This Project is co-financed by
European Union and Republic of Turkey

TECHNICAL ASSISTANCE ON INCREASING THE IMPLEMENTATION CAPACITY OF THE SEVESO II DIRECTİVE

PREVENTION of the RISKS OF MAJOR INDUSTRIAL ACCIDENTS (BEKRA LEGISLATION)

GUIDANCE FOR OPERATORS

ekodenge

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ÇEVRE VE ŞEHİRCİLİK
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This report is presented to fulfil requirements partially of "Technical Assistance on Increasing the Implementation Capacity of the Seveso II Directive" project whose beneficiary is Republic of Turkey Ministry of Environment and Urbanization.

Reminder

The content of this report does not necessarily represent the official view of Competent Authorities.

PREFACE

Major industrial accidents become a current issue depending on the industrialization increasing every passing day but are only remembered in case of their occurrence. Insufficiency of measures to prevent accidents and mitigate their effects and emergency response in industrial plants are prioritized environmental problems of our country as well as those of all developed and developing countries.

The matter of major industrial accidents is completely related to "environment and man health", it is seen that the "Ministries responsible for environment "in European Countries implements the major accident regulations as only competent authority or making cooperation with "Occupational Health and Safety Units" with having a coordinator role. For Turkey, it is also required that all liabilities to be performed by Ministry and operators in order to put into practice successfully.

The "Council Directive on The Control of Major-Accident Hazards Involving Dangerous Substances" aims to limit of the effects of major industrial accidents on man and environment health. The establishments holding dangerous substance exceeding some limits have to notify regularly, prepare safety report, set up safety management system and prepare emergency plan.

With the EU harmonization process, the Directive in question has been put into effect through "By-Law on Prevention of Major Industrial Accidents and Reducing their Effects" in our country.

By-Law regarding Major Industrial Accident Risks is known as BEKRA in Turkish legislation. A wide scoped study with related stakeholder groups at international level has been needed to improve knowledge, experience sharing and capacity development on the scope, method and practices on BEKRA.

In this direction, in order to strengthen the institutional and administrative capacities of the central and local authorities that implement BEKRA legislation, a technical assistance project was implemented within the scope of first component of Instrument for Pre-Accession Assistance (IPA) 2009.

Within the scope of this Project conducted with an extensive study of two year, the brochures, short movies and public spots for creating awareness and increasing information of public institutions, operators and public were prepared. With this guide, it is targeted that operators are informed about their liabilities.

I present my sincere thanks to everyone who creates opportunity to band the representatives of many institutions and organization together and makes contribution on the harmonization and implementation of the Directive and have a hand in the execution of this Project.

İdris GÜLLÜCE
The Minister of Environment and Urbanization

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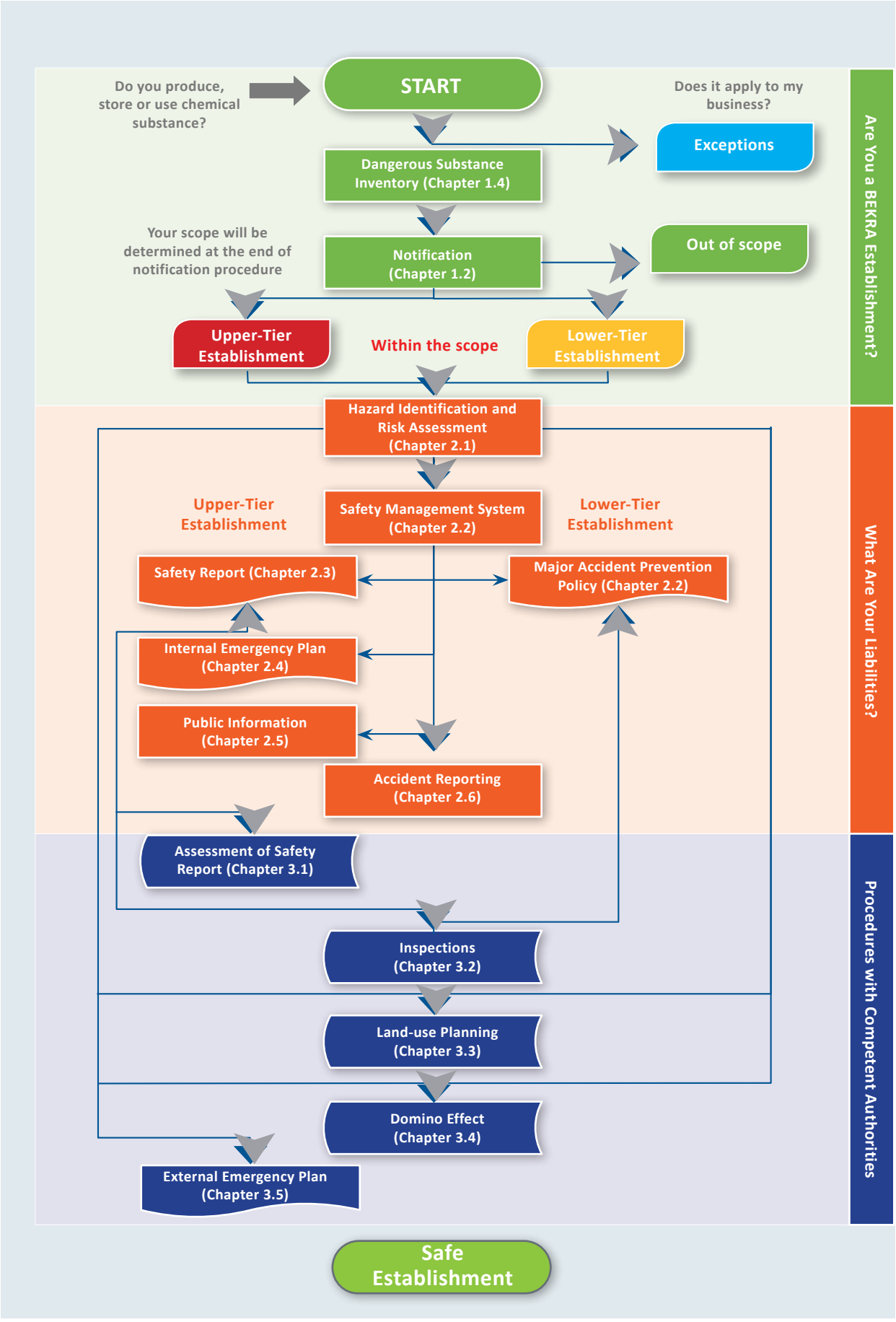
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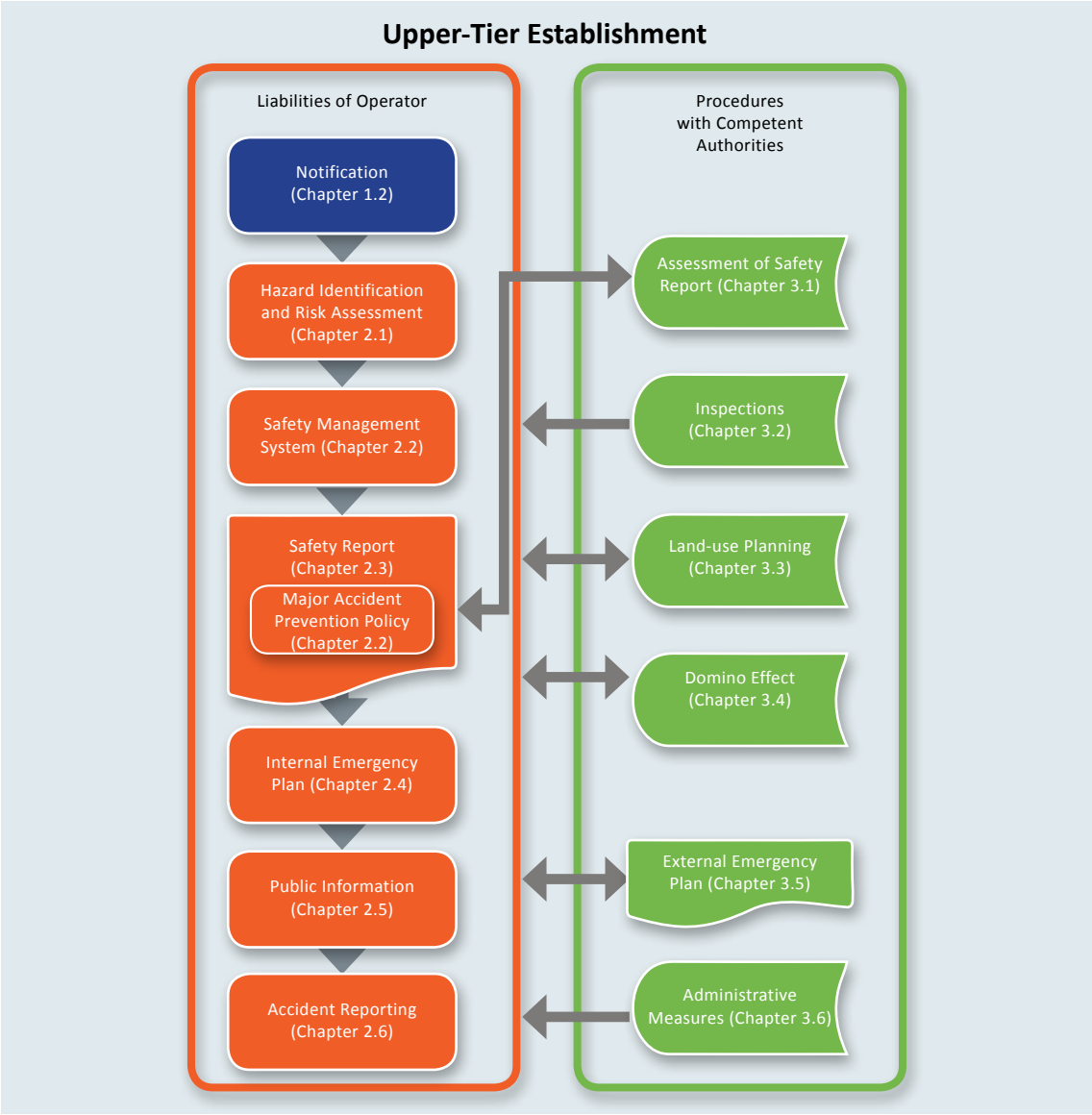
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1. ARE YOU a BEKRA ESTABLISHMENT?

1.1 What is Major Industrial Accident? What is BEKRA?

Modern industrial production processes requires the use of chemical substances. Chemical substances are crucial components of the production of consumer goods, as well as agriculture, manufacturing, construction, and service industries.

Any explosion, fire or dispersion which may occur as a result of any fault in the course of storing, usage, production, transportation or disposal of these substances can lead to grave damage.

The accidents namely **fire, explosion** and **dispersion** including **dangerous substances** which lead a serious danger to health of large populations, result in high economic costs and causes contamination of natural environment for long term or permanently and requiring large scale emergency intervention are known as **major industrial accidents.**

Major Industrial Accident Risks

- The **fire** emerged due to ignition of flammable substances by means of a flame or heat,
- The **explosion** arisen from flammable substance (air) mixture occurred with immediate gas release
- **Release** of toxic substances in air, water or soil

Sources of Major Industrial Accident Risks

The elements to be reason of dangerous events in the establishments that use produce or store dangerous substance are presented below:

- reactor,
- equipment: pipes, condenser…
- storing of dangerous substances in upper and lower sections of reactor,
- production unit.

The immense negative impacts of major industrial accidents to the environment, society and economy have been documented worldwide over the past couple of decades. The release of a toxic cloud of chemicals at Seveso (Italy, 1976) and the toxic leak at Bhopal (India, 1984) are among the worst in the history of industrial accidents.

Following the Seveso accident in 1976, the European Union (EU) prompted the adoption of **Seveso Directive** which aims at the prevention and control of such accidents. The Directive has been periodically amended based on lessons learned from major industrial accidents.

Seveso Directive has exposed two significant amendments and is known as Seveso II Directive today.[1]

[1] http://ec.europa.eu/environment/seveso/

Seveso II Directive aims at:

- **prevention of major accidents** involving dangerous substances
- **limitation of the consequences** of accidents on man and the environment

For this purpose, the Directive brings the instruments for the management of major accidents and ensures that safety procedures for prevention and mitigation the effects of major accidents are put into practice.

Seveso II Directive will be in force till 1 June 2015 in EU. From this date, Seveso III Directive will be implemented.

The Directive covers the establishments that dangerous substances to lead to major industrial accidents are available. In EU region, over 10,000 Seveso establishments are present.

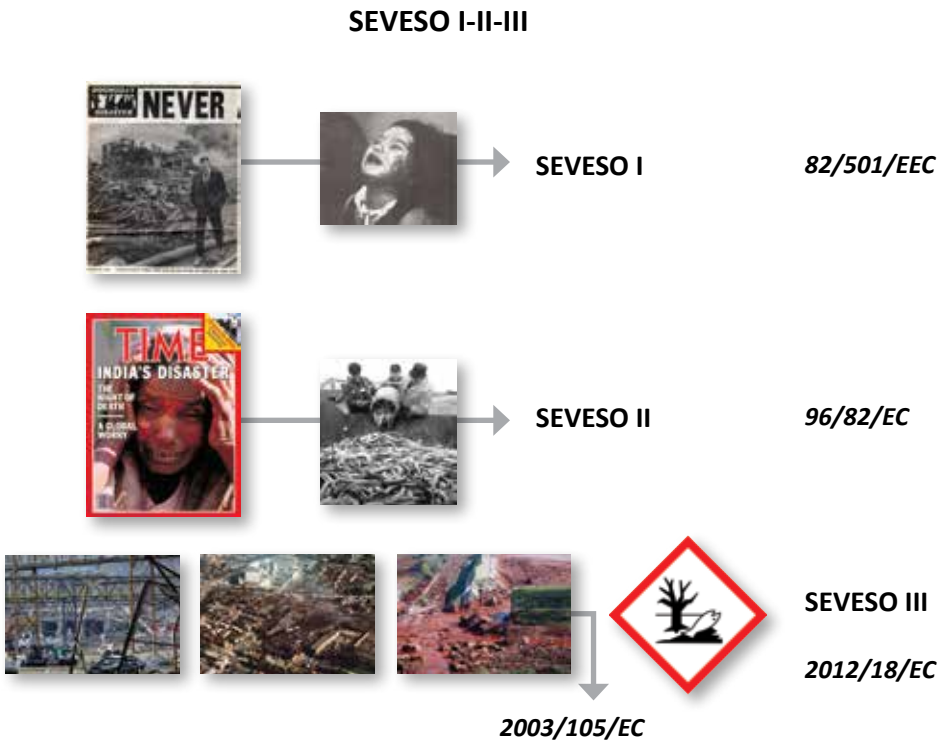


Figure 1 Development of EU legislation for major industrial accidents

Current situation in Turkey: By-law on Reducing Major Industrial Accident Risks (BEKRA Legislation)

With EU harmonization process, Turkey has put Seveso II Directive into force "By-Law on Prevention and Mitigation of Major Industrial Accidents" in December 2013.[2] This regulation is known as **"Legislation on Reducing Major Industrial Accident Risks",** with **BEKRA** acronym. BEKRA legislation has brought different responsibilities to operators, public institutions and local administrations.

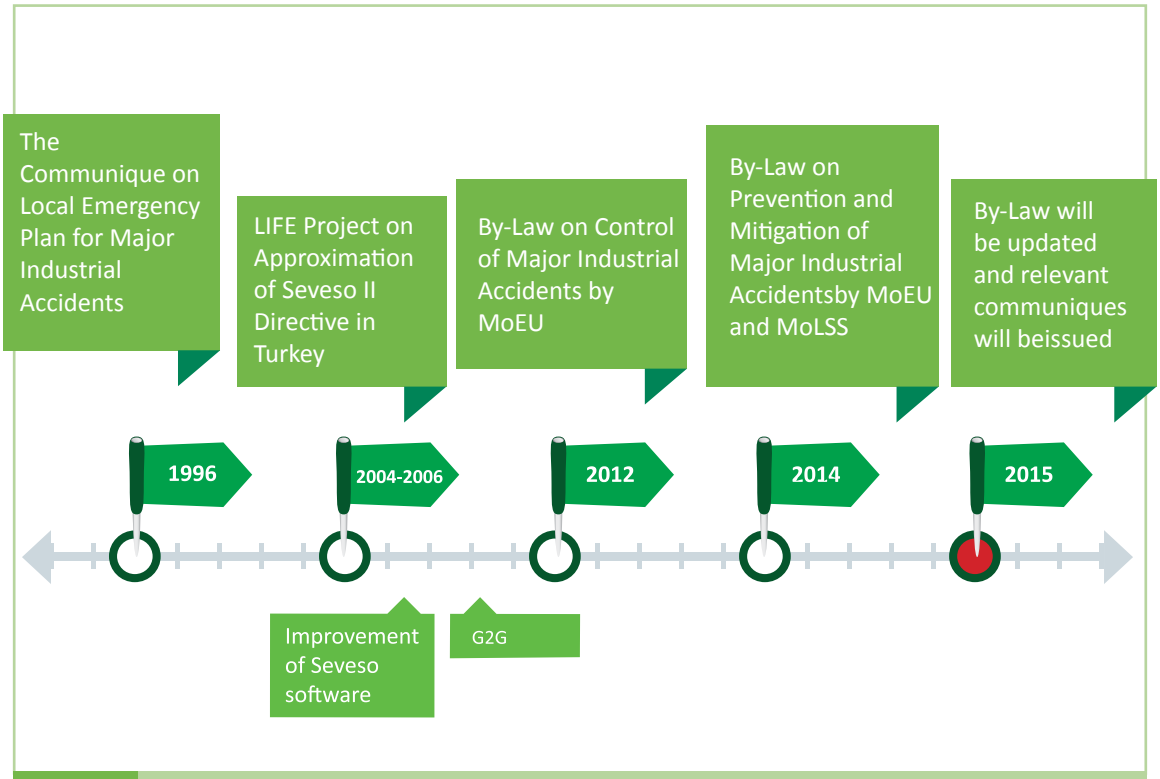


Figure 2 Development of Turkish legislation for major industrial accidents

Competent Authorities (CAs) responsible for implementation of BEKRA legislation

At central level:

- Ministry of Environment and Urbanization (MoEU)
- Ministry of Labour and Social Security (MoLSS)
- Presidency of Disaster and Emergency Management (AFAD)

At local level:

- Governorates, Municipalities, Provincial Directorates of Ministry of Environment and Urbanization and Presidency of Disaster and Emergency Management

The legislation of the institutions that have privileged powers and responsibilities on major industrial accidents is as follows;

[2] http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.19193&MevzuatIliski=0&sourceXmlSearch=kaza

Table 1 Related Legislation of Competent Authorities

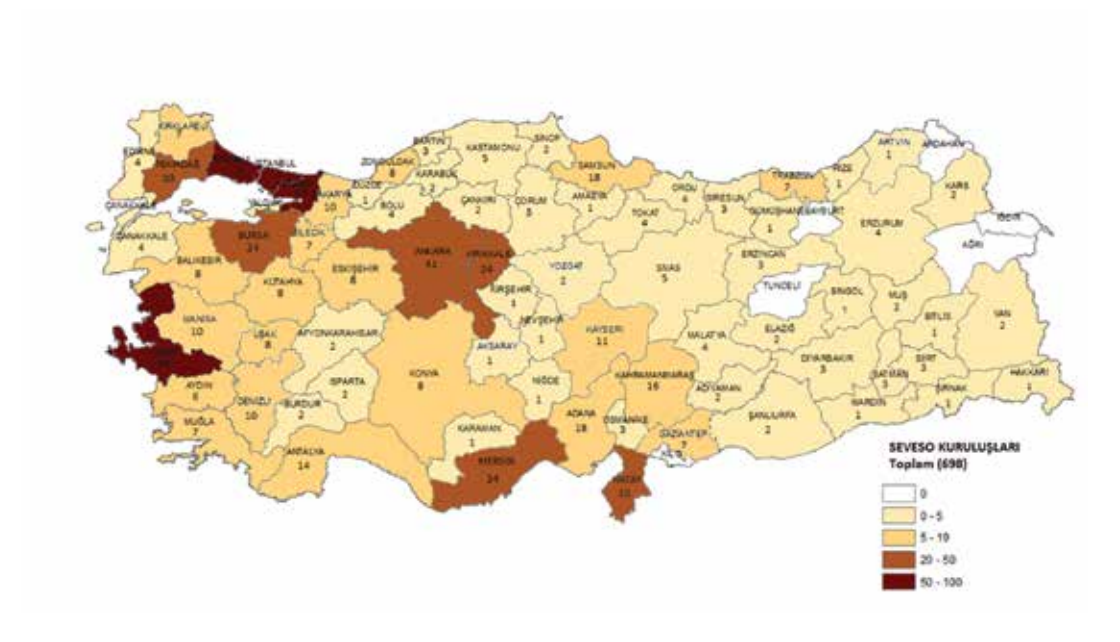
Related legislation of Ministry of Environment and Urbanization	
No: 2872 of 09.08.1983	Environmental Law
No: 644 of 29.06.2011	Statutory Decree on Organization and Duties of Ministry of Environment and Urbanization
No: 28867 of 30.12.2013	By-Law on Prevention and Mitigation of Major Industrial Accidents
No: 28848 of 11.12.2013	By-Law on Classification, Packaging and Labelling of Dangerous Substances and Preparations
No: 27061 of 21.11.2008	By-Law on Environmental Inspection
No: 29030 of 14.06.2014	By-Law on Preparation of Spatial Plans

Related legislation of Ministry of Labour and Social Security	
No: 3146 of 09.01.1985	The Law on Organization and Duties of Ministry of Labour and Social Security
No: 6331 of 20.06.2012	Law on Occupational Health and Safety
No: 25328 of 26.12.2003	By-Law on Health and Safety Measures for Working with Chemical Substances
No: 28633 of 30.04. 2013	By-Law on Protection of Employees from Hazards Of Explosive Mediums
No: 28512 of 29.12.2012	By-Law on Risk Assessment of Occupational Health and Safety
No: 28681 of 18.06.2013	By-Law on Emergencies in Workplaces

Related legislation of Presidency of Disaster and Emergency Management	
No: 27261 of 17.06.2009	The law on Organization and duties of presidency of disaster and emergency management
No: 10213 of 25.05.1959	The Law on Helps to be made with the measures to be taken due to the disasters affecting general life
No: 19808 of 08.05.1988	By-Law on Principles of Organizing and Planning Emergency Aid for Disasters

Geographical Distribution of BEKRA Establishments in Turkey

According to data of Ministry of Environment and Urbanization, total 825 BEKRA establishments, 369 upper tier ones and 456 lower tier ones are available in Turkey on December 2014.



