

## THE PREVENTION OF HAZARDOUS SUBSTANCES MAJOR ACCIDENTS

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**Abstract:** There are worldwide economic operators who use during the production process hazard substances which can lead to major accidents with severe consequences regarding health, the safety of persons and of the environment. This article describes a part of the measures imposed by the European legislation to prevent, prepare and for the responsibility of such technologies owners in order to identify, evaluate the risks and limit the consequences of major accidents in which are involved hazard substances. It is also a guide line for the companies which deal with goods transport (internal and international traffic) to know and to respect the most recent laws which were included in the new structure of The European Agreement referring to international transport of hazard substances and to run the activities which influence the transport security.

**Key words:** major accidents, hazard substances, emergency plan, risk evaluation

### 1. INTRODUCTION

The major accident caused by hazard substances is an event (example: hazard substances emissions, fire, explosion) issued of uncontrolled evolutions while exploiting an objective which leads to immediate or delayed occurrence of severe dangers regarding health and/or environment, inside or outside the objective and in which one or more substances are involved [1].

The general politics for prevention, preparing and responsibility in case of industrial accidents is based on the following principles [2]:

- *prevention* which involves processing so as to prevent the uncontrolled developing of abnormal processes, so as the consequences of possible accidents be minimum and to be in agreement with the best security available techniques;
- hierarchical *security needs assessment* is based on „the type and intensity of the expected danger”, depending on the quantity of the hazard substances and depending on the industrial activities relevant for accidents.

The major accidents prevention policy at economic operators implies a commitment of continuous ensuring regarding the security while operating the installments and equipments from all the plants, in order to reduce the risks of incidents and accidents caused by depositing and handling the hazard substances which are on these locations.

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## 2. SECURITY INFLUENCE FACTORS IN SEVESO

The necessary factors to change the legislation regarding the prevention of major accidents in Europe have not been studied deeply and shaped sufficiently up to present, the ever changing relation between a major accident and legislation is still unclear [3].

At world level, there has taken place a series of major accidents in chemical industry. In Europe, the accident form SEVESO Italy, in 1976 prompted the adoption of legislation that aims at preventing and controlling such accidents. In 1982 there was adopted Europe Council Directive nr. 501/EC of June 24, 1982, on the risks of major accidents of some industrial activities – SEVESO directive I, replaced by SEVESO directive II – Europe Council Directive nr. 82/EC of December 9th, 1996, regarding major accidents risks control which involves hazard substances, extended by SEVESO directive III – Europe Council Directive nr. 105/EC of December 6th, 2003 [4, 5].

The major accidents that took place at Toulouse – France, Enschede – Holland, Bhopal – India, Baia Mare – Romania were studied thoroughly by European Union specialists, leading to the need of changing the legislation in this domain with immediate effects upon the activities of the economical operators who use hazard substances in the production process or who transport such substances [3, 6].

SEVESO directive II is transposed into Romanian legislation by H.G. nr. 95/2003 regarding the control of the activities that involve major accidents danger, directive repealed in 2007 with H.G. nr. 804.

**SEVESO DIRECTIVE** has two important dimensions. It is about *preventing* the occurrence of major accidents that involve hazard substances. The second objective aims at reducing the consequences on health and the safety of people and the environment if these accidents occurred [5].

Both dimensions must be simultaneously observed in order to ensure efficiently a high level of protection inside the Community.

The Directive is applied to objectives where hazard substances are present in sufficient quantities so that the danger of occurring a major accident is possible.

While applying the SEVESO directive, it must be taken into account both the content of the Directive and the main factors that influence the effects of an accident, respectively:

- the properties and the quantity of the freed substances;
- the type and duration of the emission;
- the ground, the type of building and the density of constructions;
- the moment during the day;
- the meteorological conditions;
- the security management of the location;
- the distance to the place of the accident.

The operators have the obligation to take preventive measures based on some procedures referring to planning, inspection, reporting and public access to information.

The applying of the SEVESO Directive is done taking into account the following main requirements [5]:

- management security systems;
- emergency plans;
- plans for using the ground;
- informing and consulting the public;
- reporting of the accidents;
- inspections;
- administrative cooperation.

