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Precautions against industrial accidents: experience in applying the Seveso II Directive in central and eastern European countries

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Abstract

Adopted approaches to safety reports and internal emergency plans are described. Based on the provisions of the Seveso II Directive and on the achieved state of hazard prevention management of the respective enterprises in central and eastern European states, reports and plans were prepared. Although these states are no members of the European Union, the parties recognised the requirements of the Seveso II Directive as a working basis. In detail: Methodical experience in preparing safety reports and emergency plans include a methodology in the three main steps: Analysis of information on hazardous substances, hazard analysis including all plants, more specific hazard analysis for representative plants. Basic ways of forming scenarios are given. According to a procedure, various types of scenarios were usually taken into account. Based on the assessment of effects of a substance release, important conclusions can be drawn regarding the extent of danger prevention. In most cases, the structure of the described internal accident emergency plan turned out to be helpful. The programmed system DISMA (Disaster Management) which is widely used in Germany turned out to be a suitable tool for the internal as well as external emergency planning. An example of information to the population is described. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Industrial accident; Seveso II Directive; Hazard prevention

1. Introduction

It is generally known that preventing the effects of industrial accidents necessitates, above all, a high safety standard of potentially dangerous plants. The experience gained from industrial accidents also shows, however, the reverse side of the medal, i.e. a

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certain residual risk cannot be avoided, and a sequence of unfortunate circumstances, incorrect human conduct, unknown or unrecognised connections can lead to serious industrial accidents. Therefore, the European states consider it an important and urgent task to determine the effective application of precautionary, preparedness and response measures for the case of severe industrial accidents in order to enable an environmentally compatible and efficient economic development.

Authorities and enterprises of the former COMECON countries are now pursuing the same objectives. Especially for Central and East European countries, which are making steps towards a unified Europe, it is imperative to move towards standards for accident prevention and mitigation comparable to those adopted in other European Union countries. These countries have altogether a significant economical potential in the production and handling of chemicals. Only in Ukraine are there more than 2600 operators that deal with inventories of dangerous substances exceeding the qualifying quantities in the Seveso II Directive [1]. The typology of the dangerous substances, in use by the industry in the former COMECON closed market, includes all the substances nominally listed as well as those implied by the categories defined in the Directive

Within the frame of its TRANSFORM Programme, the German Federal Republic is contributing in these countries to adapt legislation and prescriptions for plant safety to the EU standards. On the way to provide ‘help for self-help’, the team for plant safety and accident prevention of the technical inspection association TÜV Rheinland/Berlin-Brandenburg (Berlin region) has gathered a certain experience in Poland, the Czech Republic and Ukraine on the practical implementation of the Seveso II Directive, and parts of the Convention on the Transboundary effects of Industrial Accidents [2].

Correspondingly, research and development projects were promoted by the German Federal Ministry for Environment, Natural Protection and Reactor Safety via projects conceived by the German Federal Agency for Environment and the Federal Ministries for Environment of the respective countries. The German expert team involved in this activity was the same one that at the beginning of 1990 achieved a similar experience in relation to safety and accident prevention in the transformation of the East Germany chemical industry from a socialist centralised control towards more effective market orientated structures. In these new tasks, this team found confirmation of past results, but also acquired new knowledge in working with these new countries in the slowly accomplishing process. Thanks to the co-operation in a spirit of partnership and the voluntary participation of chemical enterprises in Poland, the Czech Republic and the Ukraine (referred to below as the CEE countries) and of local engineering associations, useful results could be achieved [3,4]. Any conclusions, based on what has been made so far, cannot be generalised. They just give an intermediate strong point for the design of further projects.

Before describing in detail the contents of the projects achieved, there are certain characterising findings, which can be presented according to the following theses below.

- In the attempt to adopt European standards for plant safety in national legislation and technical regulations, the CEE countries can construct on a similar basis. Laws on work safety, on response to emergency situations, and detailed technical rules are available. A unitary system for plant safety with respect to major accidents does not exist yet; related laws and prescriptions are available as drafts. The trend is the adoption of the Seveso II Directive as it has been formulated by the EU within the specific national legislation on the protection of the environment. The chemical companies could themselves be more strongly involved in these drafting activities.