Picture 1 Establishments covered by BEKRA Legislation(Data Source: BEKRA Notification System, November2014)

BEKRA Establishments cover many industrial and commercial sectors from refineries to paper factories, paint manufacturing plants to chemical plants.

In order to identify establishments within the scope **BEKRA legislation,** the amount of actual, anticipated, and generated (during loss of control of an industrial chemical process) presence of dangerous substances is taken into account.

The scope is determined by the quantity of the specified dangerous substances and it is unconstrained by the size, location, sector or the ownership of the Establishments.

1.2 Notification

In order to fulfil the BEKRA legislation requirements, Ministry of Environment and Urbanization established a **BEKRA Notification System.**

BEKRA Notification System established within Environmental Information System is a system that the establishments holding the dangerous substances listed in the annex of "By-Law on Prevention and Mitigation of Major Industrial Accidents" declare the substance present and the highest amount of substance they can store. This notification is known as **BEKRA Notification.**

Box 1 Activities remained out of the scope of BEKRA Regulation/ Article 3 Exclusions

a) Troops, quarters and institutions in Turkish Armed Forces,
b) Ionizing radiation activities,
c) Even if they hold the dangerous substance at the amount and species stated in Annex-1 Part1 and 2;
   1) to transport of dangerous substances by road, rail, internal waterways, sea or air, outside the establishments covered by BEKRA Legislation
   2) to transport of dangerous substances in pipelines outside the establishments covered by BEKRA Legislation
ç) to the activities of exploration and mining of minerals and hydrocarbon in mines, quarries, and activities use means of boreholes based natural substances through quarries and drilling wells, mines,
d) exploration and extracting activities for minerals and hydrocarbon based natural substances in sea, the offshore exploration, exploitation processing of minerals and hydrocarbon based natural substances
(e) waste land-fill sites,

Other than exclusions specified in article 3 of BEKRA legislation, establishments have to enter necessary information to the system. The notification to CAs by establishments is made only for the following cases:

- Dangerous chemicals are present in the establishment that specified in Annex-1 of the By-Law(as raw material, product, by-product, waste and/or intermediate product or the ones generated during loss of control of an industrial chemical process) and
- Their quantities are in excess of Lower or /and Upper thresholds of the Annex I, Part 1 and 2

Notification procedure consists of two stages:

- Operator of establishment registers to the "Environmental Information System"
- Notification to BEKRA Notification System

Operators uploads EC no, CAS no and amount information to BEKRA Notification System. Operator can choose chemical substance from the listed menu in system. This menu includes below selections:

- Entry with reference to one of 4000 + substances described in Regulation on classification, packaging and labelling,
- UN ADR referenced explosive substance entry
- Entry of ammonium nitrate, potassium nitrate
- Entry of dioxin furan
- Entry of oil products
- Other:
  - Substance entry
  - Preparation entry

Box 2 BEKRA Notification Procedure

Pursuant to Article 7 -Notification of the By-Law, operators should notify, using special program package in the web-page of Ministry of Environment and Urbanization.

Notifications will be realized through http://bekrabs.cevre.gov.tr located under Environmental Information System in the following address http://online.cevre.gov.tr.

A. The establishments that will register to the system first time;

1. Register to the system through the address of http://online.cevre.gov.tr.
2. Register by following the steps in the tab of Registration Start.
3. Before the finalization of registration procedure, select the box that registration for BEKRA Notification system.
4. Take printout of Application Form and apply for Provincial Directorate of Environment and Urbanization.
5. After your application is approved by Provincial Directorate of Environment and Urbanization, your user name and password will be sent to your e-mail address automatically.
6. You can enter BEKRA Notification System atthe address of http://bekrabs.cevre.gov.tr.

B. The establishments that have user name and password but did not start the notification procedure;

1. User names and passwords of BEKRA Establishments have already been moved to new system.
2. You can enter BEKRA Notification System at the address of http://bekrabs.cevre.gov.tr
3. If your user name and password are not activated, you should follow the procedure for "The establishments that will register to the system first time".

C. Establishments that have user name and password, and notified the system;

1. Information of the previously registered users under Seveso Plants Data Entry system, moved to BEKRA Notification system.
2. Enter the system at the address of http://bekrabs.cevre.gov.tr and update your notification.

1.3 Determination of Scope

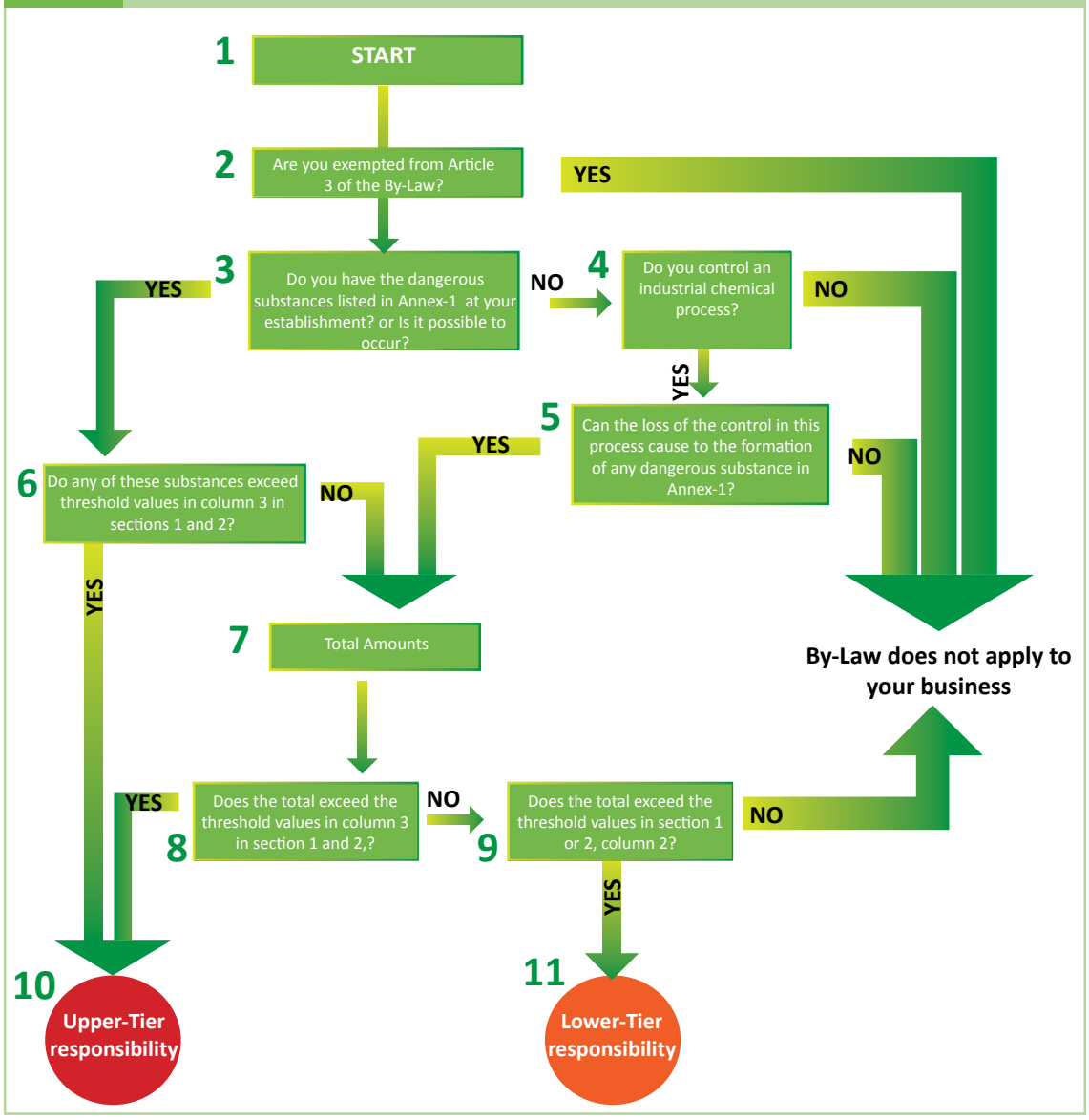
The Annex-1 of the By-Law contains two lists, namely Named Substances and Categories of Unnamed Substances. Both lists contain lower threshold of quantities and upper threshold of quantities. These lists indicate two categories for dangerous substances named Upper-Tier and Lower-Tier.

After operators notify their dangerous substance to BEKRA Notification System, system establishes assigns of the establishment automatically.

Scope of the establishment is classified as;

- Upper-Tier Establishment
- Lower-Tier Establishment
- Out of Scope

Figure 3 Explanatory diagram for determining level of establishment



1.4 Inventory of Dangerous Substance

Hazard sources of major industrial accidents and the risks to emerge as a result of these accidents are diversified. In order to prevent and control industrial accidents, these hazards and risks should be defined systematically.

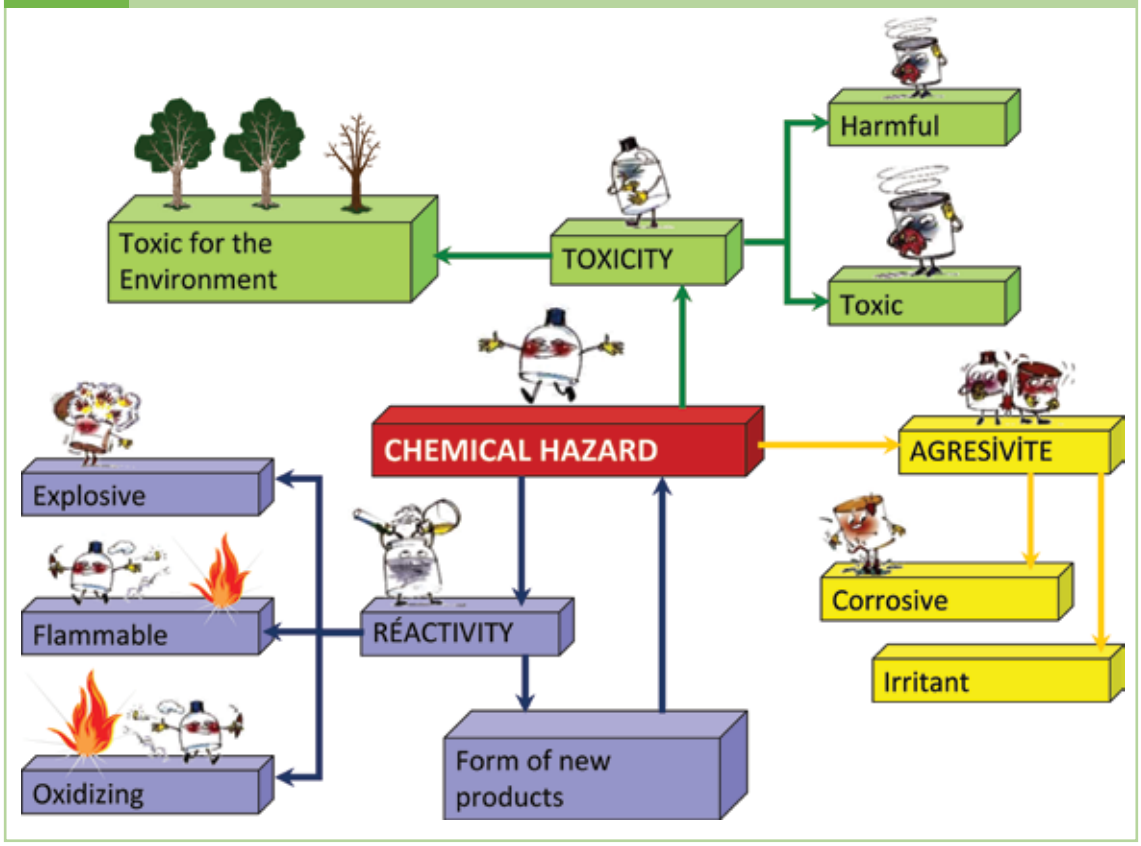
One of the steps to be taken for determining hazards is to take inventory of dangerous substances.[3] The inventory will reveal potential hazards in working environment and their impacts. For example, operator will be able to reply the following questions about dangerous substance;

- Does product form the danger of flaming (flammable?) at storing or usage conditions?
- Is product explosive?
- If this product ignites or creates an explosion, what are the effects of these on people and structures?

The By-Law on classification, labelling and packaging of substances and mixtures no: 28848 of 11.12.2013 that explains the principles for classification of dangerous substances in Turkey should be comprehended well by BEKRA establishments.

Dangerous substance states that substances or preparations have at least one of the following categories: toxic, explosive, oxidizing, detonating, easily ignitable, flammable, harmful, corrosive and irritating.

Figure 4 Hazards related to Chemical Substances



[3] Kimyasalların Güvenli Depolanması Rehberi, ÇSGB İş Sağlığı Ve Güvenliği Genel Müdürlüğü http://www.isgum.gov.tr/rsm/file/isgdoc/IG7-kimyasal_depolama_rehberi.pdf

Operators who have taken inventory of dangerous substances may also determine the hazardous substances that will determine whether or not establishment enters within the scope of BEKRA legislation.

Box 3 New Classification Criteria–Global Harmonized System (GHS)

Roadmap of EU

It was decided to the use of single classification system with the purpose of safe use of chemicals all over the World and the Globally Harmonized System of Classification and Labelling of Chemicals- (GHS) utilized by EU, especially UN countries was harmonized along with a few modification by EU.

New classification system of dangerous chemicals in EU is called as CLP (Classification, Labelling and Packaging) shortly, this new arrangement abolished the Directives 67/548/EEC and 1999/45/EC following a transition period of a few years.

This new regulation made under area of chemicals has affected many EU legislations as is the case in Seveso II Directive and necessitated that these directives are arranged again in comply with CLP.

While Annex-1 of Seveso II Directive is harmonized in line with CLP regulation, other few matters listed below have also been incorporated in new arrangement and called as Seveso III.

- Informing the public about control of major accidents and the measures to be taken, improvement of the matters related to access to information and taking part in decision making for the public
- Bringing strict standards for inspections for execution and implementation of the Directive efficiently

Council Directive on Control of Major Accident Hazards involving Dangerous Substances (Seveso II Directive 96/82/EC) adopted in 1996 with new directive will revoked on 1 June 2015. CLP regulation will enter into force for substances on 1 June 2015 (for preparations currently and for mixtures from June 2016)

Roadmap of Turkey

Within the scope of harmonization studies for EU environment legislation, “Regulation on Classification, Labelling and Packaging (CLP) of Substances and Mixtures” that harmonizes CLP Regulation was published in the Official Gazette no: 28848 of 11.12.2013 by the Ministry of Environment and Urbanization.

With this regulation, the regulation on classification, labelling and packaging (CLP) of dangerous substances and preparations published in the Official Gazette having repeating no: 27092 of 26.12.2008 was abolished.

When the new regulation is compared to CLP regulation published in 2008, amendments are available in the danger class number to be used in classification activities and the terminology.

Within the scope of new regulation, liability of operators for making classification, labelling and packaging according to the principles and procedures of this regulation will commence from 1 June 2015 for substances and from 1 June 2016 for mixtures.

To summarize, these matters will be taken into consideration during notification.

The best way for taking inventory is to visit the plants where complex processes are available and the storing, transportation areas within establishment and to note current dangerous substances. In addition, purchasing records provides easiness for taking inventory.

The inventory should present evidence for that maximum amounts of all dangerous substances held in establishment (including the substances present in the vehicles within establishment) (Guidance for Safe Storage of Chemicals, MoEU). Dangerous substances can be raw material, intermediate product, final product, by-product or waste.

Inventory of dangerous substance should be prepared by the technical personnel who have enough information on chemicals and their threats by allocating enough time. In an inventory, the knowledge such as date, name, formula, brand, package, amount (g, kg, mL, L vs.), danger class, number and the place of storing should be present.

In addition, information about inventory should include the name and surname and contact info of related person and site. Inventory should be kept for all dangerous substances with their highest amounts to be held in establishment.

- Prepare a list of all dangerous substances
- Get information about harmful properties of these
- Set dangerous substances within the scope of the regulation
- Obtain detailed information about the characteristics of dangerous substances within the scope
- Determine the maximum amount to be hold/held by each one

2. WHAT ARE YOUR LIABILITIES?

All operators within the scope of BEKRA are liable to take all necessary measures

i. To prevent major accidents and

ii. To restrict their effects on man and environment in a way to give the least damage in the event of occurrence of such a major accident

In order to fulfil this target, BEKRA legislation has brought some liabilities to upper tier and lower tier establishments.

The details about notification of dangerous substance being first liability within BEKRA are given in Chapter 1.

As a result of this notification, the establishments classified as upper tier and lower tier ones should perform the liabilities listed in the following table:

Common liabilities for all upper tier and lower tier establishments:

- Notification
- Risk assessment
- Major Accident Prevention Policy - MAPP
- Domino Effect: Information exchange
- Liabilities in case of major accident: Action, Communication and Reporting

Liabilities for upper tier establishments:

- Safety report
- Safety Management System
- External Emergency Plan: Preparation, Review and Updating
- Information Sharing for Preparation of External Emergency Plan
- Public information

In the next chapters, information will be presented for the above-mentioned liabilities.

The operators within the scope of BEKRA legislation should follow other legal arrangements regularly that concerns establishment and review their operations, apart from this legislation.

Box 4 Safety culture

Operators of the establishment holding dangerous substance should complement their activities with the safety culture formed in accordance with the conditions of technology, policies, procedures and system.

Values, attitudes, perceptions, competencies and behaviours of the employees (managers, technical personnel, workers) of industrial establishment are efficient for formation of safety culture.

Observing all operations of establishment, putting concrete safety targets forward and monitoring them are of critical importance for development of this culture.

It is also important that employees know and follow safety indicators and the developments in establishment. Safety practices in the establishment and the communication of the information on amendment, adopting safety culture by personnel will strengthen safety culture. These information should be open to and accessible by everyone. In addition to permanent employees of establishment, external service providers should also be considered while generating safety policies.

