

# The regulatory context: the role of integrated area risk studies in the implementation of the Seveso III Directive

***STRATEGIES FOR EMERGENCY PLANNING AND LAND USE  
PLANNING FOR SEVESO SITES***

***Case studies and exchanges of bilateral experience Italy/Europe***

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# The role of ISPRA for industrial control

ISPRA has a national role as a **technical body supporting the Ministry of Environment** in the national implementing of the **Seveso Directives** for the prevention of major accidents (D.Lgs. 105/2015)

Definition of technical contents of laws and decrees to control Major Accidents

Set-up of the National Inventory of major accident hazards establishments and other related data-bases

Evaluation activity for the Notification form and “exclusion of substances” procedure

Pluri-annual Planning and Inspections of UT establishments SMS-PMA on a regular basis or after an accident

Support for international activities (EU, OECD, bilateral cooperation)

Technical coordination and addressing of Regional Agencies for the Protection of Environment (ARPA)

Collaboration with other Authorities competent for industrial risk (National Fire Brigades; Civil protection; Ministry of infrastructures)

Training for Seveso national inspectors aimed at Italian CCAA

# Program and themes

1. The regulatory framework of the Seveso Directive
2. The Identification of Domino Groups and Exchange of Information
3. Identification of the domino effect
4. The contents of the Integrated Area Safety Study
5. Final considerations

# 1. The regulatory framework of the Seveso Directive

# The Annex E to the D.Lgs. 105/2015

Criteria for **identifying establishments** between which there is the possibility of a **domino effect**, for the **exchange of information** between operators, as well as for identifying **areas with a high concentration of establishments** between which a domino effect is possible

1. *Criteria for identifying establishments between which there is the possibility of a **domino effect**, and for the exchange of information between operators*
2. *Criteria for identifying areas with a high concentration of establishments between which a domino effect is possible, and for preparing an **integrated area safety study***

# The definitions

- ❑ **Domino effect**: A *sequence* of major accidents, even of different nature, causally *linked*, involving plants belonging to *different establishments* due to the exceeding of *damage threshold values*, producing direct or indirect, immediate or delayed *effects*
- ❑ **Domino group**: Two or more *establishments*, between which *domino effects* may occur
- ❑ **Industrial park**: An area under the *control of multiple operators* in which hazardous substances are present and *multiple establishments are located* that are functionally or managerially *interconnected*, including shared or related *infrastructure, activities, and services*
- ❑ **Area with a high concentration of establishments between which a domino effect is possible**: An area in which *one or more Domino Groups* are present (RIR Area)
- ❑ **Integrated Area Safety Study**: A document containing the *integrated analysis of the risks of major accidents* in the RIR Area, including those related to the *transport operations of hazardous substances* associated with or attributable to them

# Criteria for the management of the domino effect

Providing a set of criteria for the identification and management of domino effects in industrial establishments included in the scope of the Seveso III

Analysis about methodologies for the quantitative assessment of the contribution due to the domino effect to individual and societal risk evaluation

Predisposition of the integrated area safety study, aimed at preparing external emergency plans, controlling urbanization, and informing the population