- Rescue organisations and tools are available for the response to an emergency. The preparedness status is acceptable. However, the prevention activities have not yet reached adequate high standards.
- The introduction of new regulations occurs in a frame of quite difficult economical situation for the companies. Urgently needed restructuring of production plants—especially motivated by EU comparable safety standards—are considerably delayed. Too often, it is still produced at the expenses of the environment. Nevertheless, the enterprises devote a relatively high fraction of the yearly investments to disturbance-free and environment-friendly productions, just because production disturbances damage their competition ability.
- Specialised personnel with solid knowledge are available in establishments and institutions. Independent engineering organisations have started their work. The exchange of experience on solving problems for controlling major accident hazards is realised through workshops. Visits at German sites and transfer of materials support the activities of industrial and authority experts. The tight co-operation—in a spirit of a partnership—between the representatives of the enterprises, that voluntarily undergo to these safety investigations, the competent authorities, the young engineering companies and the German experts proved particularly effective. 'Learning by doing' in projects defined in agreement with the country relevant authorities appears to be the best way to promote this adaptation process.
- The public, in the proximity of accident hazards sites, has not yet been made aware of the danger potential and how to behave in the case of an accident at an extent satisfying the Seveso II requirements. At the moment, the population is only generically informed about the risks of nearby establishments. Also, in general, the population is significantly less sensitive to risk than in Germany.

All these activities were accompanied by several workshops, which served to convey ideas, and focused on practical examples showing approaches to solving problems of plant safety. On the one hand, experience from the EU states on different safety issues was provided, and, on the other hand, the often-complicated conditions for improving plant safety in the CEE countries were explained. This common work not only contributed towards a better mutual understanding, but also towards implementable recommendations for specially studied solution ways.

2. Methodical experience in preparing safety reports for enterprises with numerous plants at one site

2.1. Objective for preparing safety reports

As far as the preparation of safety reports was concerned, the current process of adapting the technical regulations to EU standards in the CEE countries had to be taken into account.

The safety report was intended to show:

- how to prevent serious accidents and
- how to limit, as far as possible, the effects of severe accidents (also transboundary effects).

When preparing the safety reports, the following aims were pursued:

- Collecting all information needed for assessing the risks caused by the concerned enterprise to the population and the environment,
- Identifying the existing shortage of safety technology and drawing conclusions to set aims for its elimination,
- Providing of required information to enable internal emergency planning in connection with the existing risk potential.

The safety reports were prepared at enterprises with quite a large number of process plants, as well as plants for storing hazardous substances. At smaller enterprises with just single plants, the following method is more simplified.

As an essential prerequisite for achieving acceptable results, there was a close co-operation between experts from enterprises, representatives from official authorities, and the German and national experts from the very beginning.

2.2. Methodology for preparing safety reports

The examinations needed to prepare the safety report were carried out in four working complexes; cf. Fig. 1:

- acquisition of information on the site and safety management,
- information collection and analysis regarding hazardous substances,
- information collection and hazard analysis for all plants,
- collecting more specific data and preparing a more detailed hazard analysis on representative plants and hazardous substances.

The structure of the safety report was formed in accordance with these four working complexes.

Since the working complexes are interrelated, constant feedback was necessary between them during the work process. The feedback is indicated in Fig. 1 in a schematic view as the external circle.

The preparation of safety reports was focused on the hazard analysis, which was performed in three main steps:

- analysis of information on hazardous substances,
- hazard analysis including all plants,
- more specific hazard analysis for representative plants.

2.2.1. Analysis of information on hazardous substances:

Essential information principles	*Main results*
• Maximum quantities of substances at the factory and at individual plants	• Exclusion of plants where no substances are handled according to the attachments of the Seveso Directive