1. Planning

- Formation of the policy that present responsibilities and vision of establishment, provide an accountable framework and is embraced by top level management
- Determination and control of hazards, introducing intervention for emergencies and the planning that follows legal standards
- Determining hazards and systematically handling of risk assessment procedures

2. Practice

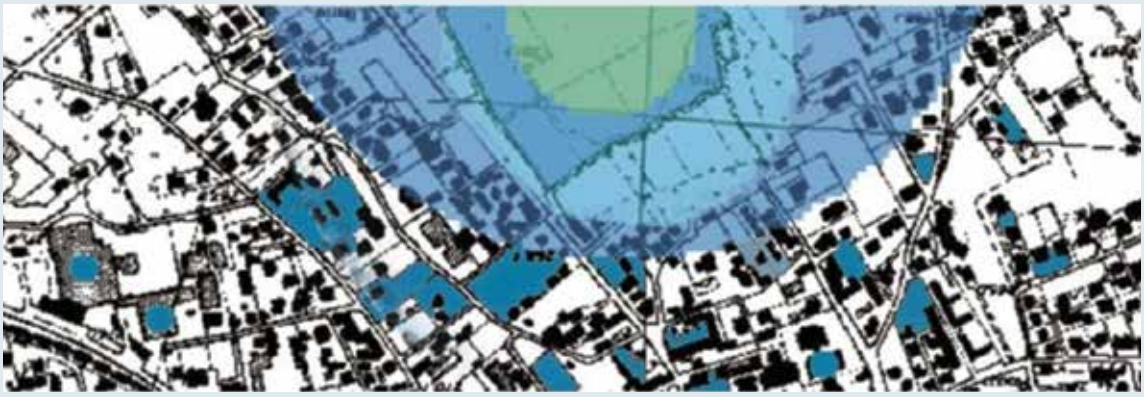
- Implementation of the matters indicated in planning

3. Control

- Realization of performance evaluation

4. Development

- Review and continuous improvement of safety practices of establishment



2.1 Risk Assessment and Hazard Identification

The first step to be taken for prevention and reduction of the accidents that will likely damage man and environment health is to define these hazards and risks.

Risk assessment conducted for major industrial accidents evaluates the risks and hazards based on fire, explosion and toxic dispersion.

Before passing to details, taking a glance at the terminology of major industrial accident would be beneficial. (see Chapter 4.1)

Explanation of key terms

The difference of **"danger"** and **"risk"** terms with regard to risk assessment should be understood well.

Description	Example
Hazard shall mean the intrinsic property of a dangerous substance or physical situation, with a potential for creating damage to human health and/or the environment	• Flammable, volatile, toxic, corrosive, explosive etc. substances; • Technical system under high pressure or temperature,
Risk shall mean the likelihood of a specific effect occurring within a specified period or in specified circumstances	• Breathing a chemical substance harmful for respiration by employee • Fire risk at the establishment holding dangerous substance

In other words, *risk is*

- A complicated function of the hazards related to a technologic or environmental system
- Possibility of conclusion of the hazard with undesired event and the vulnerability of environment where impacts of undesired event event may develop its consequences.

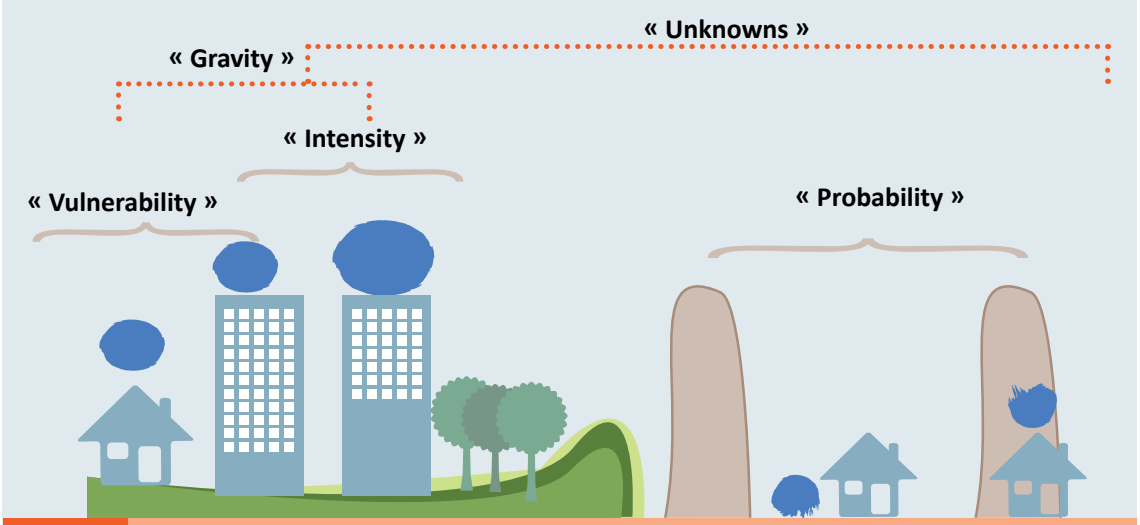


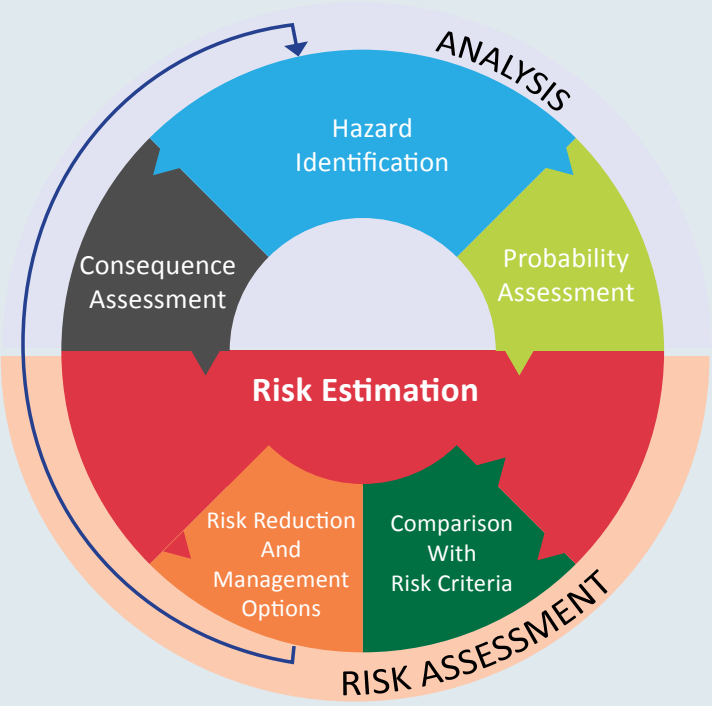
Figure 5 Risk components

Risk Analysis and Risk Assessment

Risk analysis: Process of hazard analysis process and estimation of the risk levels to people, property, the environment or a combination of these.

Risk assessment: The process of risk analysis and evaluation of the significance of the results.

Figure 6 Risk Analysis and Risk Evaluation Procedure



Risk assessment for major industrial accidents evaluates the hazards and risks based on fire, explosion and toxic dispersion.

Following section on risk assessment is adapted from two main sources:

- Joint Research Centre (2005), Guidance on the Preparation of a Safety Report and
- Guidance on the Environmental Risk Assessment Aspects of COMAH Safety Reports

After adapting the information from these documents, the risk assessment concept was analyzed and then summarized by addressing five basic questions.

Table 2	Risk Analysis and Evaluation Process	
Risk Assessment	**Risk Analysis**	**1. What Can Go Wrong?** Identification of the sources of potential accidents and the ways they could happen (hazard identification-accident scenario selection); **2. How Often?** An estimate of the probability of their occurrence (scenarios' likelihood assessment-frequency assessment); **3. What Are The Consequences?** An estimate of the potential consequences of the accidents (-accident scenarios' consequence assessment); **4. What are The Risks?** Determination of risk levels derived from the above analyses, and assessment of their significance; and (Risk ranking);
	Risk Evaluation	**5. So What?** Risk management action (Reliability and availability of safety systems) Presentation of resulting risk and comparison with established tolerability criteria (Identification of mitigation measures, acceptance of result, modification or abandoning)

Depending on the result of risk assessment, to reduce level of major industrial risks to threshold value(risk criteria), following can be take into consideration:

i. Change or reduce amount of dangerous substance used (with a substance less danger)

ii. increase of mitigation actions (safety barriers)

iii. Take measures to reduce severity of accident results

Operator should consider the following main principles for the risk assessment process.

- Reaching an agreement on objective and target of risk assessment process
- Description of required personnel and instruments
- Allocating enough resource and time
- Review of background knowledge and compiled studies (such as historical accident data),
- Description of major accident specified in legislation.

Risk Assessment within BEKRA Legislation

Pursuant to legislation, operators have to prevent the risks emanated from possible hazards in their establishments and reduce them to acceptable level according to risk assessment. Operators will need special methods, standards and instruments in order to describe, analyse, measure and evaluate risks. Furthermore, operators have to persuade CAs for sufficiency of their risk assessment procedures.

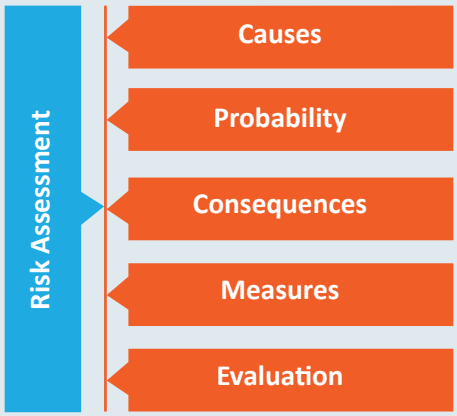


Figure 7 Risk Assessment within the scope of the BEKRA Legislation

BEKRA legislation requires quantitative risk assessment methodology. Appropriate and efficient risk assessment standards and instruments should be selected in order to ensure application of legislation correctly.

Operator has to reduce frequency of all kinds of major accidents to the level set by legislation or to the lower level for the dangerous equipment which calculated through quantitative risk assessment.

In general, the following matters should be proved for risk assessment:

- operator understands the risks involved in the operation of the installation;
- risks from arising from the establishment are at an acceptable level and
- sufficient measures are being taken to prevent occurrence and limit consequences;

The team to make quantitative risk assessment in establishment will need detailed information and trainings such as characteristics of pressurized barriers (sprinkler systems for fire, isolating leak, etc.) dispersion modelling techniques, strength of buildings against the situations such as explosion, physical reactions in case of experiencing fire, explosion, high pressure situations, - answer relationship, man error rates, error ratios of equipment.

Communiqué of the safety report which will be issıed by Ministry of Labour and Social Security and Ministry of Environment and Urbanization will be instructive for the risk assessment procedure.

2.2 Major Accident Prevention Policy and Safety Management System

It has been established that great majority of the major accidents reported across EU has occurred in consequence of management and institutional insufficiencies.

BEKRA Legislation also contains the requirements of Safety Management System (SMS) and Major Accident Prevention Policy (MAPP) paper produced by considering the former accidents.

Major Accident Prevention Policy

MAPP paper is a paper giving information on SMS of establishment. The paper should be written and include the detail enough to show that operator has established an appropriate SMS.

Liability of developing MAPP is valid for both upper tier and lower tier establishment operators. It is required that operator of lower tier establishment operator submit MAPP paper to CAs when requested and it should be uploaded to BEKRA Notification System. Upper tier establishments should also prove in its safety report that MAPP is in force.

Table 3 General framework for MAPP

MAPP is a policy document that reveals commitment to prevent major industrial accidents by top management of establishment.

While MAPP paper is prepared and at preparation stage; the matters such as

- Taking support of top management,
- Determining strategic targets,
- Determination of basic methods to implement these targets (GHS)
- Be open to Access of the public
- Signing by CEO or an equivalent manager

should be taken in to account.

The requirements stated in MAPP paper should be proportionate to the major accident hazards presented by operator. MAPP should be prepared in written and operator should indicate all objectives and the action principles pertaining to control of major accident hazards.

MAPP paper should be designed in a way to guarantee high protection level for man and environment through suitable instruments, structures and management systems.

BEKRA Legislation has determined the principles to be taken into consideration while MAPP paper is prepared.

Table 4 Content of MAPP Document

MAPP covers the following matters;

- Commitment of operator about that high level safety measures have been taken for man and environment in establishment and the resources required for this purpose will be provided,
- Description of the activities to give rise to a major accident of establishment and the commitment of operator about that will fulfil its liabilities for prevention of such accidents,
- The commitment to set up a management system containing the following matters and provide its continuity;
  - The duties and responsibilities on management of major accident risks at all levels in organization of establishment,
  - Evaluation of major accident risks and accident possibilities arisen from ordinary and extraordinary operations; the arrangements and procedures including maintenance, repair and temporary stops; arrangements for planning of changes or design of new plant, process or storing plants,
  - Arrangements for determination of envisaged emergencies by means of systematic analysis and preparation, auditing and review of emergency plans,
  - Arrangements covering corrective and preventive activity mechanisms in case of failing to meet the targets given in MAPP and SMS (these should include reporting, review of major accidents and near-misses and following system for these according to the lessons learnt)
  - Arrangements for evaluation and review of MAPP and SMS periodically
  - Analysis, plan and programs required for meeting and determination of training needs of all personnel working within establishment.

Safety Management System

It would be necessary that operator determines basic methods to implement the targets that it put in MAPP paper. BEKRA legislation requires more than use safe technology. Operator has to prove as well that it has set up “Management System” to manage this technology. This system is called as Safety Management System.

Safety Management System (SMS) is the whole of technical and organizational activities realized to prevent major industrial accidents to happen in establishment and reduce their effects.

SMS may also be accepted as transfer of determined general targets to special targets and procedures.

SMS describes a detailed management system designed to manage safety elements including necessary organizational structures, policies and procedures. Operators should address SMS as a part of general management of their establishments.

Box 5 SMS and MAPP Relationship

SMS reveals the details related to all safety system of establishment.

It contains organization and personnel, description of process units and hazards, operational control, emergency plans, monitoring process and audit.

- SMS is developed based on MAPP paper (its targets); MAPP is assumed as a part of SMS.
- Accepted as minimum requirements over legislation
- Combined with general management system of current establishment,
- SMS matches with occupational job safety partly but not the same completely,

It has the property of a strategic foundation for other operational papers and reports.

MAPP and SMS are in harmony with the approach followed in ISO 9000:2000, ISO 14000:2004, EMAS and OHSAS 18001:1999 systems.

SMS has been described and become compulsory for all establishments within the scope of BEKRA legislation.

SMS liability has been brought by considering important changes in related industrial activities and especially the risk management in last ten years and the development of new methods and organization methods in general. One of the main targets of this liability is to prevent or reduce the accidents arisen from the management factors proved as an important element in 90% of occurred accidents in EU since 1982.

SMS provides a structured approach to obtain better safety performance in establishment. Prioritized targets of SMS are to arrange activities of an establishment in continuous and safe way to improve its safety performance and support a steady safety culture. An efficient SMS reduces major accident related risks to minimum and deals with the subjects stated in following box.

Box 6 Subjects to be addressed by SMS

i. i. Organizational structure– Organization and personnel (roles, responsibilities, trainings, qualifications and relations of the persons who fulfil safety associated duties)

- Organization structure of establishment
- Safety culture of establishment
- Duties, Powers and responsibilities of the unit in charge of safety and the personnel working in that unit,
- Reporting procedure for the matters related to safety
- Resources allocated for safety
- Following up the developments pertaining to safety
- Information exchange for safety
- Training needs
- Sub-contractor management

ii. Description and evaluation of major accident hazards

That which methods are utilized for determination and evaluation of major industrial hazards in establishment are indicated from sources of possibility data used at the stage of definition of hazards and evaluation of risks. It should be prepared according to the following titles.

- Methodology
- Data sources
- Hazard Identification
- Risk assessment

iii. Operation control

It is shown that in all plants found within establishment, procedures are available and implemented for each of the following operation stages.

- Operation procedures
- Monitoring, control and alarm systems
- Maintenance policy and its application
- Stating the duties related to management of major hazards
- Allocating the resources required for implementation of MAPP of operator
- Activities of the persons who take office in the management of major accident hazards
- The systems to ensure that employees take charge in the control of major accident hazards actively.

The arrangements to provide that operator sets up communication and cooperation with other institutions and makes cooperation with other organizations

iv. Change management

It is shown that how the permanent, temporary and urgent changes to be made in current plants and/or processes found in establishment is dealt and a change management system is applied in organization for planning or designing of new plants. It should be prepared to the following titles.

- Organizational changes,
- Changes in plants,
- Closing plant for certain time or without delay,
- Process changes,
- Changes to be carried out in the capacity and methods of dangerous substance storing,
- Equipment changes,
- Changes in safety related documents,
- Changes depending on environmental conditions.

v. Planning for emergencies

vi. Observing Performance

Continuous evaluation of the compatibility with safety policy and safety management system and the mechanisms required to take action in case of violation

vii. Audit and reporting

Systematic and regular evaluation of the efficiency and compatibility of safety policy and safety management system

viii. Lessons learned from past accidents

2.3 Safety Report

One of the most important liabilities of BEKRA legislation is "Safety Report". Necessity of safety report is valid only for upper tier establishments.

Safety report has to be submitted by current upper tier establishments before starting to operation of establishment.

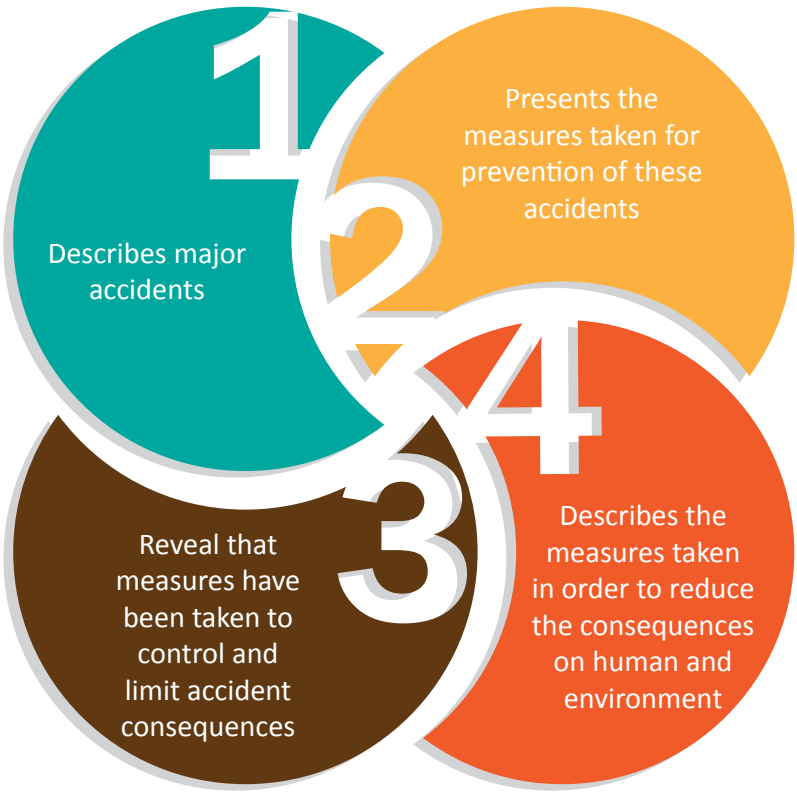


Figure 8 Components of safety report

Safety report should answer the following questions;

- Which technical or man based activities are realized in establishment?
- How are these activities conducted?
- When an emergency occurs, how is process safety managed?

Pursuant to legislation, safety report should contain minimum information about the organization regarding SMS and MAPP of establishment.

Hazard identification, accident risks analysis and prevention methods and the information on organization (and its related plants) should be given in safety reports. In addition, the subjects such as surrounding of establishment, design principles for safety and reliability, measures of construction, activity and maintenance for protection and the intervention for restriction of accident results should be addressed.

Apart from these, safety report should show that internal emergency plans have been prepared, provide the information to support external emergency plan and cover data enough to help land use planning for CAs.

According to Safety Report Guidance (Seveso II New Safety Report Preparation Guidance to meet the conditions of the Directive 96/82/EC replaced with the Directive 2003/105/EC) should follow proportion and demonstration approach:

Table 5 Proportionate and Demonstration approach for safety report

Proportionate approach	Demonstration approach
The level of detail should be proportionate to the *extent of potential risks* and the *complexity of the installation/process/ systems* involved: ▪ The safety report should be of a summarizing character i.e. Information provided is limited to its relevance in regard to major-accident hazards, ▪ However, the information should be sufficient to demonstrate that the requirements have been met ▪ The description of measures should be limited to the explanation of their specific objectives and functions.	Demonstration can be recognized by the presence of the following components: 1. Systematic analysis ▪ **hazard identification and risk assessment process** must be systematic and ▪ Identify all major accident **hazards** in the establishment ▪ Assign **frequencies and consequences to accidents** ▪ **Rank** and select reference scenarios 2. Detailed evidence The safety report must provide ample evidence to show the **consistency between the scenario selected and the safety measures taken.**

Operators are directly responsible for precision and sufficiency of the information in the content of safety report and determination of competencies of the persons or institutions whose consulted for the preparation of the report.
Operators should update safety report in a period determined in the legislation. Furthermore, updating of safety report is required for the following cases:

- Cases to give rise to major industrial accident in establishment such as
  - Near-misses,
  - Change in storage or amount, quantity of present dangerous substances, process used,
  - Making a change in safety management system stated in Annex-3 of the By-law
- In the event that it is detected that additional information related to updating safety report or safety report belonging to establishment does not reflect the situation in establishment during inspection of safety management system conducted,

Operators of upper tier establishments should prepare a Safety Report containing the matters indicated below:

i. Introduction of establishment, its surrounding and the plants within establishment,

a) Introduction of establishment
b) Maps belonging to establishment
c) Introduction of surrounding of establishment
d) Introduction of the plants within establishment
e) Information on the dangerous substances found in establishment

ii. Information on safety management system of establishment

Upper tier establishments show in safety report that major accident prevention policy (MAPP) has been formed in establishment and safety management system (SMS) is applied in this direction.

a) Information on Major accident prevention policy (MAPP) and
b) measures of safety management system (SMS)

iii. information on major accident scenarios and safety measures

Detailed information is given in Annexes 4.3 and 4.4.