According to the stipulations of SEVESO Directive, all operators should send a notification to authorities and to elaborate a Major Accidents Prevention Plan. More, the operator should also elaborate the following documents: Safety Report, Risk Management System and Emergency Plan. The introduction of the obligation to change the Risk Management System was in general a consequence of developing new managerial and organizational

methods and, especially, a consequence of the relevant changes done by industrial practice from the last 10 years in risk management area [5, 7].

The needed measures in such situations are included in Internal Emergency Plan. These will be elaborated by operators and sent to local authorities. After they study them, they must develop External Emergency Plans.

If the operators demand, the authorities may restraint the information that is to be revealed by the Safety Report.

The SEVESO Directive gives more rights to population to information access and consulting. Both, authorities and operators have clear obligations regarding public information. It is about both the passive information which means continuous access to information, as well as active information. It is necessary for operators and authorities to participate actively by distributing flyers, for example, that inform the population regarding the behavior in case of accidents [2, 4]. In the same time, the authorities must organize an inspection system that ensures the systematic evaluation of operators or at least, an inspection once a year at each operator [2].

### 2.1. Internal and external emergency plans

The emergency plans are developed in order to plan specific measures to reduce risks on employers, on the quality factors of environment and safety of goods, in case of hazard substances accidents [8, 9];

These are developed based on the information from the security report, conformable to the methodology in Order no. 647/ 2005 and Decision nr. 804/ 2007 regarding the control over the major accidents in which hazard substances are involved;

The main types of accidents that require developing emergency plans are:

- emissions of hazard substances;
- major chemical accidents;
- fires;
- explosions.

***The internal emergency plan will be tested*** and evaluated by ***exercises*** organized by the operator.

Before doing the exercises, the internal emergency plan should be updated and the personnel with powers of decision and the intervention forces should do some training.

The preparing of the exercises and training is done based on a schedule drawn up by civil protection inspector, approved by specialized departments of the objective and by local authority of civil protection and approved by the operator.

An exercise for every type of event should be done annually such as: fires, explosion, chemical accident, emission of hazard substances [10].

***The external emergency plan will be tested*** and evaluated by ***exercise and applications*** organized by local authorities of civil protection based on a schedule approved by the county governor [8, 9].

Before doing the exercises, the internal emergency plan should be updated and the personnel with powers of decision and the intervention forces should do some training.

To ensure appropriate training of the personnel with powers of decision and intervention, there will be organized and conducted several types of activities regularly, such as:

- simulation exercises in the operational center for emergency situations;
- emergency scenario exercises on the location;
- emergency scenario exercises outside the location;
- special training inside and outside;
- specific applications.

Scenario exercises involving off-site effects will be held at least every three years and will be linked to exercises organized by the operator.

Evaluation of the external emergency plan is made after execution of exercises and applications based on the findings and reports from staff specifically engaged for this purpose [10].

## 2.2. Plans to prevent accidental pollutions

The plan to prevent accidental pollutions must be elaborated in writing and must include the owner's global business objectives, as well as the purposes of action regarding the control of major accident hazards.

These plans must be elaborated according to major accident hazards of objective. The most important elements of the prevention plans are: purposes, scope, legal basis, technical report (location, critical, interventions team, plans to prevent accidental pollutions, potential pollutant inventory).

## 2.3. Risk maps

The results of risk and hazard's analyses can be presented in many ways. Risk can be presented like a estimate risk, risk charts or a serial of data and elements, they can be packed to create technological risk maps, or it can be presented on a map by marking the affected areas from the different levels consequences of a potential accident.

The risk maps must include:

- Inventory with decantation ponds (the location, less technical data);
- Inventory with all type of mining;
- Plants with technological risk according SEVESO;
- Inventory with plants who discharge pollutants (rivers, underground water, soil);
- Plants and the type/ quantity of toxic substances used (ammonia, chlorine).