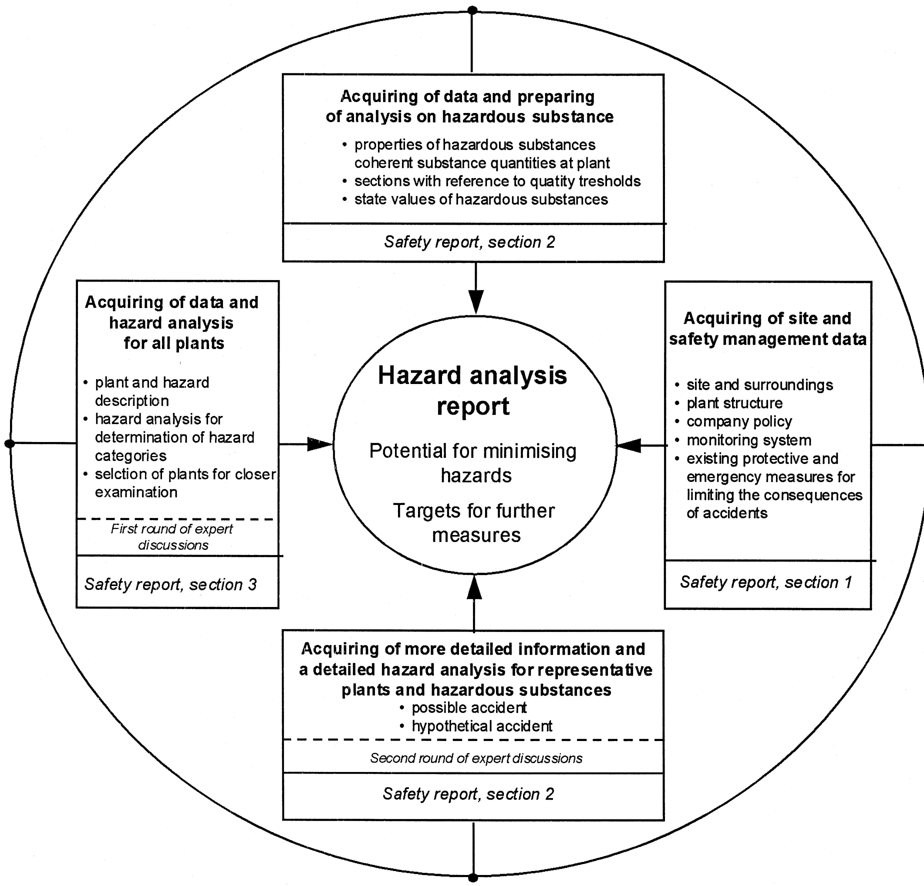


Fig. 1. Connections of working complexes and parts of the safety report.

- Largest coherently releasable amount of substances at the individual plants
- Condition of substances at the plants
- Substance properties
- Determination of an order of plants according to their hazardous substance potential

For reasons of comparing the hazards emanating from the different substances, the quotient was formed based on the largest coherent quantity of hazardous substances at the plants and the quantity threshold from the Seveso II Directive.

The relatively largest coherent substance quantities thus determined enable the comparison between each of the substances, which differ in their types and quantities, as regards the hazards caused by these substances.

As the actual conditions of releasing and affecting have not yet been taken into account, however, this relatively largest cohesive quantity is just a first starting point for the hazard analysis of the plants.

The data on temperature, pressure, concentration and state of aggregation (state quantities) of the hazardous substances provide a second starting point for the hazard analysis of the plants.

2.2.2. Hazard analysis for all plants

Essential informational principles	*Main results*
• maximal quantities of the substances at the individual plants;	• hazards for human beings and the environment presented by theplants with a hazardous substance potential based on a rough raster system;
• largest cohesive releasable quantities of substances in the individual plants;	• classification of the plant into four groups with regard to the effects of atmospheric pollutants, explosions and fires;
• state of the substances at the plants;	• classification of the plant into three groups with regard to the effects of water pollutants;
• substance properties;	• selection of representative plants or sections of plants for a more specific hazard analysis.
• data on plants and processes;	
• accident containment precautions and measures.	

As for the hazard analysis, the following basic procedure was observed:

- identification of the sources of hazard,
- assessment of the largest possible effective contents (hazardous substances, fire loads, quantity of explosive vapours or gases),
- assessment of consequences.

In addition to the assessment of possible hazards in the case of accidents at the plants, the age, the general state maintained and the anticipated production quantity in comparison with the present level were included into the analysis for evaluation purposes.

The possible degree of damage caused by the effects in the given situation was exclusively applied as the measure for evaluation.

The basic scenario adopted for assessing the effects first assumed the largest possible effective substance quantity in a plant section released independent of the causes.

The upper limit for the greatest possible effective contents of the plant sections is represented by the existing coherent quantity at the plant.

The assumptions regarding the source terms for assessing the effects were made for the actual events at the respective plant based on this upper limit. According to expert opinions, the assumptions underlying the assessments are representative in each case, taking into account that the general view is imprecise.

The basic scenarios served for assessing possible damage to human beings and the environment.

The assessments were based on average atmospheric propagation conditions. Possible reciprocal effects between plant sections and possible domino effects were taken into consideration.

As a result, the plants were classified into groups with different hazard potentials. The group classification was arranged with regard to the hazard potential caused by atmospheric pollutants, explosions and fires, on the one hand, and with regard to the hazard potential presented by substances harmful to water, on the other.