2.4 Internal Emergency Plan (IEP)

In cases that major industrial accidents are not prevented, consequences of hazards for the people and environment near impact area of accident and the establishment personnel may emerge as a result of fire, explosion and toxic dispersion

The emergency plan that provides intervention to accident instantly and taking effects of major industrial accidents under control takes important place in safety system.

Operator prepares an IEP with the following purposes, interviewing the personnel employed in establishment and taking the measures to be taken within organization

- To take accident under control,
- To inform the public,
- To turn to former state and clean environment following a major accident,
- To limit damage to people and environment and loss of goods,
- To implement necessary measures

While the requirements regarding IEP of the regulation are applied only for upper tier establishments, the information found in this plan may also help for formation of emergency policies in MAPP for lower tier establishments.

Operator should be prepared before emergence of emergency, have required equipment and know how an emergency should be avoided safely.

Operator should make available the information on emergency arrangements related to dangerous substances. Accident services within and out of establishment and emergency service should access these information easily.

These information will contain

I. The hazards at the work conducted, measures to be taken and the works to be done for being ready and making appropriate intervention by emergency services and

II. Special danger to emerge possibly in case of accident or emergency and the works to be done.

Box 7 Whom can I apply while preparing the plan?

Whom can I apply while preparing the plan?

- Authorities of neighbour institutions,
- Units conducting emergency service,
- Related governorate,
- Coast guard (if necessary),
- Related organized industry region
- Related operation directorate of industrial region

IEP is related to the measures to be taken by operator in order to control results of accident within the establishment, reduce effects to minimum and apply protection measures.
IEPs should be reviewed and updated when necessary and drills should be performed. Formation of new elements necessitates that operator consults with employees, local administrations, CAs, emergencies and the health administration that present in the place where establishment is located. Furthermore, it gives assistance to preparation of external emergency plan (EEP) by local administrations and CAs.
IEP has to describe how establishment will protect people and immovable. It assigns duties related to emergencies to the individuals within establishment and classifies the protective measures to be taken.

Table 6 Content of internal emergency plan

Operator of upper tier establishment is responsible for preparation of an internal emergency plan that considers the criteria specified by BEKRA legislation.

- Internal emergency plan prepared by operator contains the detailed information on emergency measures for intervention to major accident hazards and shows that internal emergency plan is applied in the establishment.
- Summary of the plan should be incorporated in safety report.
- It should be shown that procedures to be used for testing and reviewing of plan have been prepared and applied.
- For evaluation of results of accidents envisaged in scenarios, simulation software selected for determining impact area of accident is utilized. In this case, the models and calculation parameters used in simulation software are stated in safety report. (for instance, the reasons of the assumptions made and the values used in key variables of the model or method such as wind speed in gas distribution model, atmospheric conditions, etc. are given)
- Caution and intervention organization towards case of major accident should be expressed in a way to prove that necessary measures have been taken within plant.
- It should be shown in internal emergency plan that the equipment to be used for relieving consequences of major accidents is compatible with usage areas targeted.
- It should be shown that personal protective equipment suitable and at enough number are ready for relieving actions to be realized by emergency intervention team.
- When the resources to be found from local and other fire brigade teams are taken into consideration, it is shown that internal fire combating and fire protection possibilities appropriate and at enough number are provided.

  Suitable resource at enough quantity to be used to relieve the related consequences and to reduce release of toxic and/or flammable substances in air to surrounding area should be available.
- It should be proved that sufficient and suitable sources to be utilized to reduce the effects arisen from removal of measures that prevents mixing of dangerous substances into soil or water are present.
- It should be revealed that suitable sources at enough quantity may be provided for monitoring and/or sampling, state objectives of monitoring/sampling sources and explain the decisions and effects to be taken about emergency answer within plant of related results.
- It should be demonstrated that suitable measures at enough number have been taken to clean and bring to former state environment following major accident.
- It should be proved that enough and suitable first aid and medical support may be provided at emergency interventions
- It should be shown that enough and appropriate resource has been allocated for finding auxiliary equipment to be needed for emergency interventions.
- It should be presented that appropriate arrangements have been made for the maintenance, examination, review and testing of other equipment and the sources to be used for emergency interventions and found under the responsibility of operator.
  - Determination of organization and responsibilities for internal emergency intervention
  - Information and training for employees, workers of contractor firm and visitors and emergency intervention team
  - Arrangements for alerting the persons within establishment, competent authorities, neighbour institutions and the public if related
  - Activities for plant and persons that will need special protection or recovery intervention
  - Description of emergency services, recovery routes, escape routes, shelter buildings and control centres

2.5 Public Information

The community having awareness and conscious protects itself better from the accidents arisen from the industrial establishment holding dangerous substance and so real consequences of the accidents are reduced.
BEKRA Regulation entails giving information to all persons who will possibly affect from accident about the safety measures and what to do in case of major industrial accident.
Responsibility of public information has been defined for operators of upper tier establishment.

Impact area of accident

Operator of upper tier establishment is in charge of giving information to all persons, public and private sector institutions found within impact area determined by Provincial Directorate of Disaster and Emergency about possible accidents to happen in its establishment, the safety measures taken and what to do in case of a major accident, by using most convenient methods.

Other benefits of increasing awareness of the public and local administrations in the regions where BEKRA establishments exist are;

- It ensures that correct information (correcting wrong information) on activities of establishment is given.
- Guarantee is given for that society benefit is observed
- In case of major accident, it can be taken action in a way awareness is increased
- It is made sure that measures for prevention of repetition of major industrial accident has been taken/will be taken.
- It is ensured that awareness is raised to decrease the social concerns arisen from establishment
- It develops relations between public, local administrations and operators and increases confidence.

In addition, it provides support to emergency plans and information sharing with local administration. Solidarity and information sharing process between establishments and local administration (for establishments new or changes are present) should be a systematic and programmed procedure.

Content and format of information

Public information is essential for that society prepares itself for emergencies. The information provided should also be understandable for the persons who have no opinion on activities of establishments or operations of establishment. The information given to the public at impact area of accident;

- Should be presented user friendly (simple and understandable)
- Be provided without use of technical terms
- Be arranged again when a big change is needed at establishments.

Determination of target group

The persons who are resided within impact area of accident and may be affected from accident should be assumed as local communities. For instance, the persons stated below:

- Residents of the quarter near establishment
- Shopping centre, retail sale areas and operators of sport fields
- Schools, nurseries, nursing centres for old people
- Public libraries in the proximity of establishment

The public may request information from operators or CAs or the distribution of the brochures informing the public on what to do and safety measures to be done in case of an accident may be provided.

2.6 Reporting Accidents

If, pursuant to legislation, major accident occurred within the borders of establishment meets at least one of Major Industrial Accident Notification Criteria, operator has to notify to Prime Ministry Presidency of Disaster and Emergency Management, Turkish Public Health Agency, Ministry of Labour and Social Security and Ministry of Environment and Urbanization, especially Governorate and related Municipality immediately.

In addition, operator follows the steps of accident reporting included in BEKRA legislation in lieu of legislation and accident notification realized by means of system.

You can find the details pertaining to Major Industrial Accident Notification Criteria in Annex-6 of the regulation.

3. PROCEDURES WITH COMPETENT AUTHORITIES

BEKRA Regulation brings various responsibilities to public administrations.

Competent authorities (CAs) are in charge of application and monitoring of regulation responsibilities.

CA is an institution authorized for realization of a function. When an authority is assigned with a certain duty, only this authority has competence on the action in question.

Various activities such as developing regulatory legal framework, establishing notification system, preparation of external emergency plans, auditing institutions, giving permits, land use planning, determination of domino establishments and evaluation of safety reports and IEPs are among the duties performed by CAs.

Operators should be contact with CAs (at the same time, employees and other stakeholders) and be in compatible with CAs to act in line with legislation, apply programs and policies, and realize safety targets.

These procedures necessitate close communication with operators. In addition, after some changes experienced in establishment, CAs should be informed as well.

Up to date information is safer

Following the changes in establishment, MAPP, SMS and emergency plans should be updated

- Change in the type and amount of the dangerous substance used
- Change in the process that dangerous substance is used and/or storing
- manner
- Following the accidents and near-misses

Operators and CAs are responsible for updating reports/plans for the duration specified in the BEKRA legislation.

3.1 Assessment of Safety Report

CAs reviews safety report and informs results to operator in writing:

- Examination date
- Additional information sources used for review
- Results arrived regarding some subjects in the report (positive or negative)

The review aims to determine whether safety report to be prepared by CAs conforms to the format in its communiqué and the minimum information desired is available.

This review is not the one made about sufficiency of safety and health of man and environment, establishment that safety report belongs to and realized without making any audit in establishment.

Review of content and sufficiency of safety report is carried out by assuming that the information provided by operator is correct.

3.2 Inspections

For access to targets of legislation, necessity of an efficient audit system emerges. For implementation of BEKRA legislation, CAs are responsible for setting up audit system. Inspections play an important role in increase of the quality and consistency of the liabilities of regulation.

BEKRA legislation envisaged within the scope of BEKRA legislation covers a program for auditing on site of all establishments or establishments regularly by a CA. Inspections contain examination of establishment in terms of organizational, technical and managerial aspects. Audit system has been founded to realize the following:

- Operator has developed appropriate instruments to prevent major accidents and limit the consequences (within and out of establishment)
- Emergency planning has been put into effect;
- The information presented in safety report by operator are correct and complete and the conditions in establishment has been reflected;
- Public has been informed

Operator should prove that,

- All major accident hazards have been determined;
- The effects on environment and people have been evaluated
- Hazards have been avoided or reduced in the places where it can be applied
- There is a clear connection- ratio between preventive and reducing measures taken and the hazards determined;
- Preventive measures may hinder the failures predicted before they lead to major accident
- Reducing measures may limit the consequences of accidents predicted before
- These measures are taken into consideration during all life cycle of the establishments within the scope.

The technical team responsible for risk assessment and other safety elements within establishment should have the following features and present enough information on these subjects during inspections:

- Understanding and implementing risk assessment;
- Understanding and evaluating safety management systems
- Understanding and assessing field actions, materials and procedures;
- Comprehending and evaluating implementation of process safety principles in storing, processing, transportation and keeping dangerous substances
- They should be able to use and understand the related software and mathematical models in the places appropriate

Following inspections, CAs prepares inspection result report that deals with the following titles;

- Inspected sections of establishment
- Evaluation results of inspected systems
- Compatibility results in terms of legislation necessities
- The measures to be taken at the end of inspection
- legal sanction and interviews made with and operator

CAs expects that inspections results are given operator clearly. The deficiencies detected and the details of necessary measures and the duration required for implementation for these may be presented in the report.

Accompanying with inspections and following results by operator will make contribution to efficiency of inspections.

3.3 Land use planning

In most of the industrialized countries, to prevent and limit the consequences of major industrial accidents, there are mainly two mitigation actions: safety measures and risk reduction and control in industrial facilities (on-site), and limitation of structural and human assets exposed to the industrial accidents in the vicinity of establishment (off-site).

Land Use Planning belongs to second category of measures. It is the appropriate separation of Establishments, planning infrastructures and residential settlements in industrial areas, which has to be taken into account in planning policies.

Pursuant to Seveso II Directive, the procedures required for the implementation of these policies and other related policies and land use entails in long term;

I. Between large transport ways, recreational areas and the areas having special natural sensitivity and feature, establishments and settlement areas, structures, areas open to the public
   - to leave suitable distance as much as possible

II. For current establishments
   - To take additional technical measures in accordance with Article 5 of the Directive not to increase risk on people.

The officials of all CAs and the planning having responsibility of making decision; must follow appropriate opinion exchange procedures to facilitate the abovementioned policies. In order to provide the technical recommendations related to the risks arisen from establishments, an approach can be followed through a general approach or one changing from one situation to another.

In Turkey, legislation does not directly corresponds to the Seveso Directive, however various

regulations regarding land use planning exist. Many licenses, permits and approval are required for investment process in Turkey. Land development permit that takes place in this process are among the most complicated parts.

Legal and institutional framework of land use planning system is set by many laws and regulation. The most important ones for these laws and regulation are given in the following table;

Table 7 Legislations applied in our country for land use planning

- Zoning Law No. 3194 (Official Gazette No: 18749, 09.05.1985)
- Establishment Law of Metropolitan Municipalities No. 3030 (Official Gazette No: 18453, 27.6.1984)
- Municipalities Law No.1580 (Official Gazette No: 1471, 14.4.1930)
- Public Health Law No.1593 (Official Gazette No: 1489, 24.4.1930)
- Law on Workplace Opening and Working Licenses No 3572 (Official Gazette No: 20198, 17.6.1989)
- Environmental Law No.2872 (Official Gazette No: 18132, 9.8.1983)
- Environmental Impact Assessment Regulation (Official Gazette No: 25318, 16.12. 2003)
- By-law on Principles regarding Making Environmental Plans (Official Gazette No: 24220, 4.11. 2000)
- Organized Industrial Zones Law no: 4562
- By-law on Place Selection of OIZ (21 May 2001)
- By-law on OIZ Application (revised with the O.G. 1/4/2002, 24713 and O.G. 08.01.2003, 24987)
- Industrial Regions Law no: 4737 (revised with O.G. 19/1/2002, 24645 RG, later O.G. 01.07.2004, 25509)
- By-law draft on Industrial Regions (is still discussed at Primer Ministry)
- Technology Development Regions Law no: 4691 (06.07.2001, application by-law of this law was published in the official gazette no: 24790 of 19.06.2002).
- By-Law on Protection and Use of Agricultural Lands (O.G. 13.07.2003, 25137)
- Law on Military Prohibited Regions and Security Regions (22.12.1981, O.G. no: 17552, Law No: 2565)
- By-Law on Military Prohibited Regions and Security Regions (published in O.G. no: 18033 of 30.04.1983)
- The protocol signed between Ministry of Health and Ministry of Industry and Trade (19.09.2003; subject: the principles and procedures to be applied for health protection bands to be left within ownerships borders of organized industry regions)
- Resolution of High Council of Culture and Nature Assets of Ministry of Tourism and Culture

Approval of environmental master plans is under the responsibility of Ministry of Environment and Urbanization.

3.4 Domino Effect

The effect called as domino effect emerges in the areas where the studies pertaining to storing, process and transport of dangerous substances are concentrated. These areas have negative impact on risk control, land use planning, emergency planning and intervention. This impact requires analysis of decision making process, many accident scenarios.

- While competent authority determines domino effects, it requests information from operator and informs them
- It provides information on measures and presents contribution to information exchange and cooperation with other operators
- Domino effects are also considered for evaluation of safety report and emergency plans
- Attention is paid that audit process will also cover domino effects.

In the areas where the establishments increasing effects or possibility of major accidents are present, public administrations should be informed and cooperation should be realized to decrease domino effect.

Within the scope of BEKRA legislation, Provincial Directorate of Disaster and Emergency assigns establishment groups, considering that possibility or results of major accident may be increased due to the dangerous substances held and the location of establishments, using the information in safety reports.

Establishments should pay attention to domino effect and that the CAs are obliged to control this evaluation while making risk assessment.

Operators of any establishment in this group provides suitable information exchange to the operators of other establishments within group in a way to consider size and nature of all threats that a major accident will occur.

In other words, CAs should determine the establishments or establishment groups that accidents danger and possible results may be enhanced due to location and proximity and ensure information flow and cooperation between establishments.

Domino Effect

CAs determines the establishments or establishment groups that accidents danger and possible consequences may be enhanced due to location and proximity and the current dangerous substance inventory.

CAs ensures sharing conveniently of the information required to consider quantity of general danger of major accident in internal emergency plans and safety reports, safety management systems, major accident prevention policy of these establishments.

3.5 External Emergency Plans (EEP)

With respect to the upper tier establishments entering within the scope of BEKRA, Provincial Directorate of Disaster and Emergency is responsible for preparation of EEP.

Provincial Directorate of Disaster and Emergency and the public administrations to be assigned will apply an EEP for the measures to be taken within and outside BEKRA establishment. The authorities assigned are additionally responsible for communicating necessary information to the public in the region, services and administrations following a major accident.

External emergency plan to entail being ready of emergency service units from outside of the establishment when an emergency has occurred or to affect the environment and the persons out of establishment should be prepared based on the major accident hazards stated in safety report by operator.

While preparing EEP, the information found within Safety Report is used.

While EEP is prepared, Provincial Directorate of Disaster and Emergency takes information from

- Operators of neighbour establishment that the plans covers up
- The units conducting emergency service when it is found necessary
- Directorates of Organized Industry Region
- Operation Directorates of Industrial Zone
- Provincial Directorates of disaster and emergency of neighbour provinces and
- The institutions and organizations affiliated to civilian authorities that external emergency plan covers

CAs should ensure that the plans are reviewed once a year, tested and changed when necessary and updated. The changes taken place in related institutions or emergency services, the information about intervention to major accident are reviewed through new technical information.

In addition, informing the public and giving their opinions on external emergency plan draft should be made accessible to the public by Provincial Directorate of Disaster and Emergency for the duration specified in the regulation.

BEKRA Regulation lists the information to be found in EEP.

- The names or titles of the persons authorized to determine emergency procedures and the persons who makes coordination and is responsible for the activities out of plant
- The arrangements for preparation of related procedures and receiving emergency alarms, warnings
- The arrangements relating to coordination of necessary resources for implementation of external emergency plan
- The arrangements regarding the assistances to be provided for reducing/corrective activities within plant of emergencies
- Arrangements for reducing/corrective activities of the effects of emergencies out of the plant
- The arrangements for providing information on accident to the public and things to be done by the public on this matter

The necessary information on the quantity, size and possible effects of likely major accidents should be provided to competent authorities by operator. This information should have the details at the level to allow possibility to local administrations to prepare an external emergency plan. Local authorities can demand additional information while preparing the plan.

Table 8	Content of external emergency plan
1.1.	Early warning, alarm and commissioning procedures with regard to the accidents to be occurred in the plan
1.1.1.	Early warning
1.1.2.	Intervention and coordination
1.1.3.	Effect mitigation in plant
1.2.	Public health aspects of major accidents
1.2.1.	Special cases to be arisen in terms of public health
1.2.2.	Duties of operators for public health
1.2.3.	Duties of authorities from the point of public health
1.3.	Environmental aspects of major accidents
1.4.	Training and drill
1.5.	Implementation of emergency plans
1.6.	Review and updating of emergency plans
1.7.	Informing and warning the public
1.8.	Information needs of emergency service units
1.9.	Minimum information to be given fire brigade
1.10.	Infrastructure information to be given fire brigade
1.11.	Other information to be given fire brigade
1.12.	Information to be given security forces
1.13.	Information to be given ambulance service
1.14.	Information to be given health centres

Operator should keep the register on how the information, data source, knowledge provided to local authority will be reviewed, corrected and updated.

While emergency plans of the establishments having potential to give rise to domino effect are prepared, these effects should be taken into consideration and the operators of establishment should ensure all kinds of information exchange pertaining to subject for the purpose of efficient planning. Those having domino effect should be considered at the drill studies to be performed for emergency planning and external emergency intervention.

When a demand related to use and storing of dangerous substances comes to relevant authorities, the information pertaining to the demand in question should be sent to related governorates or municipalities, emergency service units and institutions with the intent of ensuring early assessment of effects of emergency plans of new establishments.

In cases that establishment is within the borders of local administrations more than one or close to each other, local administrations should be in contact with each other while preparing external emergency plan.

3.6 Administrative Measures

BEKRA Regulation is based on the provisions of

- Environmental Law no: 2872 of 9/8/1983,
- Occupational Health and Safety Law no: 6331 of 20/6/2012,
- Decree on Organization and Duties of Ministry of Environment and Urbanization no:644 of 29/6/2011,
- The Law on Organization and duties of Presidency of Disaster and Emergency Management no: 5902 of 29/5/2009.