Emission and imissions measuring, monitoring of technological processes in terms of pollution prevention [10, 11]. The air from atmosphere is very hard to control it, because once discharged in the atmosphere spread quickly and it cannot be captured to be treated. The purpose of measuring and evaluate of atmosphere is to prevent and eliminate the air's deterioration and improve quality to reduce the negative consequences on human health and the environment.

Emissions are defined according to the Law 541/ may 17th 20003 as discharge of substances into the air from combustion plants, which come from the direct or indirect evacuation, fixed or diffuse sources of installations, substances, vibrations, heat, noise from air, water, or soil. Imissions according to the Law 592 from May 25th2002 are the results of transmission dispersion of harmful substances.

In this studies, preformed measuring of emission from pollution source, emission measurements in different points of receptors stimulation of pollutant dispersion (with special program like ISC-Aermod, EFFECTS, SEVEX View, SLAB View) are made recommendations for preventing pollution and reducing environmental impact.

## 2.4. Report of investigation and evaluation of environmental pollution

Investigation report and the environmental impact assessment technical documentation developed by experts in the field, individuals or legal persons comprising the steps of investigation results of investigations and pollution evaluation and are regulated by the law HG no. 1408 from 19/11/2007 regarding methods of investigation and evaluation of soil and subsoil [4].

Methods for investigating and evaluate environmental pollution are the geological, hydro geological, geochemical and geophysical, this adds to any other method, depending on the specific pollution.

Investigation and evaluation of environmental pollution basically go through these stages:

- Analysis and interpretation of existing data;
- Investigation and primary evaluation;
- Investigation and detailed evaluation.

Investigation and primary evaluation is done in order to establish the existence and intensity of environmental pollution. SEVESO II Directive requires operators using hazardous substances in the production process to demonstrate that the design, operation and maintenance have been foreseen and provided security and safety measures appropriate for the safety of people, material goods and the environment [11]. According to the Romanian standard SR CEI 60300-3-9, the major risk management is an ongoing process, accomplished in three stages: risk analysis, risk's evaluation and risk control/reduction. Those three stages and their related activities are shown in Figure 1 and Figure 2. The risk analysis should answer the following questions:

- „What can go wrong?”
- „What dangerous situations can happen?”
- „How likely are these situations?”

- "What are the consequences?"

The risk assessment should answer the question: is acceptable the level of risk?

Qualitative responses to one or more of these questions are enough to allocate resources to improve safety in operation. When it comes to cost/benefit it requires a quantitative estimate of risk.

The risk analyses
<ul style="list-style-type: none"> <li>- defining the scope</li> <li>- danger identification</li> <li>- risk estimate</li> </ul>
The risk evaluation
<ul style="list-style-type: none"> <li>- decisions on tolerable risk character</li> <li>- option's analyses</li> </ul>
Control/ risk reduction
<ul style="list-style-type: none"> <li>- taking the decisions</li> <li>- implementation</li> <li>- monitoring</li> </ul>

Fig. 1. Major steps of risk management [10].