2.2.3. Hazards from air pollutants, explosions and fires—effects on air pathway

Group 1	*Group 2*	*Group 3*	*Group 4*
Plants causing no special danger in the case of accident	Plants at which, in case of accidents, irreversible damage to health would be limited to the area next to the plant	Plants at which, in case of accidents, irreversible damage to health would be limited to the work premises	Plants at which, in case of accidents, irreversible damage to health would not be limited to the work premises

2.2.4. Danger caused by substances hazardous to water—effects on soil and water pathways

Group I	*Group II*	*Group III*
Plants causing no special hazard in the case of accident	Plants at which water-endangering substances may spread into flowing waters in the case of accident	Plants at which water-endangering substances may spread into the ground water via the soil in the case of accident

Note: Effects for the soil pathway are covered by the examinations concerning the water (groundwater) pathway.

Expert talks were chosen for performing a hazard analysis. This was the only way of correctly acquiring important factual information on the plants an on essential connections.

Each hazard situation for the respective plant was analysed based on the expert talks about the hazard analysis in which specialists of the operators, the TÜV technical inspection association, and the engineering associations of the respective country participated.

2.2.5. Detailed hazard analysis for representative plants

The representative plants or plant sections examined here more in detail were selected in the *hazard analysis of all plants*. The selection was made by means of a general assessment of potential dangers.

The examinations of hazard potentials for the selected plants or plant sections were further deepened here within the scope of the iterative process of the hazard analysis.

One procedural scenario was selected for each accident which may not be reasonably excluded (design-basis accident). There is a comparatively high probability for such an accident to occur.

Moreover, an accident sequence scenario was chosen for an accident which may be reasonably excluded (hypothetical accident). The probability for this hypothetical accident to occur is comparatively very low.

This accident sequence scenario exclusively serves for disaster prevention planning. In this connection, the two aspects of the occurrence probability and damage extent were taken into account.

The occurrence probability was described by means of the sequence of failures of precautions and counter-measures.

The extent of damage was identified based on danger zones and the persons affected, as well as the protected goods located in them.

Essential information principles	*Main results*
· maximum quantities of substances at the individual plants	· selection of representative accidents which may not be excluded (design-basis accidents)
· largest effective and coherent quantities of substances which may be released at the individual plants	· determination of the respective extent of damage
· state of the substances at the plants	· selection of representative hypothetically more serious accidents
· substance properties	· qualitative occurrence probability of the hypothetically serious accidents
· detailed information on plants and procedures	· determination of the respective extent of damage
· accident-limiting measures and precautions	· potentials for minimising hazards
· accident-preventing measures and precautions	· principles of internal emergency planning
· persons and protected goods in possible danger zones	

Model calculations for assessing hazards and danger zones were carried out with the necessary assumptions.

In this way, the total extent of hazard resulting from accidents was assessed both in terms of the enterprise and its vicinity.

In each case, an inspection of the plant and/or plant section to be examined was carried out followed by a subsequent discussion with experts for a detailed hazard analysis.

Possible sources of hazard and the conditions for them to become effective at the actual plant were analysed during the expert discussions.

This included in each case explosions, fires, and the release of hazardous substances. The possible hazards caused by spreading in the air, soil (groundwater) and surface waters were examined.

Based on the results of the hazard analysis, technical and organisational recommendations for accident-preventing and accident-limiting precautions and measures were derived, e.g.

- adapting the quantity of stored hazardous substances to the actual demand,
- reducing and/or substituting hazardous substances,
- improving the maintenance condition of the plants, introducing plant-specific maintenance and check programmes,
- installation of safety equipment,
- training, instructing of personnel.

The following measures are derived e.g. for one plant (in an anonymous way in the example)

Plant A: Compressing, storing and loading of pressure-liquefied substance X, group 4

Potential for reducing the occurrence probability and the quantities becoming effective	*Potential for reducing the extent of damage*
-improvement of training, information, care shown by the personnel	-Due to the short time till the occurrence of increased concentrations of the substance X and the short time of influence, counter-measures are possible only as warning by means of sirens or visual signals, shutting windows and doors, switching off air-conditioning and ventilation installations as well as going up to higher floors.
-avoiding the use of even flanges	-Improvement of examination and maintenance of site personal protective clothing.
-prevention of external corrosion on plant components	-Informing employees, neighbouring enterprises and institutions, the emergency squads and the population concerned about sensible conduct if substance X is released.
-application of leak-proof valves and fittings suitable for admitting with substance X	
-preventing of hidden material defects in welds when repairing pipes	
-protecting pipes from vibrations caused by compressors	
-reconstruction of plant by using additional or improved technical precautions	

3. Internal emergency planning

Based on the provisions of the Seveso II Directive and on the achieved state of hazard prevention management of the respective enterprises, internal emergency plans were prepared. Already existing and very carefully compiled documents form a solid basis for this purpose.