Pursuant to Environmental Law, the operators that engage in the activities of production, sale, storing, use and transport of dangerous substances and collection, temporary and intermediate storing, recycling, re-use and disposal of dangerous wastes are in charge of the liabilities brought with this law severally.

The responsible persons are in charge of making financial liability insurance for dangerous substance and dangerous waste against the damages to be given third parties that will be occurred due to an accident because of their vocational activities stated in this law.

BEKRA Regulation can prohibit operation of establishment, plant and storing plants when the measures taken by operator to decrease and prevent major accidents are seriously insufficient.

OCCUPATIONAL HEALTH AND SAFETY LAW

Stopping work

ARTICLE 25 – (1) When a matter comprising a vital danger for employees who work at work equipment or in working methods and manners, buildings and attachments at workplace is detected, work is stopped at the some section or all of workplace by considering the employees and the area that the risk to be arisen from this danger will affect and the quantity of vital danger until this threat is eliminated.

In addition, work is stopped in case risk assessment is no made at the workplaces that major industrial accidents may occur or works with dangerous chemicals and the mining, metal and building works included in very dangerous class.

(2) The committee composed from three work inspectors authorized to audit in terms of occupational health and safety may decide stopping of work in two days from date of detection, making necessary examinations. However, the matter determined requires urgent intervention, the work inspector stops work in a way to be valid until decision is taken by the committee

(3) The decision on stopping of work is sent to related civilian authority manager and provincial directorate of labour and work institution where workplace is located in a day. The decision on stopping of work is realized in twenty four hours by civilian authority manager. However, the matter detected entails urgent intervention, the decision on stopping of work is fulfilled in the same day by civilian authority manager.

Preparation of safety report and major accident prevention policy paper

ARTICLE 29

Operator having liability to prepare safety report can open their workplaces for operation after the contents and sufficiency of safety reports have been reviewed by MoEU.

If no major accident prevention policy paper or safety report are prepared and implemented, no safety report is available, they are not sent to MoEU for review or found insufficient, working is stopped.

- To the employer who have not prepared the major accident prevention policy paper stated in article 29 of the law, fifty thousand Turkish Lira fine,
- To the employer who continue to the activity whose operation is halted or open the workplace not allowed by MoEU for operation, activates workplace without preparing safety report and submitting It to the evaluation of MoEU, eighty thousand Turkish Lira

To the employer who fails to perform the liabilities indicated in the regulations specified in article 30 of the Law, one thousand Turkish Lira administrative fine for each provision from date of detection are given

4. ANNEX A

4.1 TERMINOLOGY

Emergency services: Health and security services including security forces, fire brigade, ambulance, coast guard, civil defence and research- rescue services for reduction to minimum of the damage in and around establishment at major industrial accidents,

Disaster: Natural, technologic or man- made events that stops or causes cut at men activities and normal life, lead to physical, economic and social losses for some section or all of the society

Lower tier establishment: The establishment holding dangerous substances equal or over the threshold values in Column 2 in the dangerous substance lists given in chapter 1 and 2 of annex-1 of the regulation but lower than the values in column 3,

BEKRA Notification: will be made by means of http://bekrabs.cevre.gov.tr present under Environmental Information System at the address of http://online.cevre.gov.tr .

BEKRA Establishment: Upper and lower tier establishments within the scope of the by-law on prevention and reducing the effects of major industrial accidents

BEKRA Legislation: By-law on Prevention and Reducing the Consequences of major industrial accidents

Major industrial accident: A great dispersion, fire or explosion event caused by one or more dangerous substance(s) that gives rise to serious threat later or at that moment for environment and/or human health within or out of the establishment and arisen from uncontrolled developments in the course of operation of any establishment,

External Emergency Plan: The guidance that helps operators, local administrations and emergency teams, everyone having responsibility on planning and major accident hazards to take place at and around establishment. Also described as a plan determined by considering all accident scenarios, accident intervention and accident prevention procedures, being prepared against the accident at and around establishment.

Storing: Keeping dangerous substance under control in a way necessary conditions are ensured, in a safe place or making it available at stock

Domino Effect: When a Seveso plant (plant A) is influenced from external accident happened at another plant (typically non-Seveso) (plant B), domino effect takes place.

Dow Index (FEI): Fire and explosion rating system makes evaluation about potential explosion and fires for relatively independent unit processes.

Industrial Chemical Process: In article 2 of Seveso II Directive, the dangerous situations to emerge during loss of control of an industrial chemical process are pointed out. The term of industrial chemical process has been selected for determination of general lines of the scope of Directive intentionally. Loss of control in chemical processes rather than the hazards to emerge during loss of control of chemicals have been considered. For that reason, storehouse fire in stock area of a chemical is not taken under that scope. Non-dangerous substances stored that have potential to become dangerous in the course of accident have not been assessed within the scope of the accidents to arise out as a consequence of loss of control of industrial chemical processes.

Severity of effects: Means the severity of accident results/effects. These effects can be expressed as possibility of accident impact. (for instance: death possibility of an unprotected person). It can be defined as a function of severity of physical impact. (for example: death possibility can depend on the function of H2S concentration found in air.)

Frequency: Means occurrence possibility of major industrial accident

HAZOP: Hazard and operability study (HAZOP Hazard and operability studies (HAZOP studies) - Application guidance IEC 61882 Ed. 1.0 b:2001) HAZOP method was developed in 60s in order to urge a rational and consistent procedure structured for review of hazard and operability sizes of process design (namely, with regard to current plants). The method is applied by very disciplined team who use a methodology structured on the basis of guide words)

Committee: The committee composed from at least three job inspectors authorized to audit in terms of occupational health and safety that decides to the actions to be performed as a result of safety report review,

HFT - Hardware Failure Tolerance

Operator: Establishment owner or any legal or natural person who gives decision on technical operation here and/or is responsible for operation of a plant or establishment within the scope of employer indicated in Occupational Health and Safety Law no: 6331 of 20/6/2012,

IDLH: The concentration that will give rise to health effects if it continues more than 30 minutes

IEC 60300-3-9: Reliability management

IEC 60812, ANALYSIS TECHNIQUES FOR SYSTEM RELIABILITY: (FMEA) (Analysis techniques for system reliability – Procedures for failure mode and effect analysis –FMEA)

IEC 61025, (Fault tree analysis - FTA)

Acceptable Risk: The risk level not to form loss or injury, compatible with legal liabilities and prevention policy of workplace.

Quantitative risk assessment: Risk assessment methodology made through digital based scientific methods,

Commission: The commission composed from at least three job inspectors authorized to audit in terms of occupational health and safety to review safety reports,

Establishment: All area where one or more plants holding dangerous substances are located within the scope of the description of workplace indicated in Occupational Health and Safety Law no: 6331 including the activities and common infrastructure found under the control of the same operator and located in the same campus that two or more area(s) separated with road, railway or continental water way are evaluated as a whole,

LC50: The concentration that leads to death at 50% of the individuals exposed

LOC: Loss of Containment

LOPA: Analysis of Layer of protection

MECHANICAL EFFECTS: are emanated from a pressure fluctuation occurred as a result of an incapacity and occurrence of mechanical incapacity of an element (for example, from a reactor explosion)

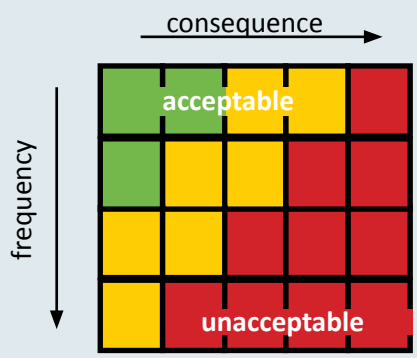
Possible highest measure level: The frequency level that major accident risk whose scenario is formed according to result for quantitative risk assessment should be decreased,

MSDS: Material Safety Data Sheets

P&ID (Piping and Instrumentation Schemes): The schemes showing placements throughout flow of measurement devices, control elements, connection elements, the equipment found within process and the details related to arrangement of these.

PFD: Process Flow Diagrams

Risk: possibility of occurrence of loss, injury, environmental pollution to be arisen from hazard or other harmful results



SIL: Safety Integrity Level

SFF: Safe Failure Fraction

Tehlike: KHazard: Hazard or potential of giving damage to influence environment or man, establishment existing or to come from outside of establishment,

Dangerous substance: A substance or preparation to occur during loss of containment of an industrial chemical process or existing as raw material, product, by-product, waste and/or intermediate product within a category listed in column 1 of Chapter 2 of Annex-1 or listed in column 1 of Chapter 1 of Annex-1.

THERMAL EFFECTS: These effects depend on the thermal radiation released with implementation of one or more exothermic reaction not having the capacity of burning or very fast burning of a flammable substance.

Plant: the technical unit within an establishment that dangerous substances are used, processed, produced or stored and the equipment, structures, pipe installation, business equipment required for functioning of this unit and railway ramp lines, dockyards and loading –unloading docks, float systems, floating and fixed breakwaters, storehouses or similar structures that offer service to unit.

TOXIC EFFECTS: emerges from breathing, digestion or contact with skin of a toxic substance or preparation. Release of toxic substance can be arisen from a leak or a fire or reaction happened within establishment.

Upper tier establishment: the establishment holding dangerous substances equal or over the threshold values in Column 3 in the dangerous substance lists given in Chapters 1 and 2 of Annex-1 of BEKRA legislation,

HAZARD CATEGORIES AND ABBREVIATIONS

Overview of the UN GHS Classification system

(Fourth revised edition, 2011)

PHYSICAL HAZARDS

Explosives
(6+1 Divisions)

Flammable gases (including chemically unstable gases)
(Category 1&2, Category A&B)

Aerosols
(Category 1-3)

Oxidizing gases
(1 Category)

Gases under pressure
(4 Groups)

Flammable liquids
(Category 1-4)

Flammable solids
(Category 1-2)

Self - reactive substances and mixtures
(Type A to G)

Pyrophoric liquids
(1 Category)

Pyrophoric solids
(1 Category)

Self - heating substances and mixtures
(Category 1-2 & 2a/2b)

Substances and mixtures which, in contact with water, emit flammable gases
(Category 1-3)

Oxidizing liquids
(Category 1-3)

Oxidizing solids
(Category 1-3)

Organic peroxides
(Type A to G)

Corrosive to metals
(1 Category)

HEALTH HAZARDS

Acute toxicity
(Category 1-5)

Skin corrosion/irritation
(Category 1(A/B/C/),2&3)

Serious eye damage/eye irritation
(Category 1,2(A/B))

Respiratory or skin sensitization
(Category 1(A/B))

Germ cell mutagenicity
(Category 1(A/B),2)

Carcinogenicity
(Category 1(A/B), 2)

Reproductive toxicity
(Category 1(A/B), 2; additional)

Specific target organ toxicity - Single exposure
(Category 1-3)

Specific target organ toxicity - Repeated exposure
(Category 1,2)

Aspiration hazard
(Category 1,2)

ENVIRONMENTAL HAZARDS

Hazardous to the aquatic environment
(Category: Acute 1-3, Chronic 1-4)

Hazardous to the ozone layer
(Category 1)

Categorization nomenclature

Type of hazard

Class of hazard
(Sub-Division/Category/Group Type)

4.2 Determination of Scope

Explanations on Notification System

Notification, is a document showing that why an establishment has the characteristics of BEKRA establishment.

Main element is the list of dangerous substances and possible maximum amounts.

Substances: described with name, CAS no, physical form (high pressure, high temperature).

Example for notification terminology:

- Denominated substance + denominated substance (acetylene + hydrogen)
- Denominated substance+ category (chloride + toxic substances)
- category + category (very toxic + toxic, explosive + burning)
- substances having two dangerous features to be counted two times (methanol + toxic, methanol + burning)

Rule of 2%: If any major accident to be caused by a substance is no available, amount of this substance may be disregarded up to 2% of lower threshold.

Summation rule: It is a rule that similar substances are summed along with their own threshold percentages.

Example 1

Dangerous substances found within establishment

- Oxygen: 1400 ton
- LPG: 40 ton
- Hydrogen: 8 ton

Substance/Category	*Amount*	*Lower threshold value*	*Upper threshold value*
Denominated Substances			
Oxygen	**1400.0 ton**	200.0 ton	2000.0 ton
LPG	**40.0 ton**	50.0 ton	200.0 ton
Hydrogen	**8.0 ton**	5.0 ton	50.0 ton

LPG amount found in the establishment is below threshold value.

Oxygen and hydrogen amounts present in the establishment are over the threshold values described for lower tier establishments.

When summation rule is applied, establishment is classified as upper tier one.

1400/2000+40/200+8/50=1.06 >1

Example 2

The dangerous substances found in establishment

- Carbonyl dichloride (fosgen):200 kg
- Hydrogen cyanide:400 kg

Substance/Category	*Amount*	*Lower threshold value*	*Upper threshold value*
Denominated substances			
Carbonyl dichloride (fosgen)	**0.2 ton**	0.3 ton	0.75 ton
Unnamed substances			
Hydrogen cyanide (very Toxic-Category 1)	**0.4 ton**	5.0 ton	20.0 ton

The substances present in the establishment are lower than threshold value. When summation rule is applied, as it is 0.2/0.3+0.4/5=0.75 <1, establishment is out of the scope.

Example 3

The dangerous substances found in establishment

- Oxygen: 180 ton
- LPG: 4 ton
- Carbon monoxide: 8 ton

Substance/Category	*Amount*	*Lower threshold value*	*Upper threshold value*
Denominated substances			
Oxygen	**180.0 ton**	200.0 ton	2000.0 ton
LPG	**4.0 ton**	50.0 ton	200.0 ton
Unnamed substances			
Carbon monoxide (Toxic-Category 2 and very easy flammable-Category 8)	**8 ton**	5.0 ton	200.0 ton
Carbon monoxide (Toxic-Category 2 and very easy flammable-Category 8)	**8 ton**	10.0 ton	50.0 ton

Oxygen and LPG present in the establishment is lower than threshold value.

Carbon monoxide also enters in two different categories under toxic-category 2 and very easy flammable-category 8.

According to regulation, in case of existence of the substances or preparations to be subjected to classification more than one, the least quantitative amounts in terms of the objective of regulation is applied, related guideline should be followed.

When summation rule is applied for threshold values,

Lower level:

180/200+4/50+8/10=1.79 > 1

Upper level:

180/2000+4/200+8/50=0.27<1

Based on these results, establishment is classified as lower tier one.

Example 4

Establishment present in the establishment

- Chloride: 2 ton
- Ethylene oxide: 4 ton
- LPG: 40 ton

Substance/Category	*Amount*	*Lower threshold value*	*Upper threshold value*
Denominated substances			
Chloride	**2 ton**	10.0 ton	25.0 ton
Ethylene oxide	**4 ton**	5.0 ton	50.0 ton
LPG	**40 ton**	50.0 ton	200.0 ton

The substances present in the establishment are lower than threshold values. When summation rule is applied,

For lower threshold values;

2/10+4/5+40/50=1.8>1,

For upper threshold values;

2/25+4/50+40/200= 0,36 <1

Establishment is classified as lower tier one.

4.3 Risk Assessment

In this chapter, the questions summarizing the risk assessment process in Chapter 2.1 have been reviewed in detail.

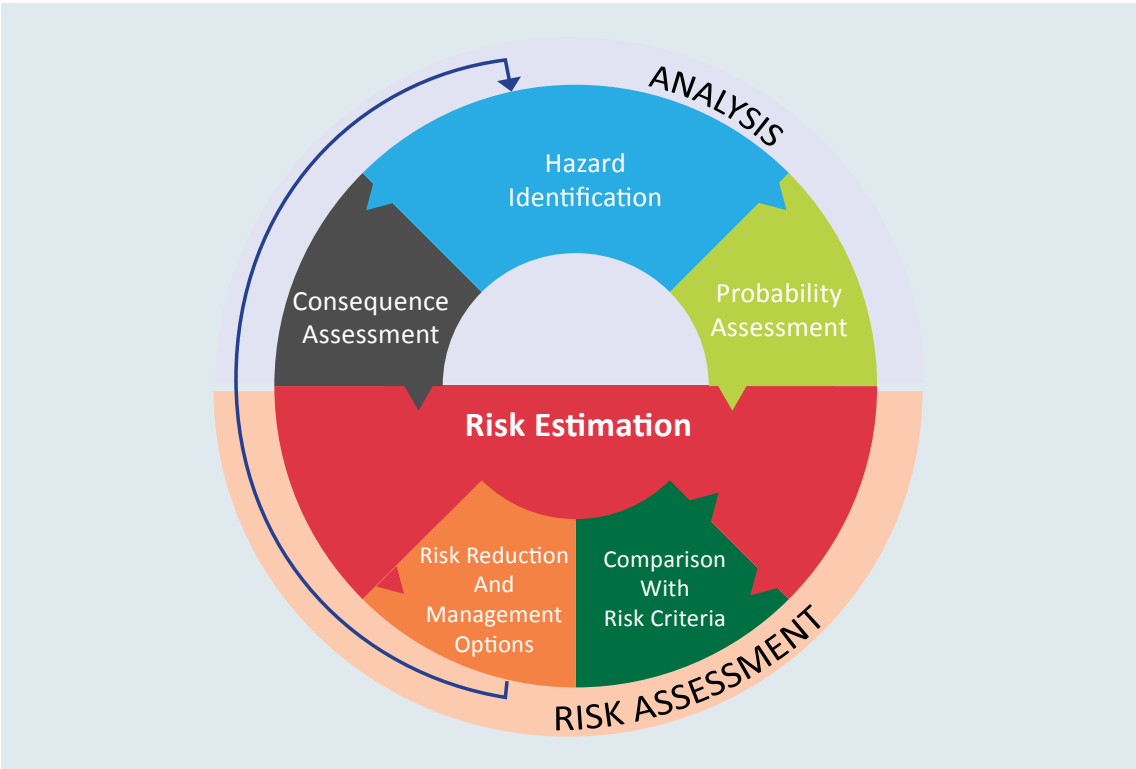
Risk Assessment	**Risk Analysis**	**1. What can go wrong?**
		2. How often?
		3. What are the consequences?
		4. What are the risks?
	Risk Evaluation	**5. So what?**

With regard to the 1st question **-What Can Go Wrong?-** *hazard identification* process carried out for which a range of tools exists for systematic assessments, which are selected depending on the complexity of the individual case. Furthermore, the level of detail required depends on the intended use of the risk assessment.

While hazards are defined, all hazards to cause to a potential accident in terms of all business cases in a way to include emergencies and abnormal cases, a potential breakdown, decommissioning, commissioning should be described.

For hazard description, the description methods used can be classified as follows;

- Inductive reasoning begins with a piece of equipment or function failure and analyze the possible consequences. Ex: Fault Tree Analysis
- Deductive reasoning begins with consequences and finds by deduction the events of the combination of events that could cause the dreaded consequences. For example: pre-hazard analysis. Event tree analysis (ETA), failure modes effects analysis (FMEA) , hazard and operability (HAZOP) , Bow-Tie analysis

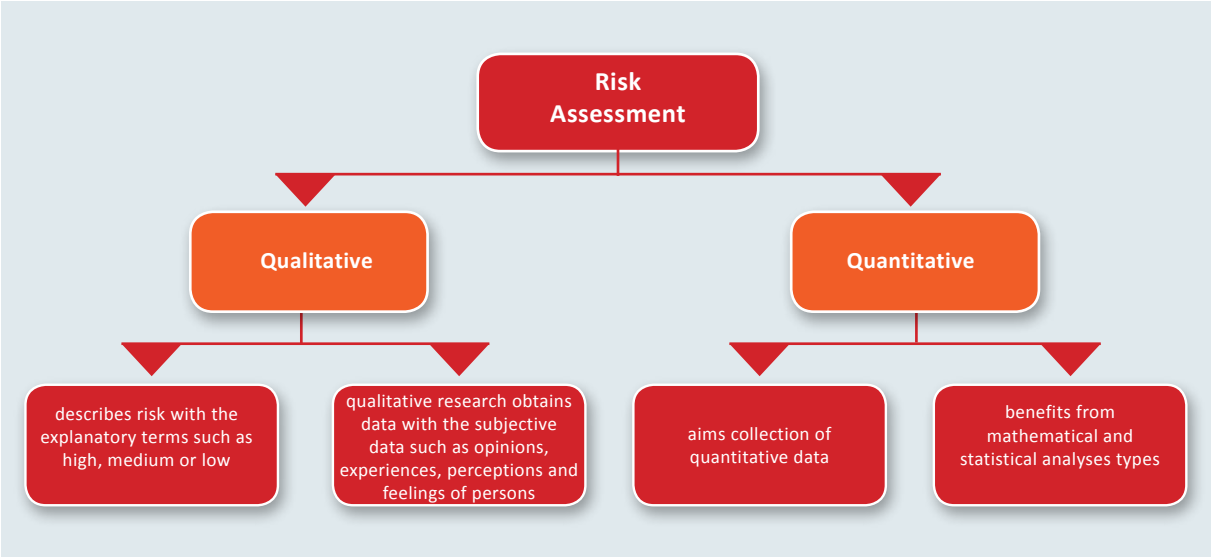


Identification of hazards is followed by designation of reference accidence scenarios, which form the basis for determining whether the safety measures in place or foreseen are appropriate.