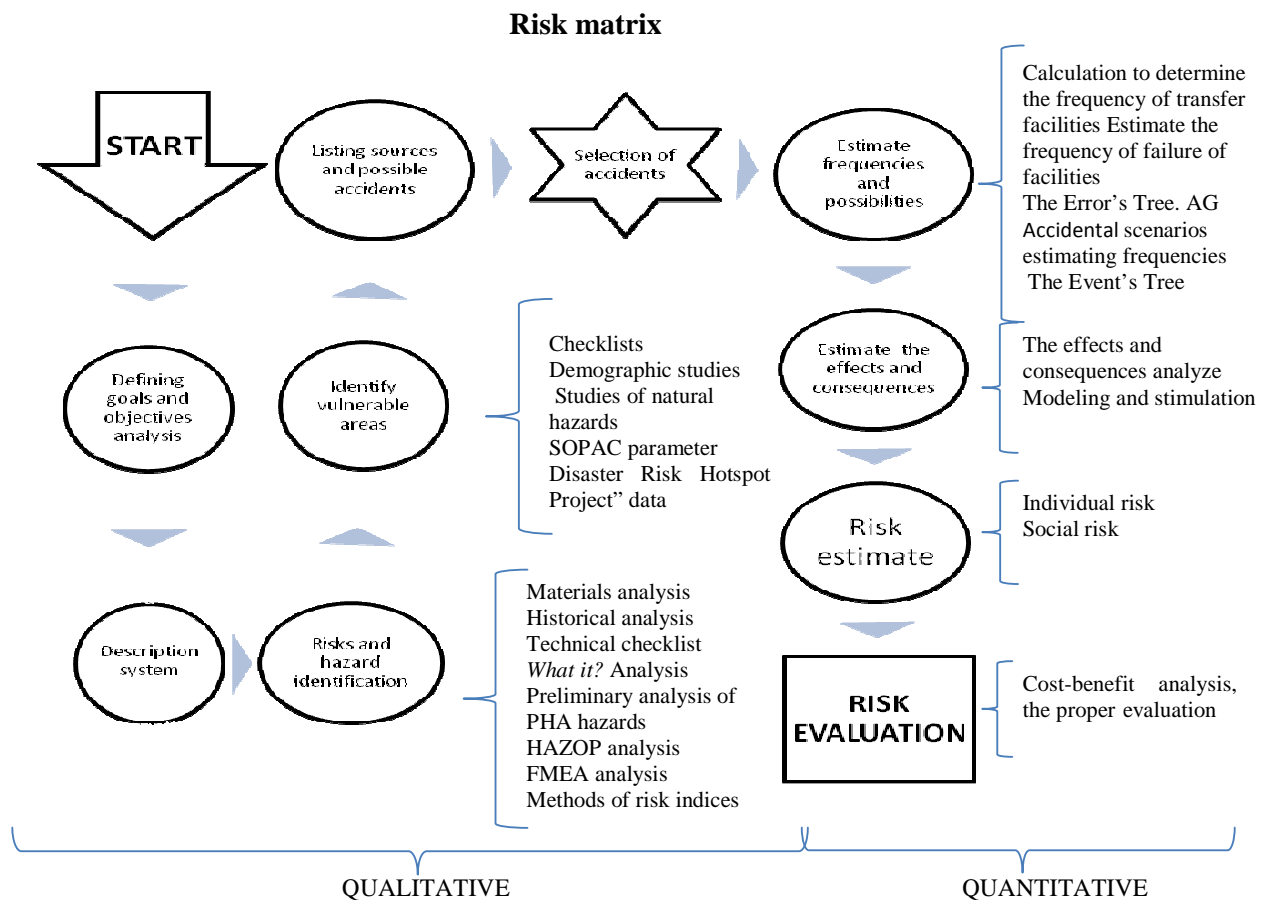


Fig. 2. Evaluation technological risk [4].

### 3. FACTORS INFLUENCE THE SECURITY IN THE TRANSPORT OF HAZARDOUS SUBSTANCES

For companies involved in road transport of goods, both domestic and international, required knowledge and compliance with the latest regulations, included in a new structure of the European Agreement, regarding international transport of dangerous goods, (ADR) signed at Geneva at 30 September 1957, that Romania joined by Law no. 31/1994.

This agreement lays the foundation procedures and conditions that must be followed to ensure protection and road safety in the hazardous transports. Complementary international law, taking into account their specific features, RMA has adapted its legal framework, so the waste transport from one place to another within Romania is subject to regulatory procedures and the *Common Order nr. 2/211/118 from 15.04.2004 of agriculture, forests, water and environment ministry, Minister of Transport, Constructions and Tourism, Minister of Economy and Trade and Procedure for regulations and control of waste transport in Romania* [12].

Under this order shall execute the following activities that influence transport safety adoption of the approval procedure of waste transport in Romania by Inspectorates for Emergencies Situations Transport documents for approval include approval from the Environmental Protection Agency and receiver's agree.

Waste transporting is proposed by the sender and the carrier's endorsed by ISU and is included in documents accompanying the transport the routing for road transport will have to avoid in the large towns for approval the transport route, ISU will consult Police Inspectorate and neighboring counties Inspectorates where the transport will be done, papers for approval of transportation will be prepared in 5 copies 1 will stay at ISU.