As far as accident emergency planning is concerned, we consider it generally indispensable to get a clear picture of more or less probable industrial accidents at the respective enterprise. For this purpose, the following method of scenario forming was applied for more or less hypothetical industrial accidents.

The following approach was taken for projects without any corresponding scenarios in the safety report. The hazard potential of the respective plant and the existing hazard prevention potential are related to one another in co-operation with the corporate partner, cf. Fig. 2. This turned out to be a co-operation process based on mutual understanding and patience.

The hazard potential of a plant was characterised in this connection as

- substance-related hazard potential and
- plant-related hazard potential.

In addition to this, analyses of operation failures and the evaluation of accidents at similar plants were performed and experience in handling extraordinary situations was used. Such information may sometimes provide certain conclusions in terms of the probable occurrence of an industrial accident case.

The following information was collected to determine the hazard protection potential:

- Organisation of hazard protection, especially the capability of the senior personnel to take sensible decisions and the reaction time, which has been optimised by training

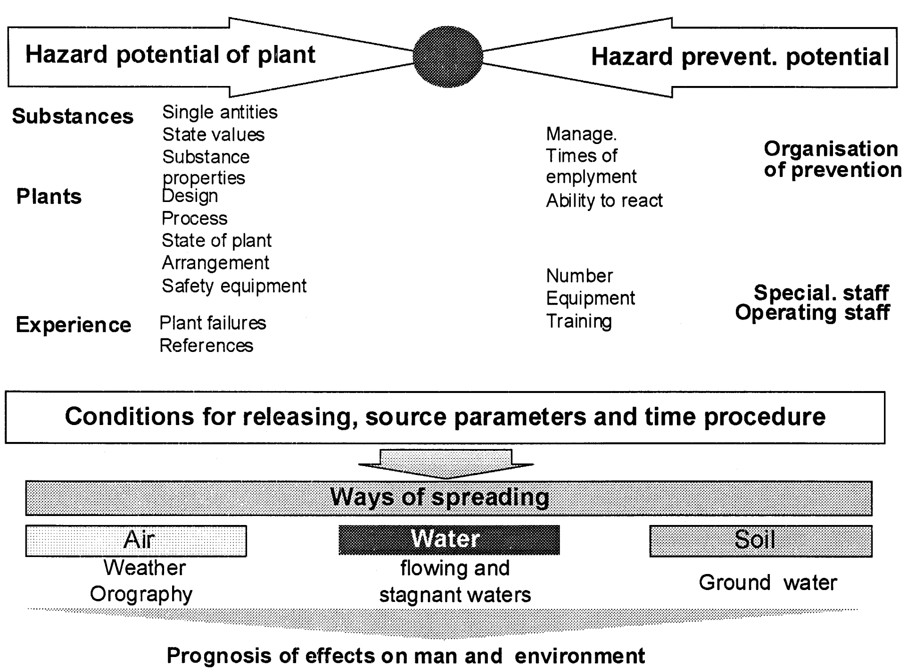


Fig. 2. Basic way of forming scenarios.

and is required by the protective personnel (fire brigade, gas brigade, etc.) to take actions in case of accidents,

- available protection personnel (operation and public danger protection), their equipment and capability of preventing hazards,
- the plant operator capability to react in the case of failures.

Plausible conditions could be found from the above considerations for releasing hazardous substances, as well as the source parameters (leaking substance quantities, time procedure). The essential starting point was that no horror scenarios were derived from the determined conditions, where the whole substance quantity is released. Afterwards, the degree of releasing and spreading via the air and water pathway according to well-known methods [5–8] were assessed taking into account the conditions at the site.

As the criteria for a prognosis of the effects, we did not just use hazardous substance concentrations but, above all, the loads experienced by the man and environment in terms of the corresponding scenario.

According to this scheme, various types of scenarios were usually taken into account. It was assumed in the selected example (Fig. 3) that ammonia which was stored deeply cooled may spontaneously be released (conditions: 6:00 a.m.; wind: 1 m/s; soil temperature: 10°C; air temperature: 15°C; cloudless sky; release in tank tray 500 m^2). Depending on the plant conditions, different released quantities were assumed.

