in the looser framework of networks whose contours and own dynamics are in a process of rapid change.
- (6) Mobilizing a limited potential of resources.
- (7) Processing information that is relatively accurate, reliable, and verifiable.
- (8) Applying to a specific part of a system, the latter – overall – being stable and well under control, the *ceateris paribus* condition here being an essential reference.
- (9) Dealing with a limited number of persons and representatives.
- (10) Dealing with difficulties in the framework of a trial and error process of which irreversibility and the critical gravity of the induced effects are not a feature.
- (11) Dealing with difficulties which are not immediately exposed to the glare of publicity, etc.

On all these points, a crisis is the exact opposite: difficulties pile up, the struggle is long term, the usual frameworks are in malfunction, action has to be taken at high speed, the basic rules have to be changed, the whole system starts resonating, the general aims are no longer known and no one knows how to formulate strategies and decide objectives, or with whom. The unfurling wave effect is not the only problem: things are out of order.

1.3.2. Crisis as an organizational breakdown: when regulations no longer operate

Crisis is to be recognized "not only by the growth of uncertainties and unknowns but also by the breakdown in regulations, i.e. the unfurling of

antagonisms and uncontrolled processes that are self-accelerating and self-amplifying" (Morin, 1981, p 16).

These basic mechanisms, acting in a time of considerable tension, can cause the headlong plunge into crisis. The following processes need to be considered in a crisis situation:

- (1) The system will, if anything, function less effectively than ordinarily. The corrective mechanisms cease to work and the pace of events heightens contradictions in contrast with the generally held notion that when there is a problem everyone rallies round and shows extraordinary dedication.
- (2) Indeed, mobilization is the exception rather than the rule. Instead of a general drive energizing a common action, one often witnesses the prudent withdrawal of a large number of potential sources of help. There are many individual organizations that see a crisis as a major threat to their position.
- (3) Neither will there be any mobilization of teams. Investigations show that, in unprepared structure, only individuals – wholly on their own in most cases – face up to problems ... watched in fascination, hypnosis, anxiety, or irony by those around them.
- (4) Nor will the very many channels of communication be set up that are necessary to link together the large number of organizations confronted with the problem. If there has been no advance preparation, the different parties involved are more likely to form separate islands. The situation of extreme tension and vulnerability is hardly conducive to the formation of these essential links.
- (5) Where there is a vital need for trust, the opposite is what usually materializes. It grows into conflict unless all concerned make serious preparation to fight it immediately. So, instead of shoulder-to-shoulder unity in distress, what dominates is latent or open conflict or even the sizing-up of opportunities for the settling of old scores.
- (6) The propensity to believe in myth is particularly acute because, in combination, the worries, uncertainties, rumors, and mysteries that are nursed increase the attraction of generalizing many people and organizations (this was particularly clear in the case of the disappearance of the Seveso drums). Instead each person, each entity, tends to rely on some item of information dredged out of the grey areas always present in a crisis situation for the assurance it gives (in terms of self-assurance and the conferring of some petty power that he, she, or it holds the key to the interpretation of the crisis and its solution).

Other avenues need to be studied and the analysis needs to be deepened but a central lesson is already to be learned from these

observations. It is that, given all these forms of disorder, what is wanted is not to counter all failures one by one but to understand that crisis is disorder and calls for other means of action.

1.3.3. Crisis as a "political" breakdown: when missions and goals no longer operate

A crisis is not simply the result of unsuitable tools or inadequate organizational capacities. It is the evidence of a deeper failing in the general context which structured the life of the system concerned up to that point. It is not the accidental failure of a particular element that is most to be feared but the vulnerability of a general sociotechnical architecture.

Tactical incapacity, of course, makes organizational inadequacies that much worse, and both together increase the exposure to basic vulnerability. Crisis results from the interaction of these three fault lines. Some of the examples already discussed clearly illustrate the point.

Seveso

The problem here was the helplessness of science, technology, organizations, governments, and states in the face of certain hazards of industrial society. During the summer of 1976 it was shown that extreme insecurity (irreversibility and incapacity) could arise from the very heart of technological development, so promising in other respects; the warning shot came from the chemical sector whereas many had expected it to come from the civil nuclear industry.

The Seveso Drums

Admittedly, tactical problems, such as customs procedures, were considered for a time, and more serious problems like waste management were raised, but the real issue related to more fundamental questions of waste production and industrial policy. Clearly anyone who perceived, in this situation, no more than a problem of customs papers or waste management would be incapable of understanding the essential factors of the crisis dynamic.

San Juan Ixhuatepec, Mexico City

The gas industry and its hazards were the first targets of post-accident activity but the tremor spread in many other directions as

well. Questions probed deeper and reached the crucial problems to which the disaster had given new force.

Searching light was thrown on the whole question of safety in Mexico. There were symbols: the big Azcapotzalco refinery located in the very heart of the capital in a district numbering a million inhabitants, the gas pipelines in poor condition threatening the whole of the north of the country and the airport, ringed by urban districts. More generally, there was the reality of an extremely fragile urban system. But there was some wavering. Where was one to begin? How much room was there to maneuver in? Would it be enough if the case were taken up?

There was a general clamor for spectacular measures. The President of the Republic set up a working group to study the problem of major industrial hazards that could be threats to Mexican conurbations.

But doubts were voiced. The difficulties of defusing the metropolitan powder keg of 17-18 million inhabitants are enormous, wrote *The News* on 26 November 1984. The newspaper recalled the editorial it had published a month and a half before the disaster, entitled "Exodus or urban Hara-Kiri", in which it had reviewed the reasons for successive failures in the efforts to deconcentrate the capital - the key to improving the safety situation in Mexico. Others smothered the immediate crisis in despair. "As usual, the government will do nothing" wrote *Proceso* on 26 November giving other and yet worse disasters as the only prospect.

Bhopal

The disruption went deep and took many forms. The headline in *Business Week* on 24 December 1984 was "Union Carbide fights for its life"; rarely was an accident to have so severe an impact on so powerful a firm.