The notification for transport may be simple, for one single category of waste and transport, or general for a certain category of waste and for more transports performed within a maximum of two years.

Starting with the second transport of hazard waste mentioned, the sender must transmit one notified by fax or email note at the ISU who gave the acceptance, at least 48 hours before start of performing transport. In agreement with the Road Authority, Police Inspectorate, Regional Environmental Protection Agency are established detour transport routes in towns and cities.

Inside Section IV "Large explosions on the surface and underground, chemical accidents and very serious damage to pipelines "in the County Committee for Emergency Situations, Advisory Operational Group is established composed of the ISU specialists, Regional Environmental Protection Agency, Local Labor, which will be able to move promptly at the event, analyze the situation and establish appropriate measures will be taken by County Committee for Emergency Situations president or head action [7].

The following algorithm will consider the activities of civil protection in case of a chemical accident during transport:

- Collecting data about accident;
- Preliminary dispositions;
- Identify the hazardous substance;
- Risk evaluation;
- Application of protective measures and procedure (is performed according to the nature of hazard substance according to directions of guidelines) [13].

It shall be notified all operators source of chemical explosions and fires, the fact that management has overall responsibility for events that occur in the area, according to internal emergency plan drafted in the H.G. 84/2007 [14].

Alarm and notifying the local population from the action area is done:

- *when the event occurred in the city's area* – with local alarm resources;
- *if the event location is outside the city* – police, firefighters, civil protection are trained to remove all the unauthorized persons from the area, protect the area, traffic guidance, and if a major event can happened, they will clear the entire area of isolation (people, animals, vehicles) [15].

### 3.1 Labeling road and rail transport's vehicles [16]

Diamond (squares) symbols that are drawn to recognize the hazardous substances. Is marked on the sides of the vehicle and give directions about transport's content

### 3.2 Warning signs

There are orange rectangles (30x40 cm) marked on the vehicle carrying the hazardous substances. There are used on international traffic being registered at the UN.

The warning signs are marked:

- In the front and the back side of the car;
- Railway carriages and tanks with multiple sections, on both sideways.

The indicator includes two numbers as a fraction, meaning:

- Above the line are 2-4 numbers means the type of danger;
- Under the line are 4 numbers means the type of hazardous substance.

### 3.3 The numbers significations who indicate danger's type

According to the International Standard Classification of Hazardous Substances, classes and subclasses of hazardous substances indicate the type of hazard by numbers:

- explosion;
- emission/leakage of gas or vapor caused by the pressure of the container, some chemical reactions or other factors;
- the flammability of liquids, vapors and / or gas;
- the flammability of solid substances;
- effects because of the oxidation or burnings;
- toxicity;
- radioactivity;
- effects due to the corrosive action and/or caustic;
- the danger of powerful reactions, spontaneous;
- dangerous reaction with water;
- dangerous extending destructive effect.

Double digit means amplification of the corresponding danger. The danger's extension is marked with the 0 digit at the end of the number.

## 4. CONCLUSIONS

From the implementation of SEVESO Directive resulted the following positive aspects:

- improving cooperation and collaboration between authority's responsible for implementing the directives;
- necessity to define very clear each authority's competences and the application of penalties organized in joint inspections;
- inspections organized to SEVESO operators, based on a common plan approved by all responsible local authorities;
- identification and enumeration of problems;
- identify and inventory problems faced by territorial structures on implementing legislation in order to improve the legal framework;
- completing training personnel competent authorities involved in the implementation of HG 804/2007 and subsequent legislation, by organizing particular training, specialized conferences, seminars, common activities organized on the field;
- establish regular meetings between the competent authorities, economic operators and employers to clarify issues regarding methods of implementing specific legislate on and technical assistance;
- initiate approaches to the competent authorities and economic operators to increase public awareness of risk exposure in emergency, planning information campaigns, distribution of leaflets, brochures, organization of conferences and seminars for people's information, "Open Day", web pages with media involvement;

- the necessity of elaborating a program endowment of equipment, devices and techniques for prevention, protection and intervention in case of major accident involving hazardous substances, and identify the ways to finance it.

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