While precautions have to be taken against serious effects within a distance of about 5 km from the plant, an offensive smell, though harmless for health, could also be found at greater distances (e.g. also at the other side of the state border) and could cause considerable irritations among the population if they were not informed correspondingly.

Analogue effects will also occur if pressure-liquefied ammonia is released through a leak.

Transboundary effects of such hypothetical, industrial accidents can also be caused through flowing waters.

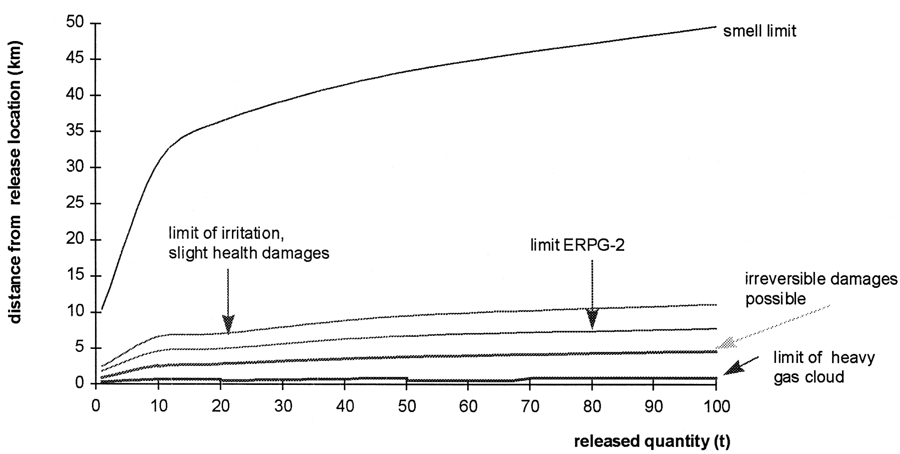


Fig. 3. Interrelation between the distance and possible effects depending on hypothetically released ammonia quantities.

The following initial parameters were assumed:
- flow distance and flow speed in the collector basin and/or a water,
- information on the average flow quantities and flow speed in flow F and in flow S,
- data on the toxic repercussions on human beings, fish and mammals.

The following assumptions were computed, cf. Fig. 4:
- time until the inlet of the contaminated water into the F flow
- mixing and concentrations in flow F and in flow S with a rough estimation of the effects in the case of skin contact as well as dying of fish
- hydrolysis.

The forming of scenarios is no end in itself. Based on the assessment of effects of a substance release, important conclusions can be drawn regarding the extent of danger prevention.

The following assumptions can be made based on the *time sequence* of a scenario:
- alarm planning (e.g. alarm events, alarm stages, sequence of alarms),
- planning of immediate measures (e.g. for shortening the time of counter-measures, for reducing the leakage, for emergency shut-off, for warning objects worth protecting and for logistics).

The data on the areas affected enable conclusions regarding the following plan parts of the internal and external emergency planning:
- planning the alarm signal measures (e.g. determination of alarm signal stages, order of signal sequence),
- planning of the warning activity (e.g. determination of hazardous areas, siren sounding, routes of the loudspeaker car, warning neighbouring enterprises),
- evacuation planning (e.g. sensibility of evacuation, efforts, times),
- detection planning (e.g. routes, main points),
- planning of public safety (e.g. sensibility and efforts needed for blocking, blocked areas),
- information planning (e.g. behaviour of population, using press, TV and radio media).

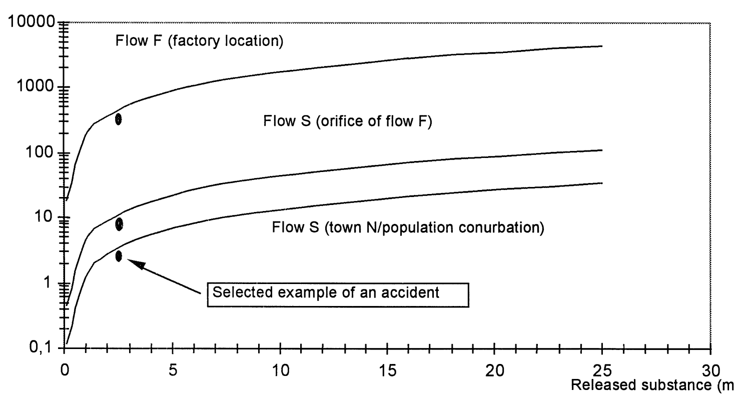


Fig. 4. Scenario for the assessment of water hazards.