After identification of hazards and designation of reference accidence scenarios, second and third questions come respectively, **How Often** (scenarios' likelihood) and **What are the Consequences** (scenarios' consequences) questions followed.

For the questions, **How Often?** and **What are the consequences?,** the scenarios' likelihood and consequence assessment, which is an essential step in the risk analysis process, quite different approaches can be followed. These assessments make use of methodologies that are generally subdivided into different categories, in particular:

- "qualitative –quantitative" and
- "Deterministic" – "probabilistic"



The next question is **What are the risks?** In this step, determination of risk levels derived from the above analyses, and assessment of their significance so called Risk Ranking is carried out. Then presentation of resulting risks and comparison with established tolerability (acceptability) criteria comes next.

The last question is **So What?** It includes risk evaluation action by considering reliability and availability of safety systems and decision on whether mitigation measures are enough to decrease the risk to accepted risk level or modification or abandoning is needed.

A range of risk reduction methods may be envisaged in this context, for example, improved operator training, introduction of additional physical safety measures, or process modifications. It is necessary to decide what risk reduction measures may be introduced and whether or not they are practicable, bearing in mind the associated costs and benefits.

Risk Assessment Approaches

In broad terms, there is a hierarchy of risk assessment approaches of increasing complexity, ranging from simple qualitative analyses through semi-quantitative analyses to fully quantified risk assessment[2].

- ***Qualitative risk assessment*** is the comprehensive identification and description of hazards from a specified activity, to people or the environment. The range of possible events may be represented by broad categories, with classification of the likelihood and consequences, to facilitate their comparison and the identification of priorities.
- Semi-quantitative risk assessment is the systematic identification and analysis of hazards from a specified activity, and their representation by means of both qualitative and quantitative descriptions of the frequency and extent of the consequences, to people or the environment. The importance of the results is judged by comparing them with specific examples, standards or results from elsewhere.
- Quantitative risk assessment is the application of methodology to produce a numerical representation of the frequency and extent of a specified level of exposure or harm, to specified people or the environment, from a specified activity. This will facilitate comparison of the results with specified criteria.

[2] Guidance on the Environmental Risk Assessment Aspects of COMAH Safety Reports

Risk Assessment Approach of BEKRA Legislation

Although the detail level and type of the analyses necessitated by BEKRA regulation shows change, mostly, it is proportionate to the followings:

(a) extent and nature of major accident hazards to be arisen from plants and activities,

(b) the risks posed to neighbour population and environment expose to, in other words, size of possible damage,

(c) complexity of the procedures and activities regarding major accident hazard and the necessity of sufficiency of decision making and risk control measures adopted.

Use of assessment methods in line with the hazards addressed is recommended for risk assessment. That is to say, risk quantity should be considered for selection of the instruments to be used.

A tool not interested in uncertainties and the variability present in quantity of accidents and hazards detected can be unsuccessful for meeting needs and be useless for expressing the difference between control measures.

Box 8 Quantitative Risk Assessment within BEKRA Regulation

For quantitative risk assessment, the hazards to give rise to major accident and the following matters are taken into consideration:

- Classification of dangerous substances, amounts and mutual interactions of these chemicals
- Evaluation of chemical exposure in terms of man and/or environment
- Explosive mediums and permanency of these medium, classification of explosive medium and compatibility of the equipment to be used in these areas
- Determination and grouping dangerous equipment within process
- Process hazards and mutual interactions of process equipment and/or instruments
- Reliability evaluation and certification of process instruments and emergency shutdown systems
- Reliability data at maintenance and repair works
- Maintenance and risk based control methods to be realized as security based
- root cause and consequence analysis of major accident scenarios.
- the accidents experienced in the past and the quantitative repetition possibilities of these accidents.

Quantitative risk assessment is a tool used widely at different industrial sectors (nuclear, aviation, chemistry sectors). Although cost of quantitative risk assessment based on a comprehensive procedure is high at current practices (man/day and software prices), it comes close to lowering levels today.

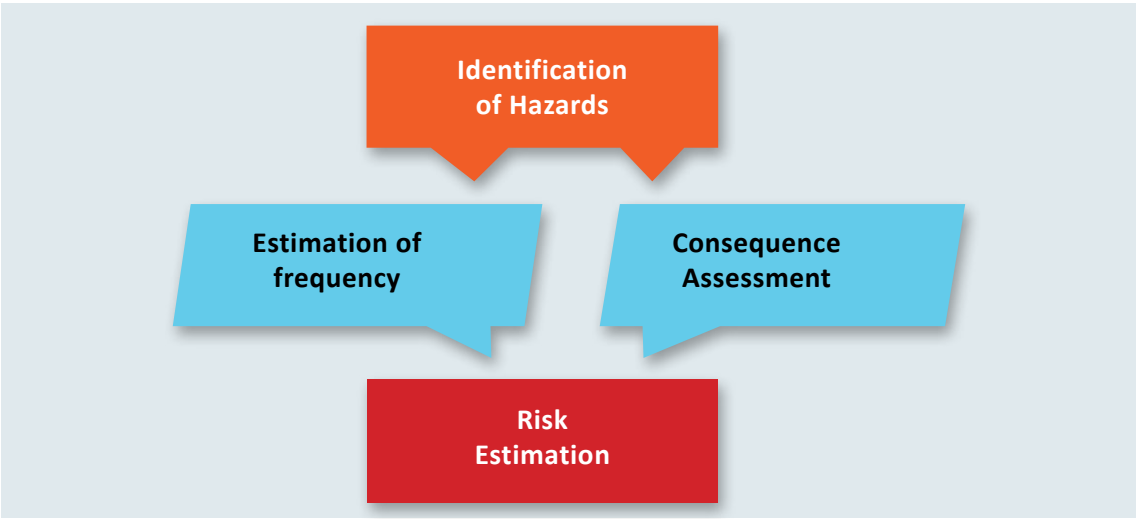
CAs utilize results of quantitative risk assessment results at their land use planning and other decision making procedures.

4.3.1 Quantitative Risk Assessment

Industrial accident risk has been described in a way to be dependent on 2 parameters within the scope of Seveso II Directive.

Risk= f (Frequency, results/severity of effects)

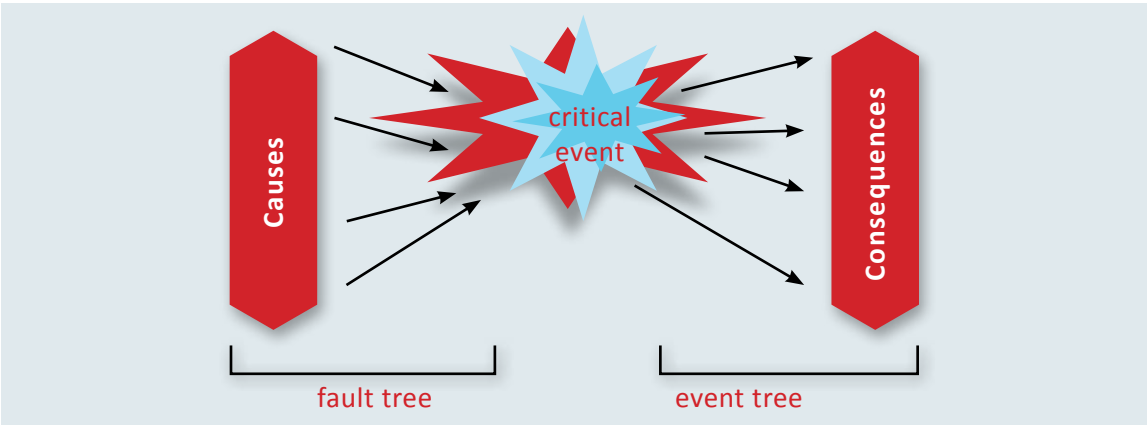
- **Risk:** shall mean the likelihood of a specific effect occurring within a specified period or in specified circumstances
- **Frequency:** means the occurrence possibility of major industrial accident
- **Severity of effects:** means the severity of results/effects of accident. These effects can also be described as consequence possibility of accident. (for instance, death possibility of an unprotected person) (for example, death can be depend on the function of H2S concentration present in the air)



For hazard identification, the methods such pre-hazard analysis (PHA), Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Fault Modes Effects Analysis (FMEA), Hazard and Operability (HAZOP), etc. are used.

At determination stages of frequency and consequences, the procedure recommended to be followed by operator and used frequently in EU countries is

- • Use of bow-tie method that critical event is present at its centre, fault tree at its left and event tree at its right in order to determine accident hazards.



At the first stage of this approach, hazards (reasons) to cause to critical event remained at the left of bow-tie should be described. Operator should determine the equipment having hazard potential within establishment and critical events should be interrelated. Operator should analyse possible results through failure tree analysis based on failure of an equipment or function.

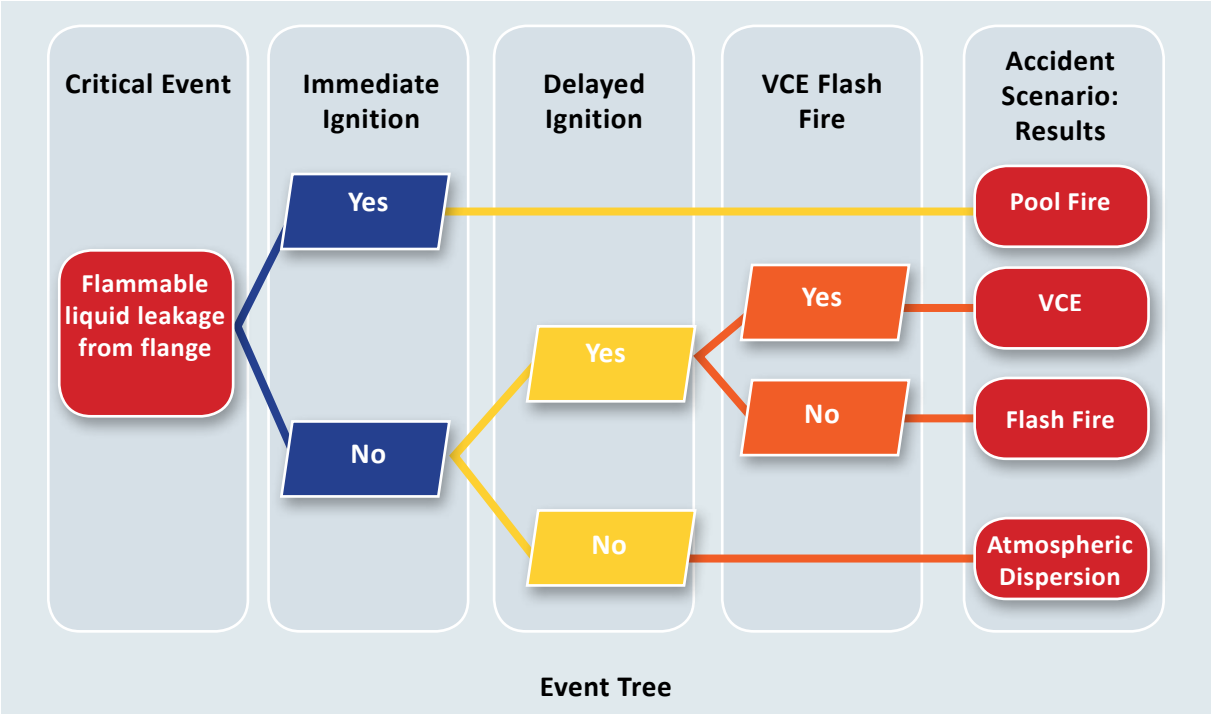
Next step is determination of the risks arisen from safety barrier failures and dangerous accident scenarios remained at the left of bow-tie.

In risk assessment process, hazards are detected for the critical event to give rise to accident scenarios (loss of containment) and the safety measures of establishment are increased to reduce and take under control of the effects to emerge as a result of these scenarios.

Critical Event Samples:

- Catastrophic destruction occurred at tank
- Rupture on tank wall
- Break/Fracture on pipe

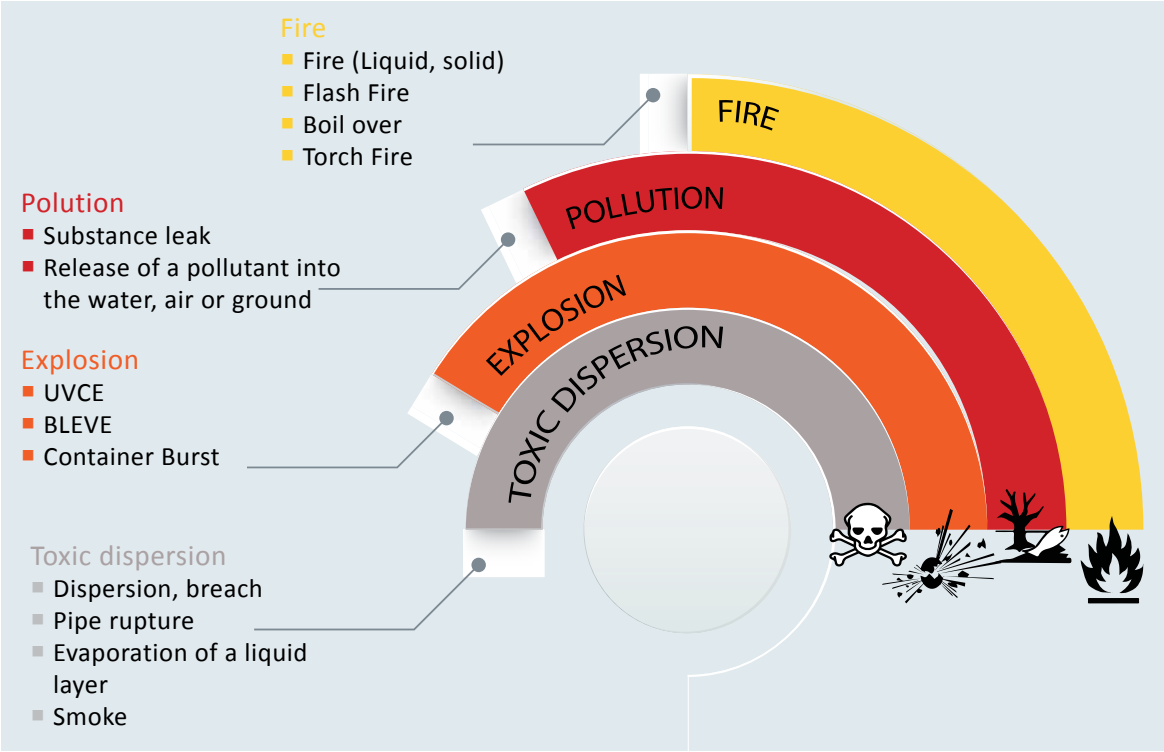
"Description of possible accident scenarios" forms a basic element at the risk assessments that the establishment within BEKRA will make. Risk assessment procedure reveals the possibility and effects of these possible accident scenarios.



Event Tree

These scenarios should be "realistic" ones agreed by all related persons and to be used in safety report. Operator should implement prevention and mitigation measures of establishment, paying regard to these scenarios.

Although BEKRA legislation does not make an apparent description of the scenarios used for risk assessment, various agreed accident scenarios are available.



1. Fire

- Pool fire, Tank fire, Jet fire, flash fire, fireball ,

2. Explosion

- Boiling liquid Expanding Vapour Explosion(BLEVE), Vapour Cloud Explosion (VCE), physical explosion, and RPT, dust explosion

3. Toxic dispersion: dispersion to air, soil and water

Samples of accident scenario

- BLEVE,
- Total loss in measure,
- Fire at the largest tank,
- Explosion of explosive substance in big mass

Scenarios may change the features of the area where establishment is located.

For instance: in case establishment is near river or lake coast, environmental pollution danger is high. Delayed ignition depends on existence of highways around establishment.

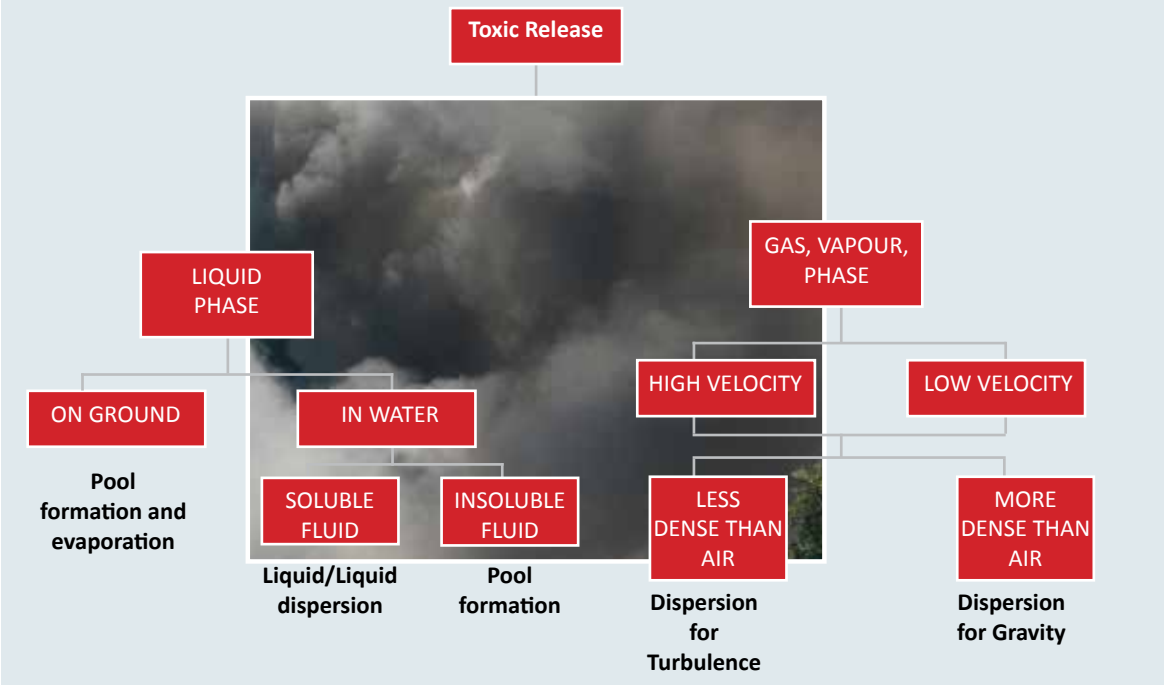
At risk evaluation process, following description of accident scenarios, operator

- May evaluate severity of accident result
- May measure efficiency of prevention management
- May predict environmental sensitivity.

4.3.2 Consequence Assessment

Following presenting accident results (fire, explosion or toxic dispersion), the damages to be caused by these accidents should be calculated.

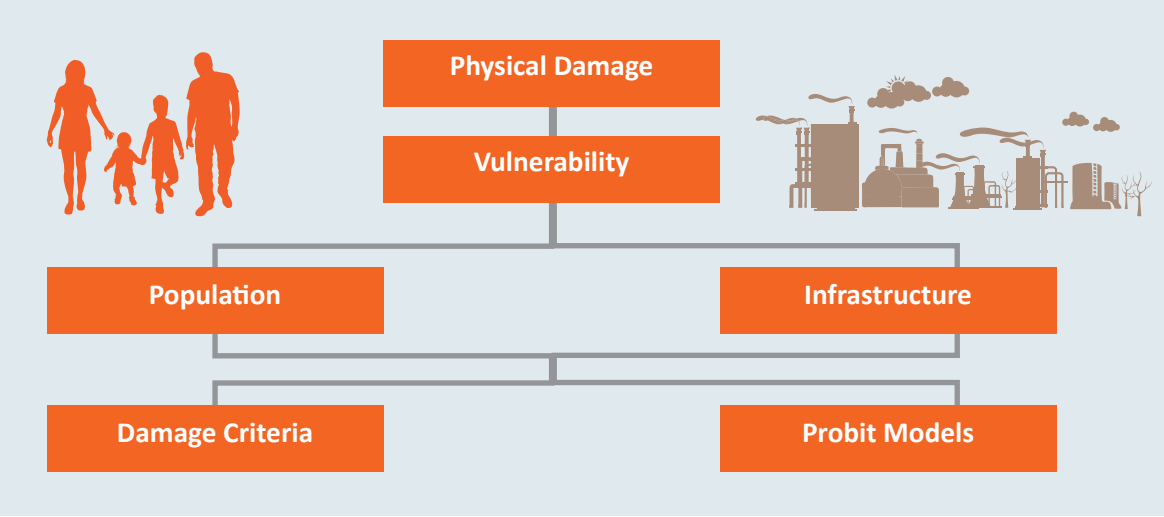
For instance; toxic dispersion[4]:



Calculation process of the damages of toxic dispersion, fire and explosion events necessitates modelling studies for the models entailing specialty and needing experience.

