

A Procedure for Emergency Planning for SMEs under Seveso III Directive in the ISO 31000 Framework

Giacomo Antonionia, Valeria Casson Moreno

Alma Mater Studiorum – University of Bologna, Department of Civil, Chemical, Environmental and Materials Engineering,
 via Terracini 28, Bologna, Italy
valeria.cassonmoreno@unibo.it

Starting from the statement that all activities involve, in principle, an exposure to risk, some years ago, the standard ISO 31000:2009 was published, in order to provide principles and generic guidelines on the management of risks within organizations of all types and sizes throughout their whole life. The standard does not specify the exact nature of risk (i.e. industrial, natural, occupational, etc.) nor it is specific to any industry or sector, therefore any public, private or community enterprise, association, group or individual is supposed to be able to use it. The standard ISO 31000:2009 is supported by the standard ISO 31010:2009, which provides guidance on the selection and application of systematic techniques for risk assessment.

In a less generic framework, risk can be due to different activities that are carried out in different industrial sector. Among them, activities involving dangerous substances may be cause of accidents. The Seveso III Directive (2012/18/EU) aims at the prevention of major accidents involving these substances. The Directive covers establishments where dangerous substances may be present (e.g. during processing or storage) in quantities exceeding certain threshold. Depending on the amount of dangerous substances present, establishments are categorized in upper and lower tier, the latter may include also some SMEs adopting dangerous substances in their activities (a typical example is the electroplating industry).

The legal framework established by the Directive creates a continuous improvement cycle of prevention, preparedness and response to major accidents. The cycle is closed by provisions on lesson learned, similarly to ISO 31000:2009 and ISO 31010:2009 standards.

Also in the framework of Directive 89/391/EEC, which is aimed at offering guidance and promotes healthy and safe working environments – particularly in small businesses, some aspects related to accidents due to critical activities are present and the same general principle of risk management according to a cycle of continuous improvement can be applied.

In this work a procedure aimed at the application of a continuous improvement approach to emergency planning, response and management starting from risk assessment and management activities is shown also with the aid of a practical illustrative example based on a small facility under Seveso III directive.

1. Introduction

The Seveso III Directive (2012/18/EU) aims at the prevention of major accidents involving dangerous substances. The Directive covers establishments where dangerous substances may be present (e.g. during processing or storage) in quantities exceeding predefined thresholds. Depending on the amount of dangerous substances present, establishments are categorized in upper and lower tier, the latter may include also some SMEs adopting dangerous substances in their activities (a typical example is the electroplating industry).

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2. Risk management and emergency management

In the standard ISO 31000:2009 the risk remaining after risk treatment procedures (Figure 1) is called "residual risk". Residual risk is cannot be zero, because risk treatment usually reduces risk without eliminating it. Consequently, after risk treatment the chance that an unexpected event occurs still exists, making it difficult for the organization to reach its objectives.

The aim of emergency response is to face unexpected events, in order to minimize their impact on the capacity of the organization to reach its objectives. Therefore, emergency response is one of the tools for the management of residual risk.

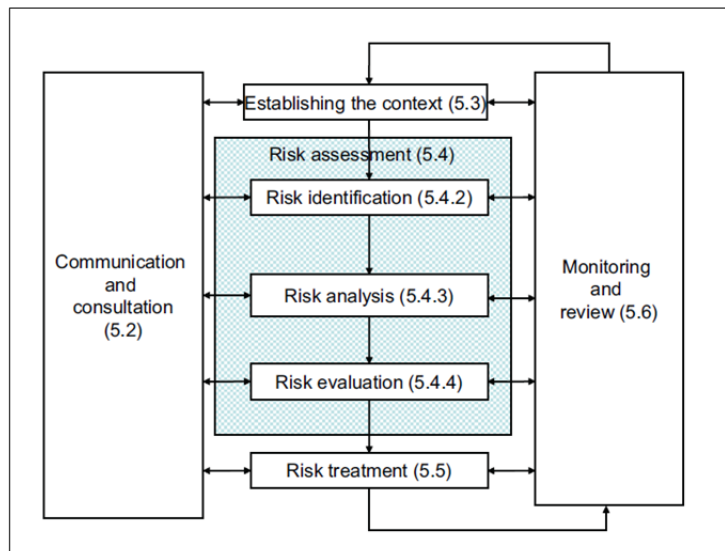


Figure 1: ISO 31000:2009: risk management process [ISO 31000:2009]

Emergency response can be defined as the set of human resources, financial resources, technical equipment (e.g. comprehensive of Personal Protective Equipment), procedures, decisions and actions, which allow to give an answer, to reply, to respond to an unexpected event, by means of:

- (1) Containing or mitigating the effects of the event to prevent any further influence on the capacity of the organization to reach its objectives;
- (2) Restoring "order" and re-establishing normality in the immediate aftermath of the event.