The damage effects assessed by means of scenarios are helpful for

- planning of rescue and relief measures (e.g. data on the extent of damage, efforts required by rescue parties, transport of wounded persons, emergency supply measures),
- planning for the case of consequential effects (e.g. possible domino effects, water and soil burden).

Last but not least, the information gained from accident scenarios enable to derive main tasks for exercises (e.g. scenario-related exercises and plan games during which the regulation versions of hazard counter-measures are tried out).

In our view, the scenarios turn out to be an appropriate method based on which sensible planning for limiting the effects of industrial accidents can be achieved.

The great number data acquired can be arranged according to different aspects with the following underlying principles:

1. The corresponding enterprise must be able to operate based on the prepared plan. That is why well-proven documents of the hazard prevention have often been included.
2. The responsible authorities shall be able to derive the required information for the external accident emergency planning from the documents.

In most cases, the following structure of an internal accident emergency plan turned out to be helpful as seen in Parts 1, 2 and 3.

Part 1: Determination of hazard prevention management

This part includes the scope of application, the aim of the corporate hazard prevention, the competence and responsibility for the preparation of hazard prevention and in the case of industrial accidents.

Part 2: Activities

This plan part comprises the alarm plans, the prepared alarm warning lists, the information relations and the activities for hazard prevention indicated in schemes.

Part 3: Information material

This part summarises all maps and plans (works plan, power supply plan, waster water canal plan, piping layout plans, plans of fire brigades, etc.), a description of the enterprise and its environment, a description of the hazard substances existing in the enterprise, the assumptions and computations for the scenarios, check lists for the systematic determination of shortcomings in the hazard prevention and further documents.

The internal emergency plans form a basis in order to be able to prepare sensible external emergency plans for areas with an industrial hazard potential. According to our experience, a concerted approach together with the authorities responsible for catastrophe protection, fire protection, environmental protection and water protection has proved to be successful from the beginning of the preparation of an emergency plan until taking effect at the enterprise.

4. Computer-aided hazard prevention

Enterprises with solidly filed documents for hazard prevention were interested in computer-aided solutions. The programmed system DISMA (Disaster Management), which is widely used in Germany, turned out to be a suitable tool for the internal as well as external emergency planning.

DISMA manages all regional, substance-related and experience-related date which are relevant for an internal emergency planning.

An administrative centre ‘Precaution’ provides functions for working out corresponding plan parts (alarm plans, documents for warning, information, registration forms, filing and supplementing of regulations and contracts, check lists, etc.). It is useful for the emergency planning to assess the implications of substance released, explosions and fires based on computation models, as well as the interactive assessment of hazardous fields, which cannot be based on computational models.

The output of the performed computations can be done via a screen (cf. Fig. 5) and/or in the form of hardcopies.

In the administrative centre ‘Prevention’, features support the hazard prevention management in the event of current accidents.

- Features for prognosis computation regarding the effects of accidents,
- Possibilities for storage handling (acquisition of incoming messages, compilation of

