

## Emergency Planning for Chemical Accident Hazards

### SHORT REPORT

This short report is designed as a tool for use in planning Seveso inspections on Seveso sites involving emergency planning issues. It highlights important issues and suggests lists of questions that could be incorporated into the inspection plan for a particular site. It can be used as a reference for pre-planning or as an on-the spot reference during inspections onsite. It also gives insights to competent authorities and operations in developing, testing and reviewing their own emergency plans and public information zones under Article 14 of the Seveso Directive.

In chemical risk management, there is a hierarchical relationship between three categories of measures, such that prevention measures are considered the highest level of protection, followed by mitigation to reduce impacts, with emergency planning and response to reduce consequences in the event that prevention and mitigation fail to prevent a major incident. Since the probability of failure of both prevention and mitigation measures is considered greater than one, it is standard good practice to assign appropriate emergency response measures (internal and external) to every major accident scenario on a site. The assignment of emergency response measures is the function of emergency planning. As such, emergency planning is a specific obligation of the Directive embedded in Article 12.

On 3-5 October 2012, the Health and Safety Authority (HSA), the central competent authority for Seveso Directive implementation in Ireland, hosted a workshop on Emergency Response Planning in Dublin, Ireland under the EU programme of Mutual Joint Visit (MJV) workshops for Seveso inspectors ([https://minerva.jrc.ec.europa.eu/en/shorturl/minerva/mjv\\_programme](https://minerva.jrc.ec.europa.eu/en/shorturl/minerva/mjv_programme)). The purpose of the workshop was to share good practice for emergency planning within Seveso countries. This publication presents the highlights of the exchanges during this workshop with the expectation that they will provide knowledge to help improve emergency planning practices in competent authorities and the implementation and inspection of such measures on Seveso sites.

In this workshop, the following topics were proposed as the basis of discussions:

- Emergency planning in the safety management system: How should the emergency planning
1. processes be described and what are good practices for assessing these processes?
  2. Testing of the External Emergency Plan (EEP): How should EEPs be tested? What is the role of the competent authority in regard to EEP testing?  
Determining the emergency planning threat zone:
  3. How is the emergency planning threat zone determined? How is the critical accident scenario selected?



Figure 1: Example of an Emergency Planning Zone

This Seveso Inspection Series short report is a summary of a Seveso Inspection Series expert report of the same name. The full report can be found under Publications at: <https://minerva.jrc.ec.europa.eu>

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4. Establishing the public information zone: How should the public information zone be determined? What is best practice for providing information to the public and communicating during a major accident?

It was agreed among participants that, as a general approach, inspectors should seek assurance that the measures foreseen in the emergency plans are appropriate. It is generally not possible for the inspector to evaluate the adequacy of individual measures. Rather, the inspector should seek evidence that emergency plans have been approached thoughtfully, using appropriate expertise and experience, and tested on a regular basis. This document outlines some key assessment issues and practices in place to address them.

### 1. Assessing emergency planning and response within the safety management system

There is substantial evidence in recent incident history documenting emergency planning failures, especially in consideration of numerous fire-fighter fatalities caused by chemical accidents all over the world. In many cases, significant accident impacts can be traced directly to poor emergency response plans prepared by local authorities and operators.

The workshop highlighted a common view that the assessment of the emergency plan needs to be made more challenging for operators. In general, most Seveso countries assess the SMS for emergency planning and response using checklists and by examining documentation including the emergency policy of the company. Various practices in place for making these assessments are identified in this section.