Nevertheless, no hint on emergency response can be found in the standards ISO 31000:2009 and ISO 31010:2009.

Emergency response cannot be rough and ready. When an unexpected event occurs, it is already difficult to face it in the case it had been foreseen, or, in other words, considered possible and credible. Facing unexpected events when they have not been foreseen and considered credible is rather hard.

For this reason, emergency response must be prepared in advance. Emergency preparing is defined as the set of activities having the aim to prepare an emergency response, so that, when an unexpected event occurs, emergency response will be carried out in a well-timed, coordinate and effective manner.

Emergency preparedness and emergency response are, together with prevention-mitigation and recovery, the 4 phases of the so-called and well-established emergency management cycle (prevention/mitigation – preparedness – response – recovery and so on). The emergency management cycle though often presented in the context of natural disasters, as earthquakes or floods, has a general validity and it can be adopted for all kinds of risk including major accident risk.

2.1 The emergency preparedness cycle

The preparedness phase of the emergency management cycle presents itself different steps, which form the emergency preparedness cycle.

The phases of the cycle are:

- plan, to establish a-priori how to respond in the best way to an unexpected event;
- organize/equip, to provide the human and the financial resources and the technical equipment (comprehensive of PPE) necessary for responding to an emergency; to identify what competencies and

skills are required and who has these capabilities; and to identify and to acquire technical equipment needed to deliver a specific capability;

- train, to increase the awareness of involved people about the unexpected events that may occur, and give them confidence in the emergency procedures, improving the ability of each person to carry out his role successfully in the procedure;
- exercise, to simulate an emergency, as if an unexpected event would actually occur. Exercises have the purpose to test the procedures and to give people practice in carrying out them, in order to validate the emergency plan;
- evaluate/improve, to review objectively the exercise looking for gaps and shortfalls in the emergency plan, so to identify opportunities for improvement. The evaluation should address roles and responsibilities, coordination and communication, procedures, technical equipment.

It is important to point out that at the end of the evaluation phase, possibly a new or better plan should be made, in order to close the cycle and to apply the well-known concept of continuous improvement in the framework of emergency preparedness too.

2.2 The emergency plan

The emergency plan is a written document reporting the results of emergency planning. Emergency plans have to be accurately prepared, with the cooperation of all involved subjects: both people of the organization where the unexpected event may occur and people not belonging to the organization who can be impacted by the occurrence of the event.

Once an emergency plan is prepared, it must be periodically updated, with respect to all kinds of changes in both the internal and external context, which are defined by the ISO 31000:2009 as the internal and external environment in which the organization seeks to achieve its objectives respectively.

There are two kinds of emergency plan: the internal (or on-site) emergency plan and the external (or off-site) emergency plan. The internal emergency plan is under the responsibility of the organization; it aims at controlling and stopping the undesired event and at protecting the targets that may be affected within the organization. If the unexpected event could also affect targets external to the organization, there should be an external emergency plan too. The external emergency plan is generally under the responsibility of public authorities; it aims at protecting the targets outside the organization.

When both the internal and external plan are required, they have to be prepared together.

A schematic procedure for emergency planning, developed from Gow and Kay (2005) and HSE (1999), is reported in Figure 2, it starts with the initial selection phase, in which Relevant Emergency Scenarios (RES) are selected among those already identified and analysed in the risk analysis phase and then included in the risk registry. The criteria for their selection can be different from one company to another and can depend on the activity or thread under examination, but, as general guidance, RES should be representative of the potential hazards present when carrying out that activity. In addition, they can be sometimes or somehow simplified or generalized if compared to original ones.

After RES have been selected, for each of them it is important to define whether it can involve (or escalate to involve) the whole establishment or if it can be easily confined or limited to one or some units or sections of the plant. If there can be the potential involvement of the entire site, a general evacuation emergency procedure (which is normally included in an overall emergency plan) has to be followed, otherwise a specific procedure for that scenario should be prepared. Following the specific procedure would avoid the escalation of the accident and thus the involvement of nearby units, besides ensuring the protection of workers.