In the wider context, the multinationals, and their relation with the Third World, were again potential targets. The chemical industry itself was faced with a frightening possibility: the fears attaching to the nuclear industry in particular might suddenly shift (this had already happened - at regional level - at Mississauga). The protection offered by statistical argument had gone and was now reversed. One quarter of a regional capital was hit. The images of warfare (chemical warfare) invaded the world of industrial hazards (the exact number of deaths in Mexico City could also, perhaps, have warranted a similar transposition).

Another unresolved question was what could happen if there were a repeat of this kind of rout or even a minor accident in an industrialized country (and it happened, in August 1985, in the Union Carbide MIC plant at Institute - the "cost" of this second incident being

perhaps higher for the image of the firm). Cumulative phenomena are to be considered. Perhaps Bhopal has laid a minefield for the future. Hence the acute nature of the subject which will leave its mark for many years.

To sum up:

- (1) A grave technical failure can affect a system in its key equilibria. A major accident may explode into a crisis, i.e. a process of extreme social disruption.
- (2) Several fault lines (tactical tools, organizational capacities, basic "political" factors) crisscross the post-accident stage. The very high number of factors clash with each other and the outcome depends on their interaction.
- (3) Everything may suddenly crystallize around an event of secondary rank which will overturn what has previously been taken for granted and trigger off the crisis in this or that direction. Attention to apparently harmless events is therefore essential without, however, sight ever being lost of the basic structuring of the setting on which the crisis plays itself out. In the famous words of Montesquieu, if the chance of one particular incident causes vast repercussions it is also because the general conditions existed to give it that destabilizing power.

1.4. Coping with Crisis

1.4.1. Tactical capacities for stabilizing an emergency situation

Speed is the essence of emergency action. The rule of thumb with the fire brigades is one minute for a glass of water, ten minutes for a tender, and one hour for a complete brigade. Chemical accidents and major hazards, however, set higher requirements: technical expertise for the direct handling of the accident, high-performance emergency organization resources, and overall planning fully capable of dealing with situations on a very large scale and lasting a considerable length of time.

Basic Arrangements

Several components have to be put together for all the necessary skills to be available. Briefly, these include (Cashman, 1983; Cumberland, 1982; Lagadec, 1983b): hazardous materials response teams; communications and advice centers; on-site emergency plans; off-site emergency plans; mutual aid systems.

But the important thing today is to make sure that they are still really operational instruments and that their scale is sufficient to cope with a major situation.

*Emergency Arrangements Scaled to Match
the Major Chemical Hazard*

The gravity of the hazards entailed demands nothing less than excellence in the quality of the response systems. The following points need particularly careful attention.

Knowledge of effects and their range. Very special attention needs to be drawn to this essential point in the case of major hazards. There are numerous manuals and data sheets on the dangers associated with chemicals but the information they give relates more often than not to the action to be taken in the event of an accident at work affecting a limited number of staff. What are needed now are appropriate documents for major releases that may affect large populations.

Without this knowledge of the range of effects, emergency action can only be tentative. This is obviously a "burning" issue. Investigation would show that in many cases the distance separating a plant from an urban area (a few dozen meters, except in the explosives industry where the lessons of the many accidents that happened during the 19th century have been heeded) is too small. Apart from anything else, this raises big legal questions: if expropriation proves necessary, who foots the bill? So far, no one wants to grasp the nettle.

Homogeneity and coherence of arrangements and measures. It is vital to consider a given installation in the setting of the broader system of which it is part. Two points call for special attention: overall knowledge of the hazards in the zone where the dangerous installation is located (Health and Safety Executive, 1978, 1980; Rijnmond Authority, 1982); comprehensive emergency planning (Gray and Quarantelli, 1981; Quarantelli, 1981).

Informing the population (and the workforce). A population informed about the hazards of the place where it lives and knowing what to do in the event of an emergency is that much less vulnerable, as many examples show. But this social awareness of hazards is largely lacking, and the reflex action ensuring safety and protection even more so. It is therefore to be feared, for instance, that, in a situation where the population has to be under strict instructions to stay at home, there will quickly be an uncontrollable flood of people onto the roads.

The European Economic Community (European Communities Council, 1982) Seveso Directive requires that this information be given to

populations. In many cases, the leeway to be made up will demand a considerable effort. There is one prior condition, however, that is not always met. Information within the firm itself is sometimes inadequate.

Systems that are alive: planning rather than plans. Emergency arrangements work only if they are alive, i.e. if their quality is constantly being improved. The purpose of a plan is not to buy cheap reassurance. The authorities that bore the heavy responsibility of bringing the Mississauga accident under control warn against the traditional inadequacies of emergency plans. Three words – "No paper plans" – sum up their message. As Inspector Silverberg put it (Silverberg, 1983):

- (1) "Emergency planning is a continuous activity requiring participation and understanding of all government departments, agencies, voluntary groups, private sectors" (p 18).
- (2) "Paper plans that have been developed without consultation with all interested departments are of little use" (p 18).
- (3) "The heart of emergency planning is: an active process of review, consultation, exercises and training to develop teamwork and preparedness" (p 18).
- (4) "An emergency plan must accurately reflect existing operational capabilities and resources. Many written plans reflect more co-ordinated planning than actually exists. Actual participation is a must by all concerned in the planning effort" (p 19).
- (5) "'Compliance' plans or 'generic' plans represent little or no real planning activity at local level and have often been produced to satisfy government requirements" (p 20).

Even if a serious effort of preparation is made, doubt or at least caution, must constantly be kept alive in the minds of those concerned. The major event is not controlled that easily. Very relevantly, the same Canadian official notes:

- (1) "Warning stage is important – but remember – a disaster can occur so fast that there may be no time for warning" (p 28).
- (2) "Don't assume your communication system is going to work" (p 28).
- (3) "Remember: the reality of impact totally changes the environment" (p 28).
- (4) "No exercise will fully reproduce the actual atmosphere of a disaster" (p 22).
- (5) "Co-ordinated effort among technical sectors that may not work together during normal times is a vital aspect" (p 23).