#### *How is the safety management system assessed in practice with regard to emergency planning and response?*

- **Checklists.** The SMS for emergency planning and response is generally assessed using checklists and by examining documentation including the emergency policy of the company.
- **Coordination.** Inspections may be co-ordinated between competent authorities or they may be carried out by individual competent authorities.
- **On-site exercises.** A number of countries consider that it is also necessary to assess the emergency response exercise in order to have a complete picture. In particular, on-site exercises are also used as a means of assessing the SMS. Emergency response exercises can be especially useful for observing deficiencies in the internal and external emergency plans.
- **SMS and emergency response testing.** There was some variation between Seveso countries on assessment of the SMS as part of emergency response testing. Some countries reported that on-site exercises are used while others reported that the SMS is not assessed as part of emergency response testing.
- **Role of Inspections.** To complement the safety report review, an onsite inspection can be used to verify the emergency response plan, e.g.,
  - that the operator has an emergency response department or section
  - that there is an emergency response policy
  - that emergency responders are present
  - that a risk assessment has been documented
  - that sprinklers and other control equipment function as intended
- **Joint inspections:** The use of joint inspections by competent authorities to assess the SMS varies between Seveso countries. In some countries, the inspections are coordinated and in others, the individual competent authorities carry out their own inspections. An example was given by one Member State where the environmental agency inspects the documentation and the fire brigade and civil protection agencies do the on-site inspection and check the emergency plan.
- **Assessment of the SMS:** The SMS assessment should verify that the safety management system (SMS) is not an isolated exercise, but grounded in reality. A “reality check” could look for the following information:
  - Evidence of adequate staff and equipment resources
  - Evidence of adequate staff and equipment resources
  - Consideration of risks to emergency response teams in scenario development, including:
    - timing of the emergency response effort for different scenarios
    - consideration of different decision pathways based on different scenario outcomes
    - pathways to escalation for each scenario identified.
- **Assessing scenarios.** Several countries agreed that selection of the most appropriate major accident hazard scenarios for the EEP is a significant

challenge. At least one country focuses the emergency planning assessment on the scenarios, by reviewing the scenarios (for completeness, quality), the comments made by fire rescue, and whether the emergency response plans are practical and effective.

- **Reviewing the safety report:** Some countries consider that it is adequate to assess emergency planning on the basis of the safety report alone. However, many countries take additional inspection measures (observing an exercise, on site questions), with the view that the safety report is not sufficient for judging the quality of emergency planning.



Figure 2: The Emergency Testing Exercise Cycle

## 2. Practices for testing EEPs and clarification of the roles of the competent authorities

As Figure 2 at right emphasises, testing the emergency plan through planned exercises is important to verify and improve the functionality of the emergency plan. In the workshop, Member States offered a number of observations in regard to good practice for conducting emergency planning exercises and the role of the competent authorities.

### What is the best way to test the EEP?

- **Live vs. desktop exercises.** Live exercises are carried out in more detail and are deemed to be important for finding weaknesses in EEPs. However, desktop exercises seem to be carried out more frequently in Seveso countries because they are easier to organise when there are a large number of sites and less costly. Desktop exercises are thought to be useful in understanding the roles of the competent authorities. For example, it can be beneficial to conduct a table top exercise initially so that logistical issues are resolved before running with a live exercise. In fact, live and desktop exercises have important complementary functions and should each be incorporated into the testing routine.

EEPs for domino establishments are tested at the same time in some countries.

- **Scenario selection for testing the EEP.** EEPs are generally tested using a standard or guidance, which tends to vary at national and local levels. They are generally based on major accident hazard scenarios identified in the safety report but not necessarily the worst case scenario. The workshop groups highlighted the importance of selecting good scenarios in order for EEP tests to be successful.

Mitigation measures proposed by the establishment are tested as part of the EEP in some countries and it is expected that the operator would brief the fire services on arrival. In others, it is an internal matter between the fire brigade and the operator when testing the IEP.

- **Reporting test results.** Written reports are prepared in all Seveso countries after EEP tests. In some, the local competent authorities are responsible for producing the reports. The operator may also be required to report on testing of the internal emergency plan.
- **Participation and observation by competent authorities.** The role of each competent authority is considered to be clear regarding the testing of EEPs. In some Seveso countries the national authority has a reporting role only, while in others, a national authority may be required to liaise with the operator on the interface between the internal emergency plan (IEP) and the EEP and assist the local competent authorities, particularly if the operator is reluctant to provide information. The local competent authorities are responsible for drawing up the EEP in most Seveso countries.