Then, for each emergency scenario, it should be checked if threat zones, which are normally available or obtainable from risk analysis results, could affect areas outside the plant boundaries. If so data and information about this scenario must be provided to local authorities in charge of preparing the external emergency plan.

Once all the RES have been analysed, the preparedness cycle previously described should be followed and thus the prepared plans and procedures should be tried and checked for their correct implementation.

An example of emergency plan is described in the following sections with the aid of an example taken from an Italian SME.

3. Preparation of emergency plan: an example

The company chosen for the example (further details omitted for the sake of privacy) is an Italian SME that has to develop its Emergency Plan in order to comply with Seveso Directive. The company operates in the field of electroplating, dealing with process and treatment of metals using Galvanic cells: chromium plating, nickel plating and other types of surface treatments that requires the use of some hazardous substances.

According to the organization chart of the Company the CEO is also the OHSE Director as in many SMEs. Other specific OHSE roles and responsibilities are covered by the OHSE Manager and the OHSE Officer. The Company defines also specific roles for the Emergency Responders, participating to the Internal Fire Brigade and First Aid Team. According to the local regulations, the Company appoints a Doctor to supervise and collaborate with the OHS management.

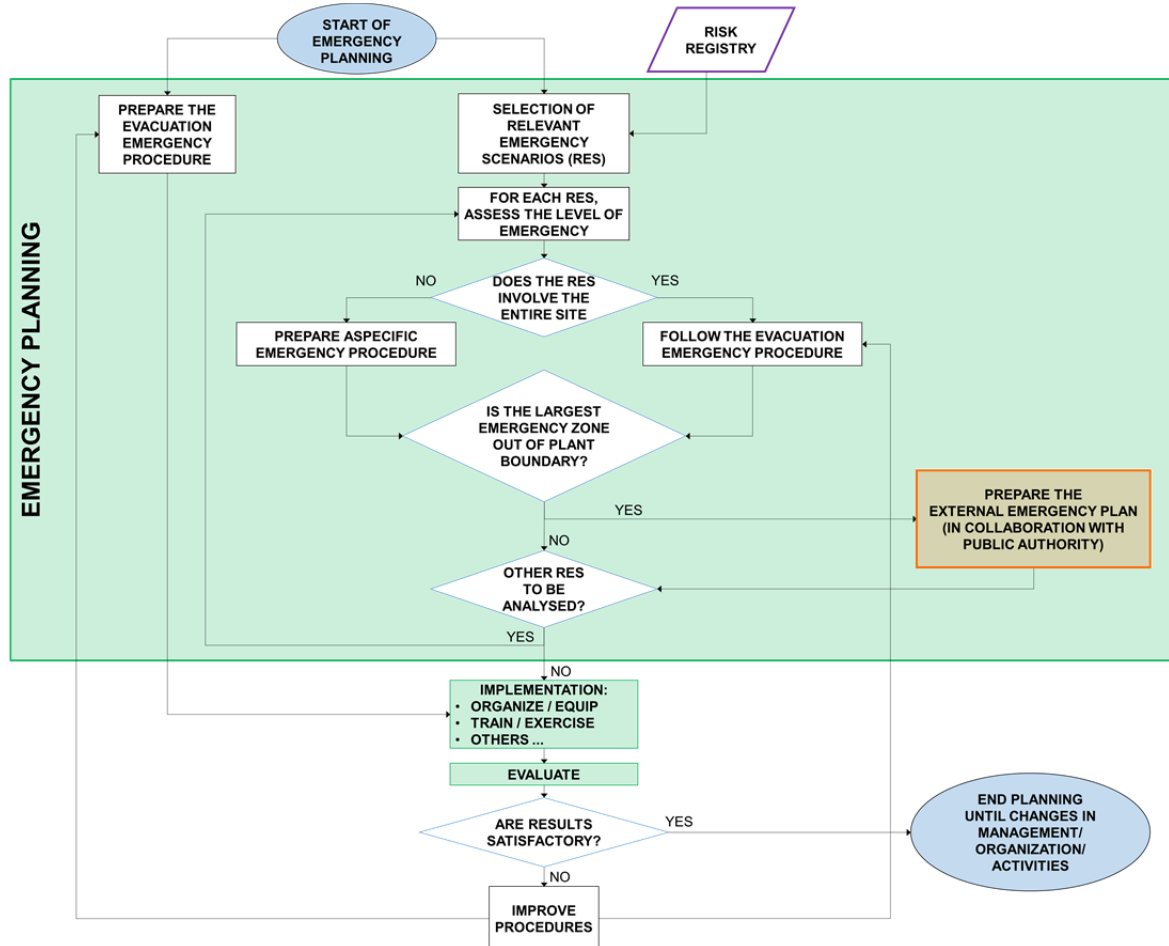


Figure 2. Conceptual steps of emergency planning

The emergency classification defined by the Company is the following:

- Level 1 (L1): scenario involving the entire site;
- Level 2 (L2): scenario involving part of the site.