- (6) "There are no such things as purely technical decisions: political factors are more prominent than ever during aftermath of disaster. Prepare policy makers and administrators to deal with the problems they will face" (p 23).

1.4.2. Organizational capacities able to bring the runaway dynamic under control

A major accident causes more than just an emergency situation and the mobilization of relief teams. It sets off a turbulence which puts vast systems to the test and penetrates far deeper than just the outer fringe of the organizations concerned. The major hazard creates the need for a real "organizational defence in depth" allowing the general momentum generated by the event to be brought under control. Often the problem is not really grasped because, here too, there is an implicit clinging to the "accident" concept for which the front-line action of the emergency services will suffice.

Crisis is different. It is a situation in which a large number of organizations, wrestling with critical problems, exposed to intense external pressures and acute internal tensions, and placed in mutually conflicting positions and stances, are suddenly and for a long period of time thrust to the front of the public stage in a society of mass communications – in other words, they are "live" – and are guaranteed an unflinching place in the headlines of press, radio, and television (Lagadec, 1984a).

An Organizational Culture that often Excludes the Possibility of a Major Accident

The problem would be simple if organizations merely had to put together response plans for the major accident eventuality. But there are many other prior needs at a more fundamental level. The real basis on which organizations' response capacity is founded consists of their customary references, their standards – in other words, their "culture". Before considering what tools to provide or rules to follow, therefore, we need to explore these basic springs of action which regularly inhibit the preparation, initiation and control of the necessary response.

Mindset. The case studies that have been made teach one very first lesson: if problems of major hazards, crisis, and the exceptional are not part of the culture of an organization, it will be incapable of responding with the rapidity, skill, capability, and perseverance

required. Worse still perhaps, the unexpected and the abnormal will cause paralysis and reactions that will aggravate the situation.

It has to be understood that here we are up against deep-lying difficulties: the morale of the organization and the stability necessary for daily routine do not welcome any admission of the exceptional. It is only recently that the reality of major accidents has become clearly evident. The subject itself seems fraught with menace: would not even recognizing it be a kind of acceptance of "defeat"?

These reasons explain the reluctance there often is to tackle the problem frankly. That being so, organizations find themselves at a serious loss if the major accident happens. The whole of their system of representation is caught with its flank exposed, which sets off a chain reaction of difficulties.

Helplessness in the face of the "unexpected". Many recent cases yield a disturbing diagnosis. Unwilling to consider even the idea of an exceptional disruption, organizations tend to enter into crises awkwardly, "backwards" so to speak. "Too late and too little" would seem to be a fair description of all their attempts at response.

Exaggeratedly sometimes, the organization goes through a chain of difficulties:

- (1) It shuts its eyes to the many signs that precede the crisis in most cases.
- (2) It decipheres the start of the crisis a long time after many other key actors.
- (3) Hypnotized by the unexpected, the "unthinkable", its first reaction is to shrink back into itself when, on the contrary, it ought to be multiplying its relations with the environment. This is the period of (suspect) silences, the "no comment" statements (particularly dangerous for the organization's credibility), the denials that mislead no one (except perhaps their authors, which is serious), and hasty statements of the kind "everything is under control", immediately interpreted as meaning that the situation is completely out of hand.
- (4) The organization puts up the shutters, cultivates the "fortress under siege" spirit, breaks up into a multitude of islands eyeing each other watchfully, and soon offers itself as an easy victim to the crisis and those who know how to benefit from it. When (for example) too many denials have been disproved by the facts and television pictures, the organization's room for maneuver is seriously curtailed. It is then likely to harden its attitude still further and worsen its position unless those in charge are able to intervene and get different strategies adopted – a change of heading it is very difficult to obtain when the storm is at its height.

We would stress one capital point: these processes can happen at breathtaking speed. Take the example of the *Mont-Louis*, the French ship which sank off the Belgian coast in August 1984 with drums of uranium hexafluoride in its holds.

In less than 24 hours, after Greenpeace had sounded an immediate alarm and following the silences and labored denials of the organization in charge of the cargo, the Belgian Environment Minister accused the French Government, on radio and television, of concealing the truth. Amusingly, the Belgian Minister, while violently denouncing the fact that his country had been unable to obtain the slightest piece of information about the ship's cargo and the dangers incurred by his country, gave assurances in his statement that the country was at no risk. In 24 hours the custom of the immediate "reassuring" denial had thus placed not one, but two, governments (and certain firms or agencies in the nuclear industry) in a very uncomfortable position vis-a-vis the ecologist organization. The latter – again following habit – then threw away its advantage by making wild exaggerations, thus enabling those responsible to extricate themselves from a very difficult position. Although the risk, in the opinion of the specialists, was minimal, the culture of the organizations involved had very nearly converted a minor accident into a "media disaster".

The point to remember, therefore, is that even before the rules for responding to an emergency situation could be brought out of the safe, the "culture" of the organization had had the time to do considerable harm. So what purpose do writing clear press releases, holding press conferences, showing one knows the facts, and so on, serve in such circumstances? It is extremely difficult for even the best tactical measures to rescue an organization from a strategic defeat.

So the first requirement to help an organization respond more successfully to a crisis is not to provide it with a list of instructions. The essential need is to look carefully at the deep-lying culture from which its reactions spring. Once again, it is difficult to sidestep this deep-lying culture. There is every likelihood it will surface (and violently) at a time of crisis. In communications, for example, a professedly outgoing policy pasted artificially over a culture of secrecy will not last long, and the idea that things are being concealed will quickly gain ground. So mere recipes will not do.

Crisis Management Aptitudes

A great deal of work would be necessary to draw up organizational rules for crisis management. The case studies that have been produced, however, tell us that the ability to develop a proactive attitude both inside the organization and towards the outside world is an important precondition.