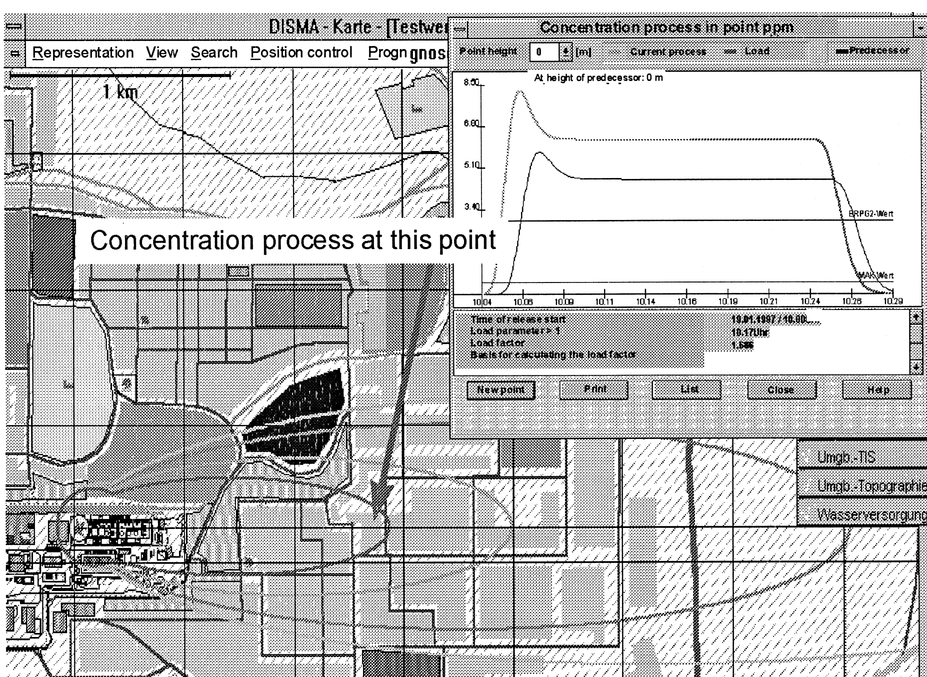


Fig. 5. Display map showing substance release and spreading to the air pathway. Note: The internal curve encircles an area outside of which no irreversible damage will probably occur.

situation reports, description of the situation at the display card, determination of endangered objects,

- Help for giving alarm, warning, informing, employing rescue squads, evacuation, saving actions and supply.

All parts of the administrative centre are directly based on the data compiled in the administrative centre ‘Precautionary measures’. Individual activities which were planned in advance and tested in exercises for hazard prevention, e.g. giving alarm, warning, informing, employing rescue squads, evacuation, saving actions and supply can also be applied and ‘adapted’ accordingly. The results thus support the rapid preparation of decisions by the adaptation of prepared planning data to the real situation.

The use of programme systems as regards transboundary effects in the event of industrial accidents will be of special advantage for protecting the population.

5. Informing the population

Great attention is paid to informing the population in the Seveso II Directive, as well as the Convention on the transboundary effects of Industrial Accidents. The population has to be informed in a vivid and open manner about the hazards and its required behaviour under these conditions.

According to our experience, the communicating about risks is a sensitive subject and needs accurate planning. In addition to the well-balanced information contents, the analysis of the social conditions of the population in the neighbourhood is of decisive importance for successful communication. Emergency planning can become an offer for neighbourliness between the enterprise and residential areas.

If the enterprise concerned is located near the state border, the company hands over corresponding information to the neighbouring state.

Our experience as regards to informing the population can generally be summarised in the following theses below.

- The anxiety of public reactions to making known types of production involving hazardous substances is groundless. Open and honest information is mainly rewarded by greater trust.
- If the benefits of chemical techniques and possibly involved hazards, the correspondingly taken safety measures and the hazard prevention management are made public, the enterprise becomes transparent and the risks are finally accepted. This contributes to improving the image of the enterprise.
- Frankness in terms of informing about risks also ensures higher trust in the responsible authorities. The citizens are confident that the state cares for their protection and will be warned in time. Excessive mystery-mongering will sooner or later have detrimental effects.

The contents and form of the information material were jointly determined with the enterprise. One version will shortly be described below.

Following a personal letter by a competent representative of the company directed to the population in the neighbourhood and after naming the manager in charge of safety issues, the following page was arranged under the heading ‘We about ourselves’.

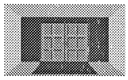
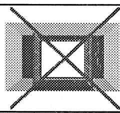
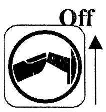
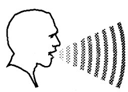
	⇒ Go to closed rooms! Closed rooms provisionally provide effective protection against gases.
	⇒ Close all doors and windows!
	⇒ Switch off ventilation and air-conditioning installations and gas heaters! Extinguish fire in coal stoves! ⇒ If you are in a car, switch off the venting system.
	⇒ Call out the information to neighbours and passengers! Give passers-by temporary shelter! ⇒ Obey the orders given by the rescue parties!

Fig. 6. Extract from the information brochure for the population (What must be done first and quickly?).

The production profile and the safety concept were shown, especially the precautions taken as far as environmental protection is concerned.

The stored hazardous substances which are used and produced in the production process are named. The risk characteristics and hazard information are elucidated in generally understandable terms. The effects that may be imagined due to wrong actions and other reasons in the worst event are described in the following section.

The way of behaving in the case of hazard is subsequently discussed in a question–reply manner:

- How is hazard recognised?
- How are people alerted?
- What must be done first and quickly?
- What must be done next?
- What can still be done?
- What must not be done?

The answers to these questions are given by characteristic symbols and concise sentences; cf. Fig. 6. A hard-wearing information leaflet comprises the essential rules of behaviour.

The sensible way of behaving and acting is depicted by symbols and verbally described.

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