In some Seveso countries, all relevant authorities attend EEP tests. In others, the competent authority may or may not attend EEP tests and may give advice. The importance of going on-site and making an assessment was emphasised by several participants.

- **Pre- and post-brief testing.** Briefing before exercises and a thorough debriefing afterwards are essential components. If major deficiencies are identified during an EEP test, it is not usually re-tested. However, deficiencies are followed up and remedied. EEPs should be live documents that are updated following tests. Debriefing after the exercise ensures that the weaker elements of the EEP are disposed of and the good elements are retained, with a record kept of the changes made and the reasons for them.
- **Cost of testing.** Testing emergency plans can be quite costly. The recovery of costs for EEP tests varies between Seveso countries. Sometimes costs are recovered indirectly through a special tax on Seveso sites. In a few countries, the competent authorities charge the operator for use of their resources in testing exercises

Minor	most common, no real potential for harm
Immediate	common, operator fatality no risk of escalation
Controllable	occasional, major risk to ERTs
Evacuation	occasional, risk to ERTs and the public
Catastrophic	rare, little further risk of fatalities

Table 1: A method for classifying scenarios for emergency planning<sup>1</sup>

(either a specific percentage or a fixed cost. However, in a number of countries the competent authorities absorb all the costs generated from their participation. In one country, the local competent authorities can make a reduction in the cost if they get a training benefit from the exercise. A few countries charge for the running of EEP tests.

### 3. Determining emergency response zones, public information zones, and communication strategy

Emergency response planning for chemical accident risks requires establishing a reference scenario (or scenarios) for each hazardous site. The potential consequences of the reference accident scenario, taking into consideration foreseeable variability in the sequence of events (e.g., night vs. day, direction of the impact, etc.), determine the nature of the response and define the area of impact (sometimes also called the “threat zone” or “impact zone”). The reference scenario also will define the level and scope of the response, the logistical requirements, organisations involved, and the contingency strategies that may have to be activated.

In addition, some Seveso countries also use reference accident scenarios to establish public information zones to fulfil the obligation under Article 14 of the Seveso Directive that competent authorities should ensure for every upper tier site that

“all persons likely to be affected by a major accident receive regularly and in the most appropriate form, without having to request it, clear and intelligible information on safety measures and requisite behaviour in the event of a major accident.”

This obligation raises questions as to who should be informed about a major accident and what kind of information should be communicated. For this reason, some Seveso countries have used reference accident scenarios to establish “public information zones”. Other countries rely on established protocols for communicating emergency information to the public, often delegating leadership to authorities with local knowledge and experience.

<sup>1</sup>Dalzell, G. 2012. Relationship between the operator and emergency services. Mutual Joint Visit Workshop for Seveso Inspectors on Emergency Planning. Dublin, Ireland.

## Questions to ask when inspecting emergency planning and response

### Emergency planning and response

- Which scenarios have the greatest risks to emergency response personnel?
- Who would be exposed?
- What is their role?
- Do site emergency response plans describe the hazards to which they could be exposed?
- Does it appear that a good quality hazard consequence and escalation analysis was used as the basis for emergency response planning?
- Is there a clear linkage between safety report scenarios and emergency response plans?
- Have the scenarios been documented?
- For each scenario, has a specific timing been estimated from initiation to major escalation?
- Do the plans take into account consequences and potential escalation within each section of the plant?
- Have the critical control and protection systems been identified?
- Are there reliable barriers to major escalation in place, i.e., passive or effective fixed active barriers?
- Does each scenario have a realistic expectation that the incident can be controlled?
- the emergency plan adequately resourced with the appropriate personnel and equipment?
- Do safety reports highlight and assess the risks arising from emergency response?
- Is the information adequate to assess the risks in an emergency?
- Are the civil authorities involved in the planning?