The following points need to be considered.

- (1) *Recognition of the reality of the major hazard.* The traditional reaction rejecting any review of this subject on the grounds of the need to show "optimism" has to be scrapped. "Clear thinking" is not necessarily synonymous with "catastrophism" or "anti-industrial attitudes".
- (2) *Knowledge of the major hazards that could concern the organization.* Here, other references than just statistics and habits need to be brought in. The rare event may in future carry just as much weight as all accumulated experience. Marginal logic is no longer the only desirable intellectual reference.
- (3) *The ability to recognize, quickly, the onset of crisis conditions and to manage the information collected without delay.* The point is well illustrated by the case of the *Mont-Louis* already referred to. It may be analyzed briefly as follows. A business enterprise has to perform an ongoing mission. It therefore tends to concentrate on the large masses, the regular event. The role and interest of the press and critical groups is to highlight the exceptional. These are two opposite cultures which have developed different response modes and tools. The latter set of actors possesses extraordinary capabilities in this respect: gathering of information, the swift reporting of that information, and immediate distribution. Public and private officials have duties, of course, which oblige them to exercise more prudence – which explains some delay in their response.
- (4) *The ability to bring swiftly to life a network of actors relevant to the crisis.* The collection of information, the analyses that have to be made, and the decisions that have to be taken imply that a large number of relationships – often new ones – have to be woven immediately within the organization and with the outside environment. Existing conflicts, the absence of previous links, and differences in "culture" between the organizations concerned greatly impede the development of the necessary cooperation. Very often, a new mode of operation will become established only after the higher levels of authority, recognizing the seriousness of the situation, demand the necessary changes. But it is still difficult for them to modify the culture of their organization at a time when it is dangerously exposed and therefore on the defensive. The capability of proactive response has to be developed beforehand.
- (5) *The ability to work with the media.* Here again the basic culture of the enterprise is deeply involved. Particularly in Europe, the rule of secrecy is often all-powerful. There are reasons for it, but the dangers of too uncommunicative an attitude have to be

carefully weighed. Journalists do not simply ask for information and wait for those responsible to be kind enough to give it to them. They are professional information hunters and not easily put off. To dispel the illusions that have long been held on this subject, it is sufficient to remember the ingenuity of the journalists at Three Mile Island (Scanlon and Alldred, 1982; Sandman and Paden, 1979). Donald R. Stephenson (Director, Corporate Communications, Dow Chemical, Canada) sets out very clearly the attitude needed in this field where the proactive approach is often tragically absent:

1. The public must be fully informed frequently and accurately through the media, from the outset. This must be done by one or two highly credible senior spokesmen who understand the situation and can explain it calmly and clearly in lay language. The first 24 hours of a crisis are critical.
2. If this is not done, a public information vacuum probably will develop rapidly – and be filled by rumors or alarms far worse than the real situation.
3. Silence in the midst of a crisis implies guilt, whether justified or not.
4. It is not enough merely to assure the public that everything is O.K. and there's no reason for alarm. To be credible, we must provide details of how that conclusion is drawn.
5. It is vital to realize that reporters face deadlines hour by hour. Information must always be correct, consistent and current, even if all the answers aren't immediately available.

These are principles that many top executives and operating managers find hard to adopt. They fail to understand the urgency of the situation or the implication of delayed response. They are inclined to try to smother bad news rather than air it. (Stephenson, 1984, p 3)

With J. Scanlon, one must stress the crucial importance of this capacity to manage information in a crisis. In an open Information Society there can be no division drawn between operations and communication. Anyone who cannot control information problems can have no control over the operational conduct of the emergency situation.

- (1) "An emergency, among other things, is an information crisis and must be treated as such" (Scanlon *et al.*, 1982, p 31).
- (2) "to a considerable extent whoever controls the access to information, whoever is the source of information becomes the center of operations and control; and if you don't have communications systems operational, if you can't disseminate it, then you also lose

the power to have operational control and it will shift to whoever has that" (Scanlon, 1982, p 17).

- (3) "communications are so important in the aftermath of disaster that the centers of communication may well be the centers of operational control as well" (Scanlon, 1975, p 429).

Tactical capacities and organizational aptitudes form a whole, but another dimension of response is needed to complete the picture: the ability to run the system caught in the turbulence of a crisis.

1.4.3. Management capacities

The major accident and the crisis dynamic – where weighty issues are at stake – are problems for top management. Here, too, basic references have to be completely changed. The "incident" used to have only marginal effects and could be handled by the relevant specialized technical service. A major accident can derail or even fatally damage the systems concerned. Today, managements of both public and private organizations have a duty to recognize and explore this "new frontier" and bring it under control. With brutal suddenness, Bhopal revealed the critical importance of these matters for the heads of firms and public agencies.

The men in top management must arm themselves with the specific management capabilities necessary for controlling crisis situations and prepare their organization as a whole to withstand such conditions. Their task is also, of course, to take every step to prevent major accidents and to make their constant concern the anticipation of problems, without which their field of maneuver could be extremely narrow.

Managements in the Eye of the Storm: Controlling Systems in a Crisis Situation

From a study of recent cases, it is possible to identify a number of important requirements for the managements of systems faced with a crisis dynamic:

- (1) *Put the organization on a "crisis mode" footing.* This is a question of swiftly actuating the patterns of thought, arrangements, and behaviors that the organization (and not just the emergency services) needs to adopt to be in a position to cope with the situation in every respect instead of waiting for the crisis to attack each of the subsystems concerned one by one.