Evaluation of many different situations such as dominant wind direction and speed, geographical conditions in the region where establishment is located and many different events such as explosion, toxic dispersion and fire together require calculation of risk contours by hand. Therefore, modelling of possible disaster scenarios in workplace by a simulation program and obtaining risk contours is a method used very widely.

Procedure for setting results of accidents



[4] Workshop on Accident Analysis and Risk Assessment A JRC Enlargement Workshop http://www.unece.org/fileadmin/DAM/env/documents/2013/TEIA/MAHB__nov_2013/Session_7-_Risk_Assessment.pdf.

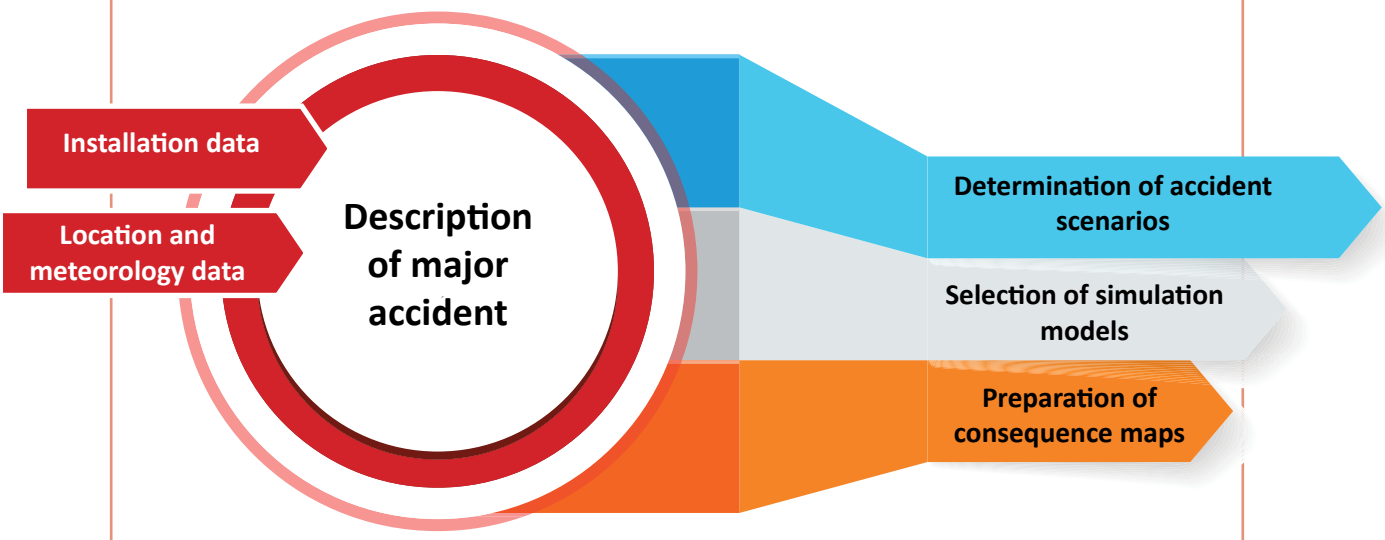
For analysis of accident results, the simulation model that ensures prediction of effect density of the events taking role at accidents (release and possible evaporation, dispersion, thermal radiation, overpressure, etc.) as a function of time and distance from source.

Result evaluation research aims description and detection of the following:

- Potential hazard areas within and/or outside of industrial activities
- Possible damages given people, ownership and environment.

SonuResult evaluation may be conducted as the diagram shown in Figure 9.

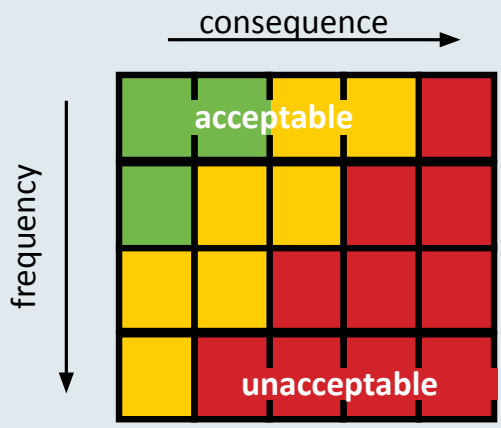
Figure 9 Diagram for result evaluation



4.3.3 Calculation and Displaying of Risk

Risk values for each accident scenario are obtained by mathematical calculation of the realization possibility of hazard and the damage it may cause. If these risk values are available, they are compared with risk criteria. If risk is out of acceptable limits, operator has to review its safety management system.

No single tool to meet all needs and requirements is present for risk assessment. However, all instruments have some weak aspects and restrictions.



Box 9 Best practice in risk assessment[5]

In principle, the following factors are available at all risk assessment methods regardless of individual practices:

- Description of scope, obejectives and risk criteria
- Description of the object or area of concern
- Identification of hazards
- Identification of vulnerable targets
- Assumption of source terms or hazardous incidents
- Development of escalation scenarios
- Estimation of consequences
- Estimation of likelihood
- Presentation of resulting risk and comparison with established tolerability criteria
- Identification of mitigation measures
- Acceptance, change or leaving results

4.4 Preparation of Safety Report

It is compulsory to prepare safety report for upper tier establishments.

Operator of upper tier establishment has to prepare a safety report that contains the information in regulation and communiqué.

In the following chapter, contents of the safety report in force in Italy and Ireland are presented as an example.

Accident scenarios should be formed according to the worst start-up and limit conditions by considering past experiences and current general technical and scientific data among accident cases.

[5] Excerpted from the sources titled Mannan/Lees "Loss Prevention in the Process Industry", 2005.

Figure 10 Flowchart of Safety Report

1	**Pre-analysis for determination of critical areas (index method)**			
2	**determining the events to occur as a result of accident**	HAZOP (process deviations) and experienced accidents	loss of containment	
3	**Estimation of frequencies of the events to occur as a result of accident**	fault tree analysis	databases	
4	**determination of accident scenarios and estimation of frequencies**	event tree analysis		
		scenario 1	.....	scenario...n
5	**result analysis**	physical- mathematical model		
		radiant heat	overpressure	dispersion at burning/explosive/ toxic feature
6	**preparation of internal emergency plan according to accident scenarios**			

Primary events to be taken into consideration while preparing safety report are as follows:

Risk Analysis and Evaluation

Basic elements in any risk analysis process are:

- Hazard Detection;
- Selection of accident scenario;
- Possibility evaluation of scenarios
- Result evaluation of scenarios
- Risk Ranking;
- Existence and reliability of safety systems

Essential parts of hazard detection are presentations regarding

i. Scope of analysis and related restrictions,

ii. Detection methods used

Detection of hazard should state whether or not current or envisaged safety measures are appropriate.

Deepness and type of risk assessment, giving decision on sufficiency of risk control measures adopted and difficulty of reasoning and complexity of procedures and activities, size of possible damage will be proportionate to the structure of major accident hazards offered by plant.

Major accident scenarios

One of main factors of safety reports is description of reference accident scenarios. Under normal conditions, these scenarios are essential to prove that necessary measures are enough.

Scenario description should be structured for this purpose and evidence ensuring conformance between the measures taken and the selected scenario should be provided.

Compulsory and extensive part of a safety report consists of description of the critical scenarios to cause to a major accident and dangerous plants, establishment and its around.

In this case, it is expected that description of different scenarios is quantified with different detail level depending on the subject taken within the scope for objective of safety report.

Safety report will show the sufficiency of measures taken with systematic definition of possible major scenarios and the events starting accidents (reasons).

Scenarios are based on the assumption of loss of containment normally. However, all scenarios, for instance self-deterioration may not be LOC type and in such cases, may be related to later start of fire or explosion as well.

For specific objectives of safety reports within the scope of control of major industrial accidents, a scenario is always a series of such events quantified with undesired event or loss of physical integrity or loss of containment, immediate or delayed results of this event

Major accident scenarios may serve different objectives, for example:

- To show that a special scenario does not offer major accident hazard any more due to current measures in practice
- To prove that the effects of a special scenario have been limited because of current protection measures.
- To show the efficiency and productivity of mitigation measures put into effect
- To determine whether activity should be considered acceptable or not
- To establish whether or not especially advanced mitigation measures within the scope of safety report are required

Operational causes are determined according to selected methodology, should consider at least the following:

- Limits of physical and chemical process parameters
- Hazards at the moment of specific operation manners (namely, start- up/shutdown)
- Restriction failure
- Faulted functions and technical failures of equipment and systems
- Secondary effects from other equipment
- Failures of infrastructure supplies (gas, electricity, water)
- Factors of man involved in operation, testing and maintenance
- Chemical incompatibility and pollution
- Ignition sources (electrostatic charge, etc.)

Internal reasons covered by safety reports may be related to release of dangerous substances or explosions, fires at the plants within establishment that affects (for instance, rupture of water pipe at cooling tower, so delaying at cooling capacity in plant)other plants by leading

to cut at normal operation.

The external reasons to be considered are mainly:

- Effect of the accidents in transport networks (for instance, fire, explosions, toxic dispersion) and other third party activities and at neighbour plants (domino effects)
- Transport of dangerous substances out of plant (for example, roads, railways, pipeline, shipment, oil or gas ports, air, etc.)
- Activities dependent each other functionally at neighbour plants
- Pipelines and other common infrastructure services
- Transport networks and centres (i.e. public road, railway lines or airports near plant and/or establishment)
- Natural danger sources i.e. (excessive) rainfall, wind, storm, lightning, flood, land slope, seismic activity, etc. (Natural Hazard Triggering a Technological Disaster).

Installation security

The effect of intentional actions to affect plant security should be evaluated.

Other accident reasons can be related to design, construction and security management, as can be related to management of plant life cycle, commissioning, decommissioning or process or equipment changes, work permit system, maintenance, etc.

A distinction should be made between general typology of measures; the ones activated by process situation and permanent ones independent from process situation (all passive measures). Active measures either deactivate operations (locking systems that prevents performance of some actions, i.e. safe operation guards for processes) or activate one or more procedures. (i.e. opening or immediate shutdown of release valve)

Activated measures always necessitate series of detection-diagnosis-procedure. Using software, hardware and human action lonely or together can realize this series.

Box 10 Italy Example for Safety Report

1. Content of Safety Report

1.A.1 General Description and Location of Plant
1.A.1.1. General Information
1.A.1.2 Place and Description of Plant
1.B.1 Information about plant
1.B.1.1 Organization structure
1.B.1.2 Description of activities
1.B.1.3 Pre-analysis for determination of critical industrial activity
1.B.1.4 Information on Meteorology, Seismic Activity, Sea, Weather Forecast and Lightning
1.B.1.5 Interaction with other plants
1.C.1 Plant Safety
1.C.1.1 Health and Safety of Plant
1.C.1.2 Uncontrolled Reactions
1.C.1.3 Emissions
1.C.1.4 Sequence Analysis of Accident Events
1.C.1.5 Prediction of Results of Accident Events.
1.C.1.6 Domino Effects of the Plants under high fire or explosion risk
1.C.1.7 Measures to be taken for prevention of accidents
1.C.1.8 Design related and structural measures .
1.D.1 Critical cases. Emergency conditions and things to be done.
1.D.1.1 Sensing systems
1.D.1.2 Controlling systems
1.D.1.3 Operation guide
1.D.1.4 Movable risk sources.
1.D.1.5 Restriction of entrance to plants.
1.D.1.6 Fire combating measures
1.D.1.7 Emergencies and related plans
1.E.1 Treatment, disposal and disposal plants
1.E.1.1 Waste water treatment plants
1.E.1.2 Disposal and storing of wastes.
1.E.1.3 Treatment of wastes, gases
2. Accident analysis procedure
2.1 Requested analyses.
2.2 Description of accidents
2.2.1 Checklists of plant borders
2.2.2 Checklist for storing plants.
2.2.3 Detailed researches.
2.2.4 Analysis of the past.
2.3 Safety analyses.
2.3.1 Evaluation of occurrence possibility of accident events
2.3.2 Evaluation of possibility level of accident events
2.3.3 Assessment of results
2.3.4 Cautious result evaluation.
2.3.5 Preparation of emergency plans.
2.3.6. Information to be present in safety report for external emergency plan

Box 11 Ireland Example for Safety Report

General

1.1 Have the details been obtained in order to provide communication with competent authorities?

Dangerous Substances

1.2 Are maximum amounts of all dangerous substances available in described establishment or potentially available?

1.3 Have safety report been explained according to chemical name (including widely used chemical name) and CAS no according to IUPAC denomination system for each determined substance?

1.4 Have the physical and chemical characteristics of each dangerous substance described been determined with normal operation conditions and predictable accident terms?

1.5 Have instant or delayed harmful effects on people and environment of each dangerous substance been described?

Environment

1.6 Have the surrounding of the establishment been defined in detail enough to evaluate results of major accident?

1.7 Have the surrounding of the plant been defined in detail enough to assess effect of major accidents in terms of external factors at plant?

Plant

1.8 Have general description explaining chapters related especially to major accidents of plant been made?

1.9 Have the process(es) to lead to major accident present at each installation been described?

1.10 Have clear information been given for each installation to support decrease of effects or prevention of major accident hazards?

Envisaged Factors

Risk assessment is a basic requirement of legal arrangements. Risk assessment has to determine the risks in terms of both people in and outside of plant and environment.

Regardless of being quantitative, semi-quantitative or qualitative of risk assessment, a logical and systematic process should be adopted.

Exaggeration cannot be made on the necessity of being proportionate to the followings of the analyses made for risk assessment by operator.

- Extent and nature of the major industrial hazards displayed by the activities within and outside plant and establishment and
- The risk that it comprises for the population and environment around.

The views regarding "appropriateness" should be taken into consideration at starting stage of evaluation process.

Risk Analysis Approach

2.1 Have the approach of operator on risk assessment been described?

2.2 Have man factor been considered for risk analysis?

2.3 Have the criteria for decisions been explained clearly for removal of possible hazardous events additionally?

2.4 Are the information used suitable for risk assessment?

Box 11 continued

Hazard Identification and Major Accident Scenarios

2.5 Have all potential accidents been determined and have appropriate sub-set been selected for detailed risk analysis?

Conditions or Possibility that Major Accidents Scenario may occur

2.6 Have possibility and/or conditions been reviewed for selected sub-set towards detailed analysis?

2.7 Are used reliability and reaction times realistic?

2.8 Has suitable and enough result evaluation been made?

2.9 Does safety report show lowness of risks sufficiently?

2.10 Have the results obtained from risk analysis related to emergency planning been based on reliable foundations?

4.5 Pre-control list for Internal Emergency Plans

While operator prepares internal emergency plan, it can use the following checklist to determine basic elements;

General Planning

- Does establishment prepare emergency plan based on an integrated approach?
- Does plan meets the needs of establishment?
- Does plan display flexible and simple approach?
- Does it provide adaptation to changing conditions?
- Does plan take full support from top management?

Consultation

- Have key stakeholders at emergency planning process been determined and listed?
- Have all stages of emergency planning process been consulted with key stakeholders?
- Have needs and concerns of all stakeholders been dealt?
- Have emergency plan been communicated to all stakeholders?
- Are all stakeholders been satisfied from the plan?

Objectives and Targets

- Does objective of the plan reflect reasons of plan development?
- Does targets list desired results and are they sorted according to their Importance?
- Do targets provide detail for developing emergency plan?

Parameters

Urgent case description

- Does it cover up major industrial accidents to require application of emergency plan?
- Does it define accident types not to be described as an emergency?
- Do all urgent cases and their level cover all possible accidents?

Plan

- Does it cover all hazards to give rise to major industrial accident?

- Does it describe seriousness/size of all hazards?
- Does it determine potential effect on people and environment?

Planning Section

- Do the emergencies selected to monitor effects represent all accident types?
- Are all areas to be affected by accident included in the plan?
- Have a systematic approach been monitored to determine effect area of an emergency?
- Have the workers and people to be affected by accident been incorporated in emergency plan?
- Have all related stakeholders and their number been determined?
- Are the assumptions in the plan been listed and are the assumptions logical?
- Have auxiliary plans been developed for unsuccessful assumptions?

Emergency System

- Are targets of the plan addressed?
- Does it describe its main focus and priorities?
- Can system emergency of establishment be managed until emergency services provide control?
- Can it ensure information and support to other stakeholders and emergency services?
- Can it manage emergencies for environment without need to provide control by emergency services?
- Is system activated automatically when alarm rings?
- Are actions to be undertaken during emergency described and listed?
- Are establishment personnel assigned to all defined actions?
- Does an organization structure being net command chain take place?

Organization structure;

- Are sufficient arrangements done for safety?
- Is control of emergency provided under all conditions including out of working hours?
- Are procedures developed and documented for all emergency actions?

Emergency procedures:

- How safe is it in practice?
- Is it supported by enough resource?

Emergency resources provided,

- Is it enough to support emergency procedures?
- Is it accessible during emergency?
- Does it work at all planned times?

Planning Department

- Does system provide information enough and is its use easy to emergency services and establishment personnel making intervention to accident for management of emergency?
- Have key personnel information and capability at level defined as necessary to fulfil their responsibilities?

Emergency Plan Management

- Does it allow for regular monitoring, application, auditing and review of emergency plan?
- Is training given to workers for reaching qualification level defined to provide fulfil their responsibilities and roles at the moment of emergency?
- Is training given on use of emergency procedures and emergency sources?
- Is awareness of local emergency services, society and other stakeholders increased via providing information?
- Does it ensure enough supply and usability of emergency sources?
- Does it give possibility to update emergency plan when necessary?
- Does it allow opportunity to review emergency plan and update it as a part of management system of change?
- Does it offer probability to documentation of records of activities?
- Does it allow discussion of findings and review of emergencies?

4.5.1 Summary of the Protection and Intervention Measures used for Preparation of Internal Emergency Plan

This chapter offers abstract information for the protection and intervention measures for preparation of internal emergency plan.

1. Safety Report should summarize the prevention and protection measures for preparation of internal emergency plan. This report should cover the followings particularly:
   - **a.** The equipment installed at establishment to restrict results of a major accident
   - **b.** Alarm and intervention organization and
   - **c.** The resources to be mobilized within and outside of area

Fixed equipment installed at the plant limiting results of major accident and how this equipment will affect dealing with an emergency should be indicated, for instance, emergency elimination arrangements including the scope of necessary interaction.

2. In case of a major accident, safety report should define alarm and intervention organization. In the event of being related to major accident scenarios in area, the following may be included:
   - **a.** The functions and complementary arrangements of key locations and groups to be taken place in emergencies;
   - **b.** The arrangements for restriction and control of increase of accidents in area
   - **c.** The arrangements for alarming the public and neighbour establishments, persons in area
     - Dangerous situation,
     - Quantity of alarms and the plant conditions required for activating these and
     - First actions necessary both within and outside area in exchange for alarms and warnings
   - **d.** Preparations required for providing and ensuring communication during emergency intervention
   - **e.** Quantity of mutual assistance agreements with neighbour establishments and the arrangements for providing these, for instance, preparations for equipment and man resources, first aid and expert health services,

f. Arrangements and terms for alarm and mobility

- The individuals or groups with their described responsibilities under emergency plans including the personnel in and out of area
- Emergency services
- Neighbour establishments in case of existence of mutual assistance agreements

g. essence and locations of the plants to require special protection or recovery intervention

h. essence and location of the following;

- emergency control centres
- health and first aid centres
- emergency shelters
- shelter buildings
- collection points
- formerly determined pre-control points and
- other related information;

i. emergency services, recovery roads, escape routes and location of access roads to any prohibited region

j. evacuation arrangements and transport requirements

k. necessary arrangements for providing evacuation of all personnel from buildings

l. research and recovery arrangements

m. pollution control instruments and nature and locations, follow-up of materials, environmental cleaning and restoration arrangements

n. arrangements for the areas that personnel number changes in different times and moments when personnel is not available;

o. dealing with the effects of internal emergency intervention activities including fire extinguishing for reduction to minimum of the effects on environment and people. This should cover alternative options for disposal and discharge of the chemicals released to around and both the short and long term effects and

p. the preparations made for monitoring wind speed and direction and other environmental conditions.

3. Safety report should describe internal and external resources for mobility in case of major accident. This should prove whether or not necessary measures are present to contribute to all measures for limiting the consequences of a major accident.