### Emergency response implementation

- Are the control room and ERTs aware of the hazard potential of the plant and activities?
- Is there regular and meaningful communication and planning between site and civil response personnel?
- Are critical control systems inspected and tested regularly and is this documented? Critical control systems include detectors, ESD (emergency shutdown device), bunds, drains and depressurisation, fixed passive and active protection systems, and any other instrumentation and barriers in place that play a role in mitigation and response.
- Does planning ensure that the necessary site and civil emergency response personnel are readily available should an emergency occur?

## Emergency response exercises

- Are the exercises based on unusual and challenging but also realistic scenarios?
- Do they focus on controllable events and include evacuation events?
- Do they take into account the potential for escalation, safety system failure and emergency response risks?
- Do the exercises include an assessment of the risks to emergency response personnel and the impact of different decisions on risk?
- Do the exercises test the relationships between control rooms, incident control, front line emergency response personnel and civil/mutual response?

## Testing of the emergency response plan

- How are the objectives of the exercise selected?
- Do the objectives take into account practical considerations, and different possible sequences of events, including potential mitigation or response failures?
- What are the criteria for selecting test scenarios? Do they adequately test communication between team members, potential risks to emergency responders, pathways that could lead to escalation of the incident, communication with the public, etc?
- Are tests conducted for response to domino effect incidents?
- When applicable to the site, are different types of scenarios tested over time (e.g., fire, explosion, release to the environment)?
- Do all personnel that would be involved in the emergency response take part in the exercise?
- Do the test exercises take into account lessons learned from previous exercises?
- Do the test exercises require a briefing before the exercise and a debriefing after it takes place?
- Does the exercise briefing explain the purpose of testing the emergency plan and objectives of the exercise?
- Are lessons learned from the debriefing documented in a revised emergency plan?
- Does the exercise briefing explain the purpose of testing the emergency plan and objectives of the exercise?

This section addresses important considerations in implementation of these obligations on the basis of threat zones.

## ***How is the emergency planning threat zone determined?***

Emergency response planning for chemical accident risks requires establishing a reference scenario (or scenarios) for each hazardous site. The potential consequences of the reference accident scenario, taking into consideration foreseeable variability in the sequence of events (e.g., night vs. day, direction of the impact, etc.), determine the nature of the response and define the area of impact (sometimes also called the “threat zone” or “impact zone”). The reference scenario also will define the level and scope of the response, the logistical requirements, organisations involved, and the contingency strategies that may have to be activated.

- **Role of authorities vs. role of industry in selecting reference scenarios.** In general, the operator is responsible for defining major accident scenarios in the safety report. However, countries vary as to whether the operator also selects the reference scenario(s) for external emergency response planning. A few countries even prefer that operators in the same local area consult together to select an appropriate scenario for external planning purposes.
- **Methodology for selecting reference scenarios.** Based on various criteria, the authority or operator will select the appropriate scenario(s) to define the threat zone(s). There is variation among countries in the degree of liberty that the operator is allowed in selecting methodologies, endpoints (e.g., exposure levels) and other inputs. Generally, regardless of how the selection process is defined, authorities must examine the outcome and review the associated calculations to ensure that they are consistent and reasonable, that the operator has used recognised methods, and can justify the method that has been chosen.
- The factors that determine the modelling methodology accepted by the authorities may also depend on whether risk or consequence-based approaches are preferred. Some Seveso countries require that specific methods are applied to support authority obligations for land-use and emergency planning. Indeed, some countries are very specific in requiring a certain approach (deterministic or risk-based) to select threat zone scenarios for emergency planning. There are also countries that prefer a consequence-based approach for selecting threat zone scenarios, while accepting or even encouraging a risk-based approach for safety report (i.e., SMS) scenarios.
- **The worst case scenario.** Some countries have adopted an approach that specifically uses the “worst case scenario” (or “credible worst case scenario”) to drive emergency planning. The definition of worst case scenarios may sometimes differ from the definition of the scenarios selected by the site as a basis for the safety management strategy in the safety report. For example, the emergency planning process may not allow application of technical measures for controlling or mitigating accident

consequences of the reference scenario, but these same measures may be assumed for purposes of site risk management. Guidance explaining how to determine the worst case scenario appears to be available in some Seveso countries.