- (2) *Initiate an ad hoc data collection and analysis system.* Crises require the capture and verification of information received via infinitely more diversified channels than in ordinary circumstances. They also demand a continuous effort of interpretation on the basis of unusual and very exposed criteria and models. In particular, special attention has to be paid to the gross intellectual mistakes that lead to fundamental errors of judgment and persistence in those errors, each fresh item of information being forced (to the point of absurdity) into the frame of logic adopted. In spite of the absolute need for resolute and immediate action, the functioning of the organization must leave room for caution about the hypotheses that are formulated and for the active and critical clarification of the implicit hypotheses behind the reasoning. In particular, the system that management perceives may not be the real system: the gap between the two needs to be studied without delay.
- (3) *Make sure no gross mistakes and blunders are made at the very outset.* It is not unusual for some subsystem in the organization to act on its own initiative, without coordination, obeying reflexes wholly inappropriate to crisis conditions, e.g. the overhasty issue of a press release claiming "nothing has happened" or "everything is under control". Foolishness of this kind can gravely compromise the position of the management (particularly if committed in its name) or necessitate disclaimers which would be highly inopportune, this not really being the time for an outbreak of internal strife. It is vital to identify these untimely initiatives that the organization might be tempted to take at the earliest moment – and prevent them happening.
- (4) *Strive to maintain the organization's internal coherence and capability.* As we have seen, the crisis dynamic sends tremors through the organization, causes cracks to appear in its structure, sows doubt about its objectives and fundamental missions, weakens allegiances, resurrects bitter conflicts, etc. Soon the system has broken up into so many islands all behaving like little besieged fortresses. Immediate steps have to be taken to counter these destructive tendencies by reclarifying the key dimensions of the life of the organization: its missions, policies and strategies, the rules of communication, the rules for the settlement of disputes, etc. No imprecision must be allowed to prevail about these very foundations of the life of the system. The beginnings of any internal contributory factors – conflict, rumor, or inertia – must be identified and dealt with immediately. Here again, the management must be constantly questioning itself on the gap between its perception of the system and the system's real state,

- and constantly checking to see that its decisions are effectively put into practice and produce the effect desired.
- (5) *Maintain and develop the organization's external capacity.* Whereas the natural tendency is for the organization to shrink into its shell, it must – on the contrary – strive to increase relations with its environment. This rapid deployment of relational systems is necessary in order to be able to receive and give out information and to implement actions with hitherto unfamiliar organizations. Efforts need to focus on two main areas: the operational and decisional system and the media. One of top management's tasks in this respect is to check the quality of the relationships that are established, in particular the level (position in the hierarchy, authority, and power) of the persons with whom links are made.
 - (6) *Informing the public.* It is a critical question in a crisis situation and this is therefore one of the important functions of which management must take direct charge (which implies new patterns of internal operation in this respect if the public relations departments are not of the highest status in the company).
 - (7) *Manage the time factor.* A constant, questioning watch must be kept on the development of the crisis. Every time a decision is taken the question must be faced: What's next? The purpose is to prevent incoherence over time and, more fundamentally, to ensure that the response to the crisis dynamic escalates as time goes by.
 - (8) *Be on the alert for any possibility of incipient crises breaking out on other fronts.* Frequently the scale of a crisis will grow as a result of certain details that the organization, paying little heed to questions that seem to be of secondary importance, fails to attend to quickly enough. Managements need to keep a careful and constant watch for the outbreak of any subsidiary crisis on a secondary front. The typical example is the case of the 41 dioxin drums from Seveso. Every "suspect" waste dump could become the main factor of the crisis within 24 hours. Managing a crisis is managing a kaleidoscope: a slight shift can change the scene completely.
 - (9) *Strive constantly to enlarge the organization's room for maneuver.* The reference here is to the need to combat a regular effect of crises which is the overhasty and heavy-handed closing off of many possibilities.
 - (10) *In addition to running the organization concerned, work for the development of the overall system affected by the crisis.* While the tendency is for the organization to turn inward on its own problems and plans, top managements should take their part in the more general moves. They should consider what initiatives might be taken and give the help that outside actors may need.

Possibly they should lay the basis for a new general configuration of the system concerned and then define new places in it for the organizations involved. Managements' tasks in a period of crisis extend far beyond merely defending the immediate and specific interests of the organizations for which they are responsible.

Preventing the Major Accident and Preparing the Organization for Crisis Situations

The precondition: mindset. Again, there can be no decisive progress in the control of major hazards and crisis situations without a clear awareness and recognition of the reality of the challenge and what is at stake. This is necessary in order that the required stimuli come from the top and so that the example of the upper echelons consolidates the progress to be made in the organization as a whole. The rule is simple and obvious, but putting it into effect is certainly more difficult. After years and decades of not doing enough in this respect, changes of attitude cannot be brought about without a great effort (Mitroff and Killmann, 1984). And yet it is here that the key to all the actions to be launched or developed to prevent major hazards and crisis situations and secure greater control over them is to be found.

A decision-making system reorganized to include the major hazard question. One primary objective is essential: safety has to be made a goal, field of decision, and problem for top management. To that end, there are several operational rules that senior executives need to institute or strengthen:

- (1) *There has to be a clear perception of the safety options.* For this to be so, safety options have to be perceived as decisions (not simply "technical" provisions) at all levels of the organization and the choices made with regard to location, design, maintenance and management need to be perceived as safety decisions.
- (2) *Safety problems must be given specific expression.* The danger is that technical, economic, and administrative considerations will overshadow safety questions. To avoid this trap, organizational systems need to be designed in which specific account can be taken of safety. For example, the head of a plant – whose duty is to develop his establishment – should not be the only architect of safety options and the only channel for conveying those options to top management. An internal critique on safety matters, via recognized organizational machinery, must be possible and must have every opportunity to express itself at top management level. There is no point in hiding the fact: the management of safety is another industrial bargaining situation. If certain equilibria are

not secured, there is little likelihood of safety questions being given proper consideration.

- (3) *Decision-making levels have to match the importance of the issues.* A major question for top management is whether hazard problems are not covered up at the lower echelons, the danger being that there may be undivulged trade-offs at the intermediate levels based on considerations that are too narrow in the light of what is at stake. Here again, it is important to ensure that the organizational system guarantees the upward flow of information, including proposed decisions. A point worth noting is that if every organization dealt with safety questions at the right level, communication between levels would become immediately easier. In short, the question for the senior manager in the private or public sector is whether he commands an internal organization that enables him to exercise his decision-making powers effectively in safety matters.