So, safety report should contain the resources:

a. Present in area;

b. Provided by emergency services;

c. Found in the neighbour establishments made with mutual assistance agreements and

d. That may be brought from any place by operator.

4. Safety report should also explain internal intervention and external emergency services and how it would be complementary and how it would be coordinated with that. This information should include the details of the following in suitable places:

a. Man resources;

b. equipment;

c. personal protection equipment;

d. fire extinguishing equipment and fire protection equipment;

e. the measures and systems required to limit and reduce to minimum of consequences and dispersion of airborne dangerous substances

f. the measures and systems required to restrict and reduce the minimum of results and dispersion of dangerous substances in water

g. the measures and systems required to limit and reduce to minimum of consequences and dispersion of dangerous substances in soil

h. monitoring and sampling

i. restoration and cleaning preparations

j. first aid and medical maintenance and

k. other complementary equipment

5. Safety report should show whether or not appropriate arrangements are done for maintenance, audit, review and testing of the other equipment to be used in emergency intervention and of resources.

6. Safety report should prove if suitable arrangements are made for giving training to the individuals within area at emergency intervention. This training should also cover training and information preparations for those who visit area and contractors, other workers and the personnel having special responsibilities in case of major accident.

7. Safety report should explain the procedures required for revision of emergency arrangements in the direction of the lessons learned and the examination and testing of internal emergency plan.

4.5.2 Information Required for External Emergency Plan

In this chapter, the information to be given (provided, supplied) to competent authority while preparing external emergency plan by operator are given.

1. Safety report should form some part of the information provided to local authority with the intent of ensuring that local authority prepares external emergency plan.

2. Minimum information to be provided in safety report are:

a. The details on the subjects such as location in filed, the roads around and access roads

b. Field plan showing the locations of key activities such as control and health centres and main process plant and storing areas;

c. Organization details;

d. The details of areas out of field to be affected from major accident and predictions on damage levels to be occurred;

e. Details of dangerous substances found in field and the similar info on other dangerous substances present in area

f. The details of technical recommendations to be provided by company with the purpose of giving support to emergency interventions

g. The technical details of the equipment and other resources to be present with the aim of supporting to external emergency services at emergency interventions and being present in field;

h. Functions, locations of the key locations to be taken place in emergency interventions and the information about how these are to be determined and

i. First actions at internal emergency plan to be realized by the personnel in area in case of an emergency and lines of procedures should be explained,

4.6 Pre-control List for Major Industrial Accident Hazards

The questions sorted below are the matters to be asked according to the assessments made for different sectors in audit reports in practices in EU and in MoEU. This list will give a general opinion for the deficiencies seen in the safety management systems of establishments holding dangerous substance.

Questions concerning all establishments holding dangerous substance:

- Are material safety data sheets of dangerous substances available?
- Is classification and labelling of the chemicals used appropriate?
- Have the chapters, containers, piping and related installation holding chemical substance in workplace been labelled in a way to describe hazards and the substance in related installation?
- Are chemicals to react each other stored side by side?
- Are chemicals to react each other separated from each other?
- Is there suitable ventilation in chemical substance storehouse?
- Are there instruction and warning signboards determining the rules to be obeyed in storehouse?
- Have the around of storehouse been cleared from easily flammable substances?
- Does gas detector exist in the places that natural gas/LPG is used?
- Does workplace operation instruction exist?
- Have trainings of fire and occupational safety of workers been completed?
- Have suitability of electricity and lighting installation of establishment been checked?
- Is classification of the places to form explosive medium made in establishment?
- Have document on protection from explosion been prepared?
- Is emergency plan of establishment available and updated?
- Do fire sensing and extinguishing systems exist?
- Is there any emergency shutdown system?
- Are fire alarm and evacuation trials made/ registered?

Establishments storing LPG and Fuel

- Does situation plan of establishment include current and enough detail?
- Is lightning rod application project present?
- Have grounding installation certificate of /safety and static) conformity?
- Are electricity devices used for dangerous region ex-proof?
- Is tank and surrounding lighting enough?
- Do tags of command button exist in establishment?
- Are movement directions of fluids shown on pipe installation?
- Are gas alarm detector available and enough in related chapters of establishment?

- Is the distance of storing tanks in establishment close to neighbouring land?
- Does external cooling fixture (spring shower) of storing tanks (surface tank) exist
- Is platform providing easy access to control installation placed on tanks available?
- Is overflowing pond present around tank?
- Does the label, plate containing information related to tank exist on storing tank?
- Are safety distances of tanks each other and to environment suitable?
- Is stock capacity of fire and cooling water enough?
- Was soil survey made for establishment?

Establishments producing and storing explosive substance:

- Are foundation features of storehouses appropriate?
- Is distance each other and safety distances of explosive substance storehouses suitable?
- Does the instructions and warning signboards settings rules required to be obeyed in dangerous substance storehouse exist?
- Is periodical control of lightning rod and/or static electric load remover plate checked?
- Is grounding and electricity installation checked regularly?
- Is sufficient aeration available?
- Is gas detector present in the places where natural gas/LPG is used?
- Are dynamite and pyrotechnical material stored in different sections?

4.7 Legal Measures taken against accidents in European Union: Seveso Directive

European Commission offered the Directive 82/501/EEC, also known as Seveso I Directive following the accident in a chemical factory in Seveso- Italy on July 1976.

The accident caused that 37.000 persons in Seveso and other around settlements exposed to dioxin cloud.

The major industrial accidents occurred in recent years in many points of the World has led to grave environmental, social and economic problems.

Picture 2 Examples of Major industrial accidents


- An explosion took place in a factory making oxidation of cyclohexane in Filxborough England in 1974. 28 persons lost their life. Wide destruction happened in plant and around.
- In explosion in a factory in Seveso, Italy in 1976, tetra chloro dybenzyl dioxin of 1.3 kg dispersed to medium. All of birds, animals and plants near the plant died.

After a series changes made following two accidents occurred in Basel Sweden in 1986 and Bhopal-India in 1984, Directive on control of major accident risks known as Seveso II Directive was adopted in 1996.

Directive 96/82/EC was adopted with the expectation of the approval of Convention on Cross-border Effects of Industrial accidents by United Nations and European Economic Commission. This approval was realized with the Council Decision (Decision 98/685/EC) about conclusion of Convention on Cross-border Effects of Industrial accidents on 23 March 1998.

Directive 96/82/EC is a tool for transposing Community liabilities within the scope of the convention to the Community legislation. Seveso II Directive came into force on 3 February 1997. Two years transition period is given to member countries to transpose their national laws, regulations and administrative provisions in a way to provide conformance to the Directive. (Harmonization Period)

Seveso II Directive brought new important elements compared to former Directive. It became first document that adds water toxins particularly, accepted as dangerous for environment. Furthermore, it brought new management systems that will reduce occurrence of major accidents to minimum, increased the information given to the public and provided easy access to environmental information.

In addition, the scope was both widened and simplified. The list of industrial plants in Annex I was removed and the number of substances denominated was reduced in list. However, increase happened both in categories of dangerous substance and the criteria in some categories was indicated more clearly.

Basic difference between Seveso I and Seveso II was summarized as below:

- Seveso II is related to establishments than plants
- A category titled “dangerous for environment” was formed.
- Lower tier establishment should obey to conditions pursuant to Article 7 and Article 10.
- Article 8 is a new term for upper tier establishments.
- Conditions of safety report were declared in more detailed way.
- New conditions were brought with regard to safety management systems, emergency plans and land use planning.
- The Importance of the provisions related to inspections and the subjects of information sharing with the public was increased.

From 3 February 1999, Directive conditions, its execution and implementation were made compulsory.[6]

The Directive 2003/105/EC changed the Council Directive 96/82/EC in 2003 and the Directive was adopted, scope of the Directive was expanded instead of making revision in Seveso II following industrial accidents (BaiaMare_Romania in 2000, Enschede-Netherland in 2001 and Toulouse-France in 2001). In this direction, it was modified in a way to cover waste disposal plants used in these activities and the procedures of processing and storing minerals containing dangerous substances extracted in mining and quarry activities.

[6] http://ec.europa.eu/environment/seveso/index.htm

On 20 January 2009, Regulation on classification, labelling and packaging of substances and mixtures (CLP) come into force. This regulation brought EU legislation to the same level with United Nation Global Harmonized System (GHS). CLP regulation will take place of (DSD) 67/548/EEC and (DPD) 1999/45/EC directives after a transition period. Therefore, dangerous substances were classified according to CLP and DSD from 1 December 2010 and CLP will abolish DSD/DPD for substances and mixtures (now called as preparations). The Council Directive on Control of Major Accident Risks concerning Dangerous Substances (Seveso II Directive 96/82/EC) adopted in 1996 with new Directive will be abolished on 1 June 2015.

CLP regulation will enter into force as from 1 June 2015 for substances and from 1 June 2016 for mixtures.

Regulation of Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation)

Former System (DSD) Directive 67/548/EEC	**New System** Regulation of Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation) Global Harmonized System (GHS)
	

CLP Regulation changes and abolishes the Directives 67/548/EEC and 1999/45/EC (packaging and labelling of dangerous substances ad preparations and the Regulation no: 19707/2006 (EC), come into force on 20 January 2009)

GHS is for consumers, workers and emergency intervention officials. Although it is binding yet, bringing through CLP means being binding legally in EU.

On December 2010, EC suggested review of Seveso II Directive to strengthen harmonization with elements of this legislation and other directives and to deal with a number of application problems and deficiencies observed. Suggested Seveso III will abolish current Directive and take its place on 1 June 2015.

4.8 Major Industrial Accidents and their Results

It is possible to prevent accidents

Operating under very tight security measures and auditing by CAs of the establishments subject to BEKRA Legislation, all safety measures have been taken and controls cannot guarantee preventing possible accidents.

These accidents can be experienced in the manner of fire, explosion or toxic dispersion. Occurrence possibility of major industrial accidents will reduce to ignorable level in case measures are taken. In spite of that, accident risk will not remove regardless of how low its possibility is.

Effects of major industrial accidents will show great change depending on extensiveness and strength of dangerous substance in accident. Geographical and climatic effects of the accidents that only fire and explosions are available may be limited but, as with Toulouse disaster, as a result of dispersion in air, water or soil of toxic substance, these effects can reach very great scales Yontar,2008.

*Effects of accidents**

Major industrial accidents are generally along with the release of toxic substance and fire, explosion.

If these substances are volatile, they can be dispersed to environment by means of evaporation and dispersion. The accidents creating big hazards are:

- Leak of flammable substance, mixing of substance with air after evaporation, occurrence of flammable vapour cloud and dragging of the cloud in flame source, finally, taking place of fire or explosion that affect settlement units around and in that area
- Immediate release of toxic substance in large quantities may lead to deaths and serious injuries in very larger area.

Explosions

Explosions are described with a shock wave heard in explosion sound that may break windows, give damage to buildings and throw parts to the distance of few hundred meters. This shock wave mainly causes damage and injuries. People are scattered, fall on the ground, stay under collapsed buildings and injured with flying window parts. The effects of high pressure may lead to death directly. However, this is valid for those who work very close to explosion. The industrial explosions occurred so far have shown that indirect effect of collapsed building, flying windows and parts give rise to more loss of life and grave injuries.

* This section is taken from the thir issue of Working Environment Journal dated July 1992 http://calismaortami.fisek.org.tr/wp-content/uploads/calisma_ortami3.pdf

Fires

The effect of fire on people is seen in skin burns developed based on exposure to heat. The fires in industry are seen more frequent than the explosions and the release of toxic substances but the deaths caused by it is less. Therefore, it can be said that fire has less hazard potential than others.

Another dangerous effect to be considered in fire is the decrease of the oxygen in air depending on oxygen consumption during burning. This event is limited with close surrounding of fire in general. Health effects associated with exposure to the smokes arisen during fire is also significant. These smokes can contain toxic gases formed from burning of sulphur dioxide or ammonium nitrate emerged with burning of various substances.

Toxic/Poisonous Dispersion

As a result of major industrial accidents, toxic/poisonous substances may threaten health of environment and people, dispersing through air. These substances are dispersed outside; they may be distributed with wind and affect a wide region. Effects of toxic substances are very different. These effects may change depending on age, gender, genetic structure, nutrition, fatigue, diseases, working hours and order, etc. Vital risk is present for the persons who expose these substances for long term in time slice immediately after and during accident.

Effect to environment

Major industrial accidents have significant effects in terms of environment. The toxic smokes conveyable in air may be very harmful for flora and fauna but the most important environmental effects emerge with death of especially fishes, ecosystems in water when toxic substances are mixed with rivers and other streams. In case the rivers or lakes affected have international location, cross-border effects may be seen.

4.9 Information on some important industrial accidents

The UNEP guidance document[4], A flexible Framework Addressing Chemical Accident Prevention and Preparedness describes a number of well-known chemical accidents such as: Flixborough (UK 1974), Seveso (Italy 1976), Bhopal (India 1984), Mexico City (Mexico 1984), Basel (Switzerland 1986), Pasadena (US 1989), Baia Mare (Romania 2000), Enschede (Netherlands 2000), Toulouse (France 2001), Texas City (US 2005), Jilin, Songhua River (China 2005), and Buncefield (UK 2005).

Table 9 General Information on some important accidents

Date/Place	Description	Casualties / Consequences
01.08.1974/ **Flixborough, United Kingdom**	- Inadequate design coupled with poor management of change led to a release of ca. 30 tonnes of cyclohexane at a chemical facility, resulting in a vapour cloud explosion which destroyed the facility and caused damage up to several km away.	28 killed, 89 injured
10.07.1976/ **Seveso, Italy**	- Loss of control of an exothermic chemical reaction led to the loss of the contents of the reactor via the bursting disc and the pressure relief system at a small chemical manufacturer. A cloud of toxic and corrosive chemicals formed, containing phenols, sodium hydroxide, and ca. 2 kg of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) "Seveso Dioxin." - Among the causes was the use of an inherently more dangerous reaction route to produce the trichlorophenol (TCP) than competing companies and dangerous operating practices which allowed the production shift to leave the reactor with insufficient cooling at the end of the Saturday morning shift. - Due to the lack of management responsibility and poor communication between the company management and local authorities after the accident, measures to prevent exposure of the population and to decontaminate the area were taken extremely slow.	- Large number of cases of Chloracne due to TCDD contamination - ca. 410 cases of chemical burns (probably caustic) - Evacuation of over 5,700 people from the area immediately affected by the toxic plume - Widespread contamination of the surrounding countryside Large number of livestock killed as a precautionary measure 11 July 1978

[7] A Flexible Framework for Addressing Chemical Accident Prevention and Preparedness- A Guidance Document (2010) http://www.unep.fr/scp/sp/saferprod/pdf/UN_Flexible_Framework_WEB_FINAL.pdf

Date/Place	Description	Casualties / Consequences
19.11.1984 **Mexico City** **Meksika**	- A 200 mm pipe between a storage cylinder and sphere ruptured, releasing LPG. The release continued for some 5 to 10 minutes resulting in a large gas cloud which ignited, causing an explosion and many ground fires. - These ground fires led to a series of BLEVEs in the LPG terminal. The cause of escalation was the ineffective gas detection system and, as a result, lack of emergency isolation. - The high death toll occurred because of the proximity of the plant to residential areas. The total destruction of the facility occurred because there was a failure of the overall system of protection, including layout, emergency isolation, and water spray systems. The terminal's fire water system was disabled in the initial blast. The plant had no gas detection system and, therefore, when the emergency isolation was initiated it was probably too late.	650 killed 6,400 injured
03.11.1984 **Bhopal** **Hindistan**	- A cloud of methyl isocyanate was released at a pesticide plant after water entered a storage tank, resulting in the deadliest chemical disaster in history. The addition of water to the tank caused a runaway chemical reaction, resulting in a rapid rise in pressure and temperature. This resulted in the formation of poisonous gases that escaped from the plant into the surrounding areas and drifted eight km over the city of Bhopal. - The plant was located in a crowded working-class neighborhood, and there was no warning for people surrounding the facility as the plant emergency sirens had been switched off. The gas release resulted in the death of many people living in informal settlements near the installation who were suffocated by the chemicals. - The storage of large amounts of toxic intermediate (an inherently unsafe process design), lack of effective safety measures and controls, poor site management, and close proximity of the local population have all been identified as major contributors to this accident and its devastating consequences.	>3,000 killed 170,000 injured
13.05.2000 **Enschede** **Hollanda**	- A stock of ca. 100 tonnes of explosives was detonated by a smaller fire. This led to a massive explosion and fireball which destroyed and damaged property in a wide area surrounding the site. Poor control of storage, as well as lack of control related to the siting of the installation, were major contributors to the accident.	21 killed > 900 injured

Date/Place	Description	Casualties / Consequences
21.09.2001 **Toulouse Fransa**	- An explosion in an ammonium nitrate and fertilizer factory destroyed the facility and caused widespread damage in the surrounding area. Problems with land-use planning contributed to the extent of the damage and the number of injuries.	31 killed ca. 2,500 injured
23.03.2005 **Texas City Amerika Birleşik Devletleri**	- A major explosion occurred in an isomerisation unit of the refinery. This was caused by the overfilling of the raffinate splitter with liquid, overheating of the liquid, and release of hydrocarbon through the blowdown drum and stack. The ignition of this vapour cloud led to extensive damage to the facility and the casualties, many of whom were in temporary buildings located in a neighbouring installation. - Numerous failings in equipment, risk management, staff management, working culture at the site, maintenance and inspection, and general health and safety assessments were identified as problems in the investigations of the incident.	15 killed 170 injured Substantial damage to property within a radius of 400 m Windows were damaged several km away
11.11.2005 **Buncefield İngiltere**	- The massive overfilling of a petroleum storage tank by pipeline at a fuel storage depot led to several explosions and a fire which engulfed 22 storage tanks. - Inadequate control of the filling and tank gauging as well as an ineffective overfill protection system were the main causes of this incident. The close proximity of neighbouring office buildings and also residential property meant that there was substantial damage. - There was no loss of life and relatively few injuries due to the fact that the incident took place early on a Sunday morning.	Disruption to the fuel distribution network, particularly the distribution of aviation fuel to Heathrow airport

The lessons learnt from these accidents may be summarized as follows:

- Importance of public control of the plants to lead to major damage
- Importance of the locations of the plants to lead to major damage
- Importance of the management of the plants to lead to major damage
- Importance of control of plant and process modifications
- Benefits of restricting inventory
- Benefits of limitation of staying under effect
- Having relatively priority of safety compared to production
- Necessity of use of standards and application codes
- Importance of control and protection of chemical reactors

- Necessity of designing chemical processes in safer way
- Importance of emergency plans
- Importance of making maintenance of equipment
- Importance of competent authorities and public information

4.10 Information Sources

- European Commission, Seveso Directive's Internet Page: http://ec.europa.eu/environment/seveso/
- United nations European Economic Commission, internet page of the Convention on Cross-Border effects of industrial accidents: http://www.unece.org/env/teia.html
- OECD General Directorate of Environment, Chemical Safety Internet page: http://www.oecd.org/chemicalsafety/
- France's Competent Authority's Internet Page: http://www.ineris.fr/en
- United Kingdom's Competent Authority's Internet Page: http://www.hse.gov.uk/comah
- Germany's Competent Authority's Internet Page: http://www.kas-bmu.de/
- Sweden's Competent Authority's Internet Page https://www.msb.se/en/
- Netherlands' Competent Authority's Internet Page: http://www.risicokaart.nl/en/
- İreland's Competent Authority's Internet Page http://www.hsa.ie
- Belgium's Seveso Portal: http://www.seveso.be
- Sweden's Seveso Portal: http://www.seveso.se

International Organizations and Platforms

- S2S, The European Web Portal for Process Safety: http://www.safety-s2s.eu/
- European Process Safety Centre (EPSC): www.epsc.org/
- The European Agency for Safety and Health at Work : https://osha.europa.eu/en
- Cefic | European Chemical Industry Council:www.cefic.org
- The European Industrial Gases Association, EIGA: https://www.eiga.eu/

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The overall objective of the project is to assist implementation of BEKRA legislation.

In addition to the Ministry of Environment and Urbanization which is main beneficiary, the inspectors and experts from Disaster and Emergency Management Presidency and Ministry of Labour and Social Security involved in the project

Within the scope of the project; advanced trainings, study visits, pilot region studies had been organized, informative short movies and guides prepared for the public and operators.

How to access more information?

For more detailed information, you can visit http://bekra.cevre.gov.tr web-page established within the scope of this project.

Competent Authorities

Disaster and Emergency Management Presidency

Ministry of Environment and Urbanization

Ministry of Labour and Social Security

Project Partners:

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