- **Acceptance of mitigation measures.** In some Seveso countries, implementation of technical measures for mitigation and control are considered as part of the IEP only, while they will by default be taken into account in countries when risk based calculations drive scenario selection. For consequence-based approaches. Whether mitigation and control measures are accepted in the scenario depends on expert judgement concerning the reliability of the measure in an emergency situation. Some countries stated that it can be difficult to assess the reliability of on-site mitigation measures outside a risk context. Some authorities take the approach that technical mitigation measures (e.g., passive measures) are acceptable but not active measures
- **Domino effects.** Reference scenarios involving domino effects from multiple sites are also considered in some countries.

#### 4. What is best practice for provision of information to the public?

The responsibility of informing the population in the PIZ may be allocated to any number of competent authorities depending on the country. The national authority may sometimes take the role of developing standardized materials with local communication strategy as the responsibility for local authorities.

The public information zone (PIZ) is not necessarily defined in the same way as the emergency planning zone. For example, the emergency planning zone may be concerned about acute human health and environmental impacts, whereas the public information zone may also include populations on the perimeter of emergency planning zones. The PIZ is often set on the basis that people outside it are not at significant immediate risk from major accidents, although they could be if the accident escalates.

Communication responsibilities are also two-fold. The PIZ populations normally should be provided with information on what to do in case an accident occurs. In addition, there should be a strategy in place that addresses all perceived contingencies for communicating with the PIZ population should such an emergency occur

A number of different issues surrounding the establishment of public information zones are highlighted in the next section.

#### *How should the Public Information Zone be determined?*

- **Methods for identifying who should receive information (“the public information zone” or PIZ).** Countries vary considerably in the approach to identifying the geographical area defining the population, the “public information zone”, that should be informed about the presence of a chemical accident risk (“persons likely to be affected” in Article 14). Selecting the PIZ may be the responsibility of the national authority, local authority or operator depending on the Member State. Consequence-based approaches (rather than risk-based) are most commonly used for determining the PIZ.

In some Seveso countries, determination of the PIZ is related to the EEP and is based on the maximum consequence scenario zone. Some countries, such as Ireland and the United Kingdom, have established a specific methodology to define the PIZ. In other countries, the public information area is based on information provided by the operator and it is determined in consultation with the local authority. Methodologies used for external emergency planning, such as Aloha and Effects, may equally be applied to determine PIZ’s but the results may be applied differently for PIZ’s than for threat zones.

- **Determining “persons likely to be affected”.** There was a discussion about “persons likely to be affected” in terms of Article 14 vs. Article 16 (“Information to be supplied by the operator and actions to be taken following a major accident”). For preparedness purposes, “persons likely to be affected” are defined broadly on the basis of an equally possible range of consequences for a given reference scenario. The geographic distribution and affected population may be much wider than if that accident actually were to occur, because a wide range of possible impacts must be taken into consideration to cover all possible sequences of events. For post-emergency communication the term “likely” is not relevant with respect to the scenario because the accident has already happened and to a large extent, the geographic scope and severity of consequences is known. Rather, “likely” applies to those who are in fact known to be affected already.
- **Defining the term “affected”.** Another related question was raised concerning the term “affected”. It was suggested that definition of this term is subject to broad interpretation. For example, in Ireland, Zone 3 of the public information zone is purposely defined so that it could possibly include



Figure 3 Example of a Public Information Zone applying the approach of the Irish Health and Safety Authority.

those that may not be very much affected in human health terms, but could experience other impacts, such as disruption of local (e.g., electrical, telephone, roads, etc.) or populations that are simply close enough distance to the impact zone to be apprehensive about their own situation.