In the emergency plan a layout of the site, including additional facilities such as laboratories, storages, etc. is provided, where escape routes, as well other emergency and firefighting equipment must be indicated as per Figure 3.

Among all the final scenarios identified during the risk analysis, a Relevant Emergency Scenario resulted the fire in one of the plastic pools, where the chrome plating is carried out, caused by an overheating of the heating elements. During the fire, involving chromium compounds, toxic substances can be released.

The level of emergency assigned to this scenario is L2, meaning that a specific emergency procedure has to be prepared, according to the steps depicted in Figure 2 and described in section 2.

The procedure, which must be performed by at least two emergency responders, is developed as follow:

1. Wear PPE and Emergency Escape Breathing Devices (EEBD), and deny the access to the affected zone;
2. Manually activate the emergency alarm;
3. Evacuate people; if necessary, give first aid and contact the Doctor in charge;
4. Manually close methane shut off valve;

5. Manually switch off the electric power at the distribution board;
6. If possible, operate fire extinguishers to limit the fire;
7. If the fire has been extinguished, manually switch off the emergency alarms;
8. Leave the affected zone and close the fire doors.
9. Call the Fire Fighters.

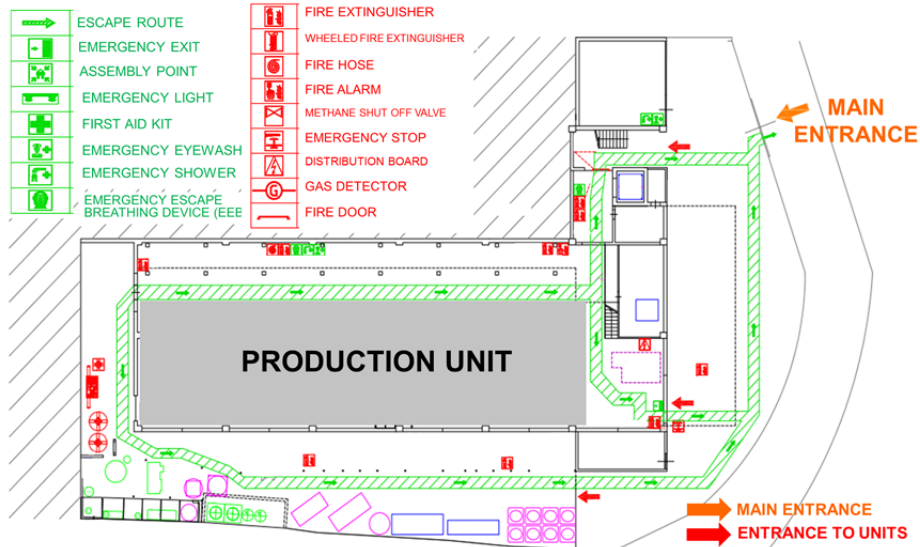


Figure 3. Emergency and evacuation layout.

The consequences associated to the dispersion of the toxic products of the combustion (mainly Chromium (III) oxide, Cr_2O_3) have already been calculated at the Consequence assessment step of the Risk Analysis. The side view of estimated plumes of toxic products are reported in Figure 4, in which the LC50, the IDLH and the LOC (Level Of Concern) have been assumed as threshold concentration values. These concentrations identify respectively: the zone of certain damage, where fatalities may occur; zone of possible damage, where serious and irreversible damage effects may occur (but generally not lethal); the zone of minor damage, where minor, reversible damages can occur, particularly to vulnerable people.

Distances at IDLH and LOC are reached, in this case, not at ground level but between 10 to 30 m above, nevertheless the local authority anyway required the preparation of the external emergency plan, because the third emergency zone falls out of the plant boundaries and there can be a fall-out of toxic products also at ground level. Thus, relevant data and information about this scenario have been transferred to the local authority in charge of the external emergency plan.