Specific prevention efforts. In view of the surprises that came out on the occasion of the alerts and accidents discussed earlier, a first step for managements in the public or private sector could be to produce a diagnosis of the situation regarding safety problems in the systems they are responsible for. A number of audits would make it possible to identify any major technical or organizational shortcomings.

The object would be to ensure there was no chance of suddenly finding situations like those there were at Flixborough or Canvey Island:

It was clear that no-one concerned in the design or construction of the plant envisaged the possibility of a major disaster happening instantaneously. (Department of Employment, 1975, p 36.)

During the preliminary visits to the premises selected for detailed assessment, the investigating teams were reassured to find that, where hazardous materials were being processed, handled or stored, the managements were generally very responsive to matters of operational safety. Where relevant codes of practice were available, these had been taken into account in the design and construction of plant and facilities. However, these visits also established that none of the companies concerned had made a systematic attempt to examine and document those few potentially serious events which might cause accidents among people in the surrounding community. (Health and Safety Executive, 1978, p 8.)

Similarly, the safety assessment which the French authorities requested be made at the Union Carbide plant at Béziers, after the Bhopal disaster, revealed certain problems at the works but, more

particularly, some very serious shortcomings in the system for transporting MIC between Fos (near Marseilles) and Béziers. Studies like these – which need to cover both software and hardware – are essential for decision-makers in public and private sectors. They supply a snapshot of the safety of their system, an information base enabling them to determine priorities, and an opportunity for displaying, internally and externally, the importance they attach to accident prevention.

Thus the exercise can be not only a tool of investigation but, at the same time, (1) an effective lever for propagating that internal culture of the organization, making it more sensitive to major hazard questions, and (2) a valuable talking point in the social discussion which unflinchingly develops on the subject of major hazards.

This last point is worth stressing. It is vital to have accurate references in these discussions that always threaten to get out of hand when fear, suspicion, and the imagination rule the mind. It was one of the lessons of the studies carried out at Canvey Island. The work done by the Health and Safety Executive and the publications it produced helped not only to reduce appreciably the hazards in the area but also to ensure that the social debate had a solid basis (Lagadec, 1979; 1983a). The British Government had every right to say in its second report on the zone in 1980:

We regard the report as a watershed – a unique, pioneering exercise which will prove to be a major turning point in risk assessment work. The report aroused extensive interest in the U.K. and around the world, far beyond the sphere of those having a direct local concern. In its range and depth the report provided, and still provides, a potent stimulus to the debate about risk assessment techniques and the practical decisions which have to be made about the relation between potentially hazardous industry and people who live and work nearby. (Health and Safety Executive, 1980, p iv.)

Decomartmentation and Opening Up to the Outside

The "ordinary" accident was something that stayed within the confines of the firm, but the major accident makes its effects felt far beyond and strikes at the surrounding communities. The consequence of this new state of affairs is immediate: the outside world demands an explanation from the company and even the right to look behind the scenes in industry. Clearly, such demands are unprecedented and a shock to the industrial culture previously sheltered by its protective walls.

Facilitating adaptation to these new social requirements is a matter for senior management. It becomes important to engineer new strategic positions defined in terms of credibility and legitimacy. It

becomes necessary to be able to supply accurate information, to embark on programs of internal transformation, etc. Authority or invoking "Science" and "Progress" no longer carry enough weight. They are even suspect, and therefore counterproductive. The major hazard requires the company (but it is also true for the public agencies concerned) to be able to justify its activity by far more open yardsticks than those previously used.

Several initiatives can be taken along these lines. One is to accept (as is tried in France) that safety assessments be reviewed by external experts reporting to the public supervisory authority and another is to make safety reports public (not including certain passages which would otherwise reveal industrial secrets but whose absence does not affect the understanding of the text). A few years ago, this kind of possibility would have seemed unthinkable. The major hazard has made readiness for this more open type of policy advisable or even essential. But there are two possible approaches, one reactive and the other proactive. The latter offers valuable strategic advantages to a company in terms of consolidating its position in the event of a crisis (which always remains a possibility even when the maximum is done in the way of prevention).

A case of considerable significance for the future: Union Carbide's strategic decisions following the Bhopal disaster. On 20 March 1985, Mr Warren Anderson, Chairman of Union Carbide, announced the following decisions (Anderson, 1985, pp 2-3):

1. There'll be intensified sampling procedures, training and retraining sessions, process review and countless administrative and physical changes.
2. Our overseas locations will face three times as many company safety audits this year, compared to 1984. And there'll be a significant increase in such audits at our US sites as well.
3. A new committee of the Board of Directors is meeting semi-monthly to handle health, safety and environmental affairs. Head of the committee is Union Carbide director Russel Train, first administrator of the Environmental Protection Administration and presently president of the National Wildlife Foundation. Mr. Train has been a director of Union Carbide for the past eight years.
4. Another significant change established a new committee of top-level management on risk assessment, reporting directly to Union Carbide President Alec Flamm. This brings to the highest level of the corporation compliance reviews of our facilities that handle hazardous materials.

These key decisions are evidence of a qualitative change in an industrial group's policy towards safety matters. They deserve most

careful attention by everyone concerned and, first and foremost of course, the whole of the chemical

These key decisions are evidence of a qualitative change in an industrial group's policy towards safety matters. They deserve most careful attention by everyone concerned and, first and foremost of course, the whole of the chemical industry.

A Third Path of Action: Anticipating Risks and Vulnerabilities

Working with the future in mind and preparing for changes of direction a long time in advance are increasingly necessary as systems become more complex and the bearings that are set become more difficult to alter. If hazards and vulnerabilities are not anticipated, efforts to prevent and, all the more so, efforts to control crisis situations will be severely handicapped. Two main directions need to be investigated although our reference to them here will be very brief.