- **Costs.** In some Seveso countries, the costs associated with determining the PIZ are included in the costs associated with assessing the safety report. Some pass the costs onto operators while others do not.
- **Pre-incident information to the public.** Most Seveso countries reported that information to the public should be disseminated both electronically and by leaflet. It was suggested that websites with risk information on maps and data contained as part of the permit process operated by some countries could be used. Citizens themselves can check what Seveso sites are present in their local area and sometimes also whether they are within a threat zone. Coupled with proactive outreach, online communication can be advantageous because it can be updated regularly at low cost and has potential to host a wide range of information.
- **Methods for identifying who should receive information (i.e., ways to determine the PIZ).** Countries vary considerably in the approach to identifying the geographical area defining the population, the “public information zone”, that should be informed about the presence of a chemical accident risk (“persons likely to be affected” in Article 14). Selecting the PIZ may be the responsibility of

the national authority, local authority or operator depending on the Member State. Consequence-based approaches (rather than risk-based) are most commonly used for determining the PIZ.

- **Responsibility for public information.** Approval and communication of information to be communicated is managed differently in Seveso countries, also depending on whether it is pre-incident information or after a major accident has occurred. The national authority takes a leading role in some countries defining the strategy and determining the content, particularly for pre-incident information, but in some countries this responsibility is allocated to local authorities (which could be the municipality, the fire brigade, a public health office, for example) with the national authority in a consultative and/or approval role. A number of countries reported that it is the responsibility of the emergency responders, not the national competent authority to communicate with the public during a major accident. It appeared that the size of the country and the historic role of the national government in emergency planning may play a significant role in this decision.
- **Crisis communication.** A number of suggestions were made about the means that could be used to inform the public during a major accident including public and company alarms, TV, radio, telephone, Short Message Service (text) and social media. Online sites for communicating to the public are also increasingly used to communicate risk and preparedness information.
- **Use of sirens.** There was much discussion during the plenary session about the means used to inform the public other than a siren. In response to a question about the best way to inform the public, it was suggested that meetings with local community groups and regular talks could be used. In order to ensure that everyone received the information, the use of widespread advertising campaigns and information displayed in many locations was suggested.
- **Use of social media.** The use of social media (e.g., Twitter) for communicating during emergencies has become a global phenomenon. Thus far, the use of social media as part of a communication strategy during a Seveso emergency does not appear to be widespread among Seveso countries. During such emergencies, the affected people are sometimes told to avoid using their phones and in some cases the authorities may have to prevent public access to the mobile network. Still, some authorities have tried it, with positive results in some cases, and less positive results in others. This situation is evolving and new practices should emerge in the coming years.

## General conclusion

This particular exchange included a discussion on a number of basic topics, how is emergency planning in the SMS and safety report assessed, how is testing conducted and what role do authorities play in it, and what means of communication are used to communicate to the public exposed to chemical risk as well as when an accident occurs. Important and challenging technical topics associated with emergency planning are also covered, including the practical aspects of response that must be considered (e.g., timing, resources), how and what to test in test exercises, preparing responders for crisis communication and decision-making, defining reference accident scenarios for emergency response plans, and determining the geographic area for disseminating pre-incident information.

Emergency planning for Seveso sites may also be an interesting topic for further research, including as a special topic for analysis of lessons learned from past accidents. In addition, it could be also envisioned that these types of exchanges may benefit from including EU civil protection authorities and public health authorities with related responsibilities at EU level. As EU level co-ordination and technical support for Member States continues to evolve in the context of Seveso, and EU disaster risk management policy, there may be further opportunities for many of these ideas to be explored and elaborated.

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## Contact

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