The external emergency plan should be defined starting from the analysis of the image obtained by overlapping emergency zones on the site layout (Figure 5). The result should allow competent authority to identify potential vulnerable sites outside the establishment that could be harmed in case of an emergency inside the plant. The same procedure has to be implemented for each Relevant Emergency Scenario, as displayed in Figure 2.

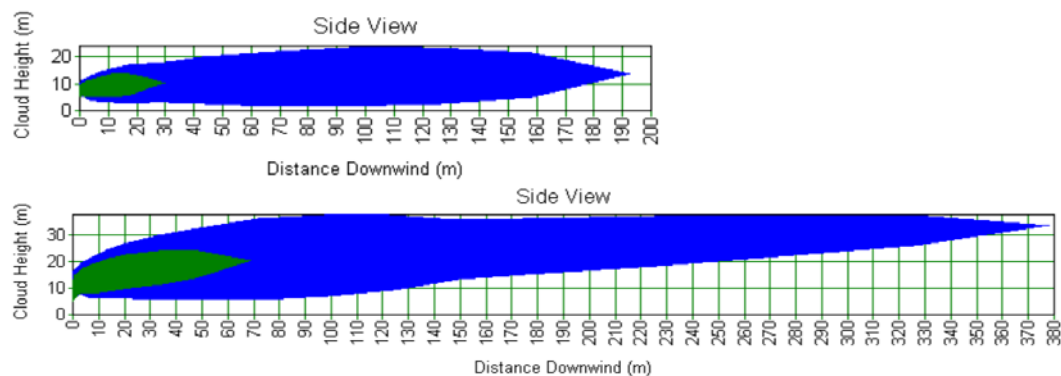


Figure 4. Side view of plumes of toxic products in meteorological conditions D5 (top) and F2 (bottom). Green area: concentration above IDLH; blue area: concentration above LOC

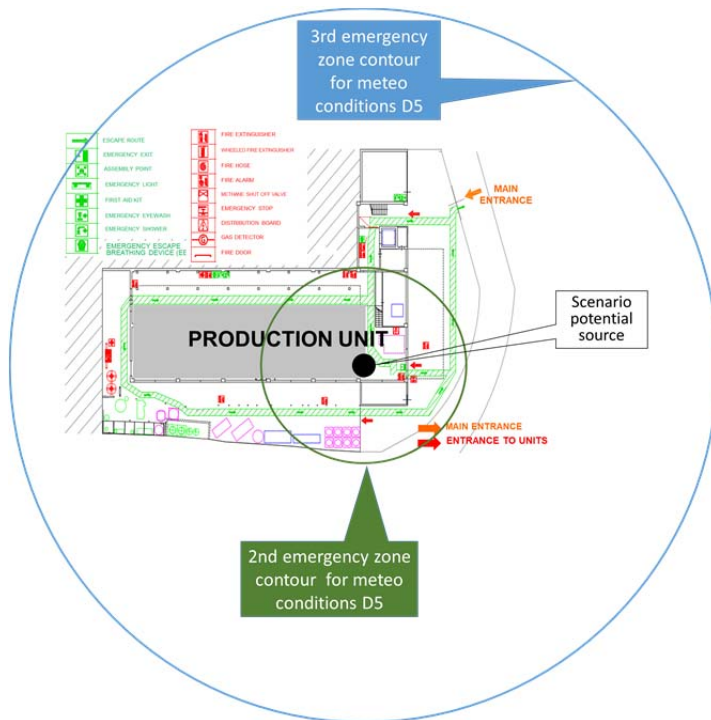


Figure 9. Emergency zones on site layout for meteo conditions D5

4. Conclusions

The procedure of emergency planning is a crucial phase within the emergency preparedness cycle because a correct design of the procedures and of the resources involved in facing a potential emergency can dramatically reduce the adverse consequences of an accident and can allow restoring the previous situation more quickly.

However, even though SMEs may undergo major accidents, or accidents that can cause an emergency, their typical small size and unstructured organization sometimes represent an obstacle in an effective emergency planning and preparedness.

Thus, in this chapter, after introducing general concepts of emergency management, a procedure for emergency planning has been proposed in order to help in the process of creating an internal emergency plan. The procedure can be followed through a simplified flow-chart and it has been explained with the aid of an application example, in order to help small and medium companies in preparing and planning for an emergency.

References

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