Internal development: hazards "in ovo" in the chemical sector. Several different starting points can be taken, including hazards associated with: expected new products; new manufacturing, transport and storage technologies; new forms of business organization (computerization, early retirement with the loss of long-experienced staff); new strategies such as the development of biotechnologies, the relocation of the basic chemical industry in the Third World, and the development of certain fine chemical sectors.

The more general setting: underlying trends in the environment of the chemical industry. The question of major hazards associated with dangerous substances arises in a setting in which conditions are becoming significantly more fragile. Some aspects are:

- (1) *The geographical interspersal of industrial and urban activities.* This is already raising the problem of the distance separating industrial plants from urban areas. New legal provisions need to be developed. A vital subject is compensation.
- (2) *The development of networks and structures of activity through which havoc-creating chain effects are possible.* The safety of dangerous substances, for example, might be imperiled by destabilizing accidents affecting wide-ranging geographical areas. In November 1981, the Lyons region (1 million inhabitants) was cut off from the outside world following a fire in a telephone exchange. Even key government links were severed because they, too, went through the same exchange. What would have happened if some kind of major accident had happened demanding trunk communications on a massive scale?

- (3) *The economic crisis.* This may have serious repercussions on firms' safety in two ways: risk-taking increases and resources allocated to control and safety (primarily maintenance and supervision) are reduced.
- (4) *Trends and changes in the social "demand" for safety.* It is clear that what until recently was regarded as "acceptable" will no longer be so in the future. More than that, any major accident may completely change perceptions and requirements. This was brought out in Ontario, following the Mississauga accident. Hazards became a far more prominent subject in people's minds and the subjective rankings of various hazards were radically reordered (Burton *et al.*, 1983). The subject of many opinion polls was the general perception of science and technology; it would be wise to look into the far-reaching consequences in this field of disasters like Bhopal. Such a survey, based on these considerations, was conducted in France in March 1985 (SOFRES, 1985). Here are some of the findings:
- (a) Public opinion is concerned about major accidents. Asked whether they thought accidents like those in Bhopal and Mexico City could happen in France, 3% said it was inevitable, 55% likely, 32% unlikely, and 2% impossible. Conclusion: the theory of the perfect control of technological systems prevalent in the 1960s and 1970s can no longer claim credibility.
 - (b) The subject of major hazards attracts much attention. Asked if there were too much or too little said about the technological risks that existed in France, 21% answered "too much" and 67% "too little" (12% said they didn't know). Conclusion: there is a definite demand for information on the subject.
 - (c) Opinion is divided about how seriously the problem is being tackled. 44% said everything was being done to obviate technological hazards and 39% said not everything was being done (no answer: 17%). These figures give food for thought on the position that the main actors would be in were a major accident to occur.
 - (d) The public do not seem to have much confidence in those with primary responsibility – heads of businesses in particular. Asked in whom they would put their trust to take effective action to reduce technological hazards, 30% replied "central government", 5% "local authorities", 9% "heads of businesses", 14% "staff of the firms concerned", 45% "accident prevention specialists", 4% "the general public", and 2% "no one" (8% did not reply). Conclusion: here again the position of business managements would be problematic in the event of a major accident.

- (5) *The problem of sabotage and terrorism.* For obvious reasons this point will not be discussed here, but the brevity of the reference should not be misinterpreted. This is one of the gravest questions that those in charge at the highest level need to go into.

On these latter points, as on those referred to earlier, what remains to be done is to set up groups to exchange views and formulate proposals. Their purpose would be to go more thoroughly into the problems arising and to identify the strategic innovations that need to be introduced before the room for maneuver is seriously curtailed by the absence of any response and before, above all, a major event – but in a highly developed country this time – overturns the technical, economic, and cultural framework in which it is still possible to think out and handle problems of major hazards and crisis situations.

1.5. Conclusion

Tactical tools, organizational flexibility, strategic capability: at each step along the way research requirements are apparent. They concern a very large number of disciplines, and the problem, no doubt, is less a question of how to identify the many different demands to be met than of how to prepare the ground for fruitful investigation.

Certainly a first need is to bring together all the approaches and disciplines. The crisis dynamic is a general movement and approaching it in too compartmentalized a fashion – the classic temptation – would be dangerous. The second need is to observe, very firmly, the requirement for research to stay very close to reality in all its complexity and keep a healthy distance from models more satisfying to the intellect than in their relevance. This presupposes that the research scientist has access to data, which is, as yet, extremely difficult: the crisis situation is, by definition, critical for those involved, and that makes the quest for information particularly arduous.

Here, industrialists, senior public officials, and research scientists have to invent, as a result of discussion and experiment, new rules for work and for the exchange of information.

Many of these skills, incidentally, could be found among specialists in international relations who have been exploring the field of crises in that area for many years. But let there be no illusions: even in that field which is so crucial for mankind, the crisis question is far from being under control:

Crisis management is an overly polite description of U.S. activities. What we really have is crisis coping and adaptation

(Richard Beal, a senior director for crisis management systems and planning at the White House, *Science*, August 1984, p 907).

According to a host of current and former NSC [National Security Council] staff members, much of the information available in a crisis is useless or incorrect; decision-makers have little or no crisis experience; careful planning is inadequate (Richard Beal, *Science*, August 1984, p 907).

No one holds the key to the problem. Dangerous substances, major hazards, vulnerability, crisis dynamics: the foundations necessary for fruitful work and collaboration urgently need to be laid, with determination and humility and bearing in mind the words of Warren Anderson: "We're learning the lessons of Bhopal and we'll be doing so for a long time to come" (Anderson, 1985, p 3).

References

- Anderson, W.M. (1985), *Concluding Remarks*, Union Carbide Corporation Press Conference, 20 March.
- Burton, I., Victor, P., and White, A. (1983), *The Mississauga Evacuation*, Final Report to the Ontario Ministry of the Solicitor General (The Institute for Environmental Studies, University of Toronto).
- Cashmann, J.R. (1983), *Hazardous Materials, Emergencies - Response and Control* (Technomic Publishing Co., Lancaster, PA).
- Cerrutti, G. (1977), Cent jours à la dioxine, *Survivre à Seveso* (Maspéro-Presses universitaires de Grenoble).
- Conti, L. (1977), *Visto da Seveso* (Feltrinelli, Milan).
- Cumberland, R.F. (1982), The control of hazardous chemical spills in the United Kingdom, *Journal of Hazardous Materials*, **6**, 277-287.
- Department of Employment (1975), *The Flixborough Disaster*, Report of the Court of Inquiry (HMSO, London).
- European Communities Council (1982), Council Directive of 24 June 1982 on the major-accident hazards of certain industrial activities, *Official Journal of the European Communities*, 5 August.
- Gray, J., and Quarantelli, E.L. (1981), Social aspects of acute chemical emergencies, *Journal of Hazardous Materials*, **4**, 309-397.
- Health and Safety Executive (1978), *Canvey, an Investigation of Potential Hazards from Operations in the Canvey Island - Thurrock Area* (Health and Safety Commission, HMSO, London).
- Health and Safety Executive (1980), *Canvey, an Investigation of Potential Hazards from Operations in the Canvey Island - Thurrock Area* (Health and Safety Commission, HMSO, London).
- H'rouda, P. (1985), *Fuite de gaz dans une fabrique de pesticides en Inde. Bhopal, lundi 3 décembre 1984*, Mission d'observation Médecins Sans Frontières; Société Française de Médecine de Catastrophe/Convergences Médicales (SAMU-94 Hôpital Henri Mondor, Créteil).

- Lagadec, P. (1979), *Le problème de la sûreté d'un grand complexe industriel: Le cas de Canvey Island* (Laboratoire d'Econométrie de l'Ecole Polytechnique/Service de l'Environnement Industriel du Ministère de l'Environnement, Paris).
- Lagadec, P. (1981a), *Le Risque technologique majeur – Politique, risque et processus de développement*, Collection Futuribles [In English: *Major Technological Risk – An Assessment of Industrial Disasters* (Pergamon Press, Oxford, 1982)].
- Lagadec, P. (1981b), *La civilisation du risque – Catastrophes technologique set responsabilité sociale* (Editions du Seuil, Collection "Science ouverte", Paris). In Spanish: *La civilización del riesgo – Catastrofes tecnológicas y responsabilidad social* (Editorial Mapfre, Madrid, 1984).
- Lagadec, P. (1983a), *Le problème de la sûreté d'un grand complexe industriel. Le cas de Canvey Island. 1978–1982* (Laboratoire d'Econométrie de l'Ecole Polytechnique; Service de l'Environnement Industriel du Ministère de l'Environnement, Paris).
- Lagadec, P. (1983b), *Dispositifs de gestion de crise* (Laboratoire d'Econométrie de l'Ecole Polytechnique; Service de l'Environnement Industriel du Ministère de l'Environnement, Paris).
- Lagadec, P. (1984a), Le Risque technologique majeur et les situations de crise, *Annales des Mines*, 8, 41–53.
- Lagadec, P. (1984b), Risques technologiques et stratégies de communication – L'affaire des 41 fûts de déchets de Seveso (septembre 1982–juin 1983). Laboratoire d'Econométrie de l'Ecole Polytechnique – Service de l'Environnement Industriel du Ministère de l'Environnement.
- Lagadec, P. (1985), *Défaillances technologiques et situations de crise. La catastrophe de San Juan Ixhuatepec – Mexico, 19 novembre 1984* (Laboratoire d'Econométrie de l'Ecole Polytechnique, Paris).
- Mitroff, I, and Kilmann, R.H. (1984), *Corporate tragedies – Product Tampering, Sabotage, and Other Catastrophes* (Praeger, New York).
- Morin, E. (1981), Preface, in M. Salomon, *L'avenir de la vie* (Editions Seghers, Paris).
- Pecorella, G. (1977), *Qui va payer? Survivre à Seveso* (Maspéro-Presses universitaires de Grenoble).
- Quarantelli, E. L. (1981), *Socio-Behavioral Responses to Chemical Hazards. Preparation for and Responses to acute Chemical Emergencies at the Local Community Level* (Disaster Research Center, Ohio State University, Columbus, OH).
- Quarantelli, E. L. (1983), *Evacuation Behavior. Case study of the Taft, Louisiana, Chemical Tank Explosion Incident*, Final Report for the Federal Emergency Management Agency (Disaster Research Center, Ohio State University, Columbus, OH).
- Rijnmond Authority (1982), *Risk Analysis of Six Potentially Hazardous Industrial Objects in the Rijnmond Area*, A report to the Rijnmond Authority (D. Reidel, Dordrecht).
- Sandman, P. and Paden, M. (1979), At Three Mile Island, *Columbia Journalism Review*, 18(7–8), 43–58.
- Scanlon, J. (1975), Crisis Communications in Canada, in B.D. Singes (ed), *Communications in Canadian Society*, 429–443 (Copp Clark, Toronto).

- Scanlon, J. (1982), *Crisis Communications: The Ever Present Gremlins* (Emergency Communication Unit, Reference to COMCON '82, Arnprior, Ontario).
- Scanlon, J. and Alldred, S. (1982), Media coverage of disasters. The same old story, *Emergency Planning Digest, Emergency Canada*, October-December, 15-22.
- Scanlon, J., Dixon, K., and McClellan, S., (1982), *The Miramichi Earthquakes. The Media Response to an Invisible Emergency*, Emergency Communication Unit, Report 8211 (School of Journalism, Carleton University, Ottawa).
- Silverberg, C. (1983), Conference at Royaumont Centre (France).
- SOFRES (1985), Sondage Association des Industriels de France - Préventique, Les Français face aux risques technologiques, *Préventique*, 2, 15-19.
- Stephenson, D. (1984), Are you making the most of your crises? *Emergency Planning Digest, Emergency Canada*, October-December, 2-5.