## 2. The Identification of Domino Groups and Exchange of Information

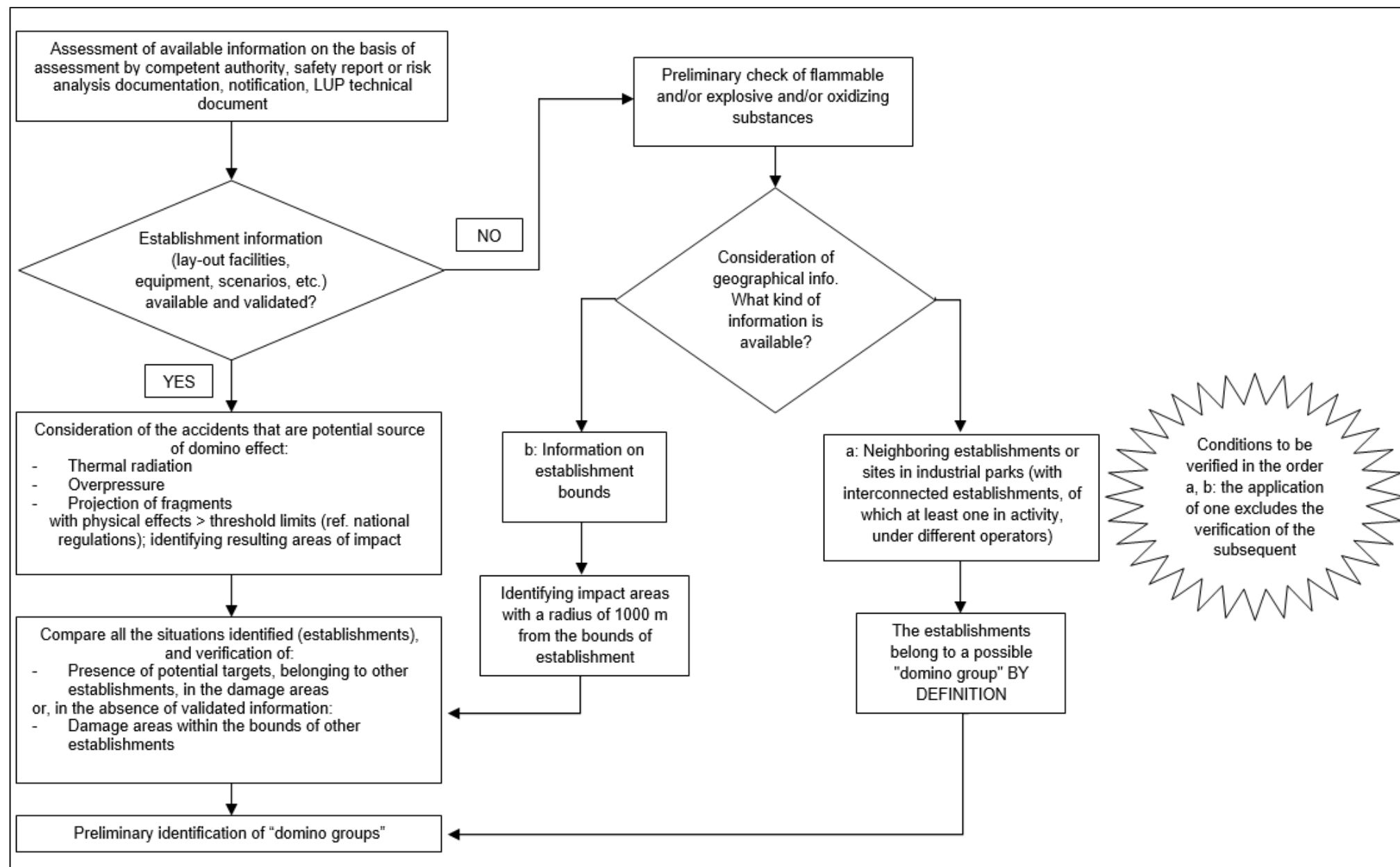


# Preliminary domino Groups (pdG)

- a) Groups of **two or more establishments** where it is possible to have **domino effects**, based on references and **information by operators**



- b) **Establishments** located in **industrial parks** can be considered **as part of a unique single pdG**, without further evaluation



# Exchange of information among the pdG operators

- Operators belonging to the same pdG must share information to check the likelihood of domino effects and update the MAPP, SMS, SR, IEP

Identify the most significant objectives in the damaged area caused by the domino effect, depending on the inherent hazard of the equipment, its location, and the type of scenario

Estimate the probability that, given a certain physical effect on a vulnerable target, the possible damage will take place

Evaluate the escalation of the consequences due to the domino, in terms of effects on the structures, people, and/or the environment

- Domino effects analysis will likely increase the number of accident scenarios considered by the operators: single scenarios plus domino scenarios, each with its frequency and consequences

# The definitive domino Groups (ddG)

Operators inform the CA of the activities and results obtained

- The **identified domino scenarios** with their **frequencies** and **consequences**
- The technical and/or management **measures**, already existing or additional, taken to **eliminate or remotize possible** direct or indirect **domino scenarios**

The CA can identify the definitive domino Groups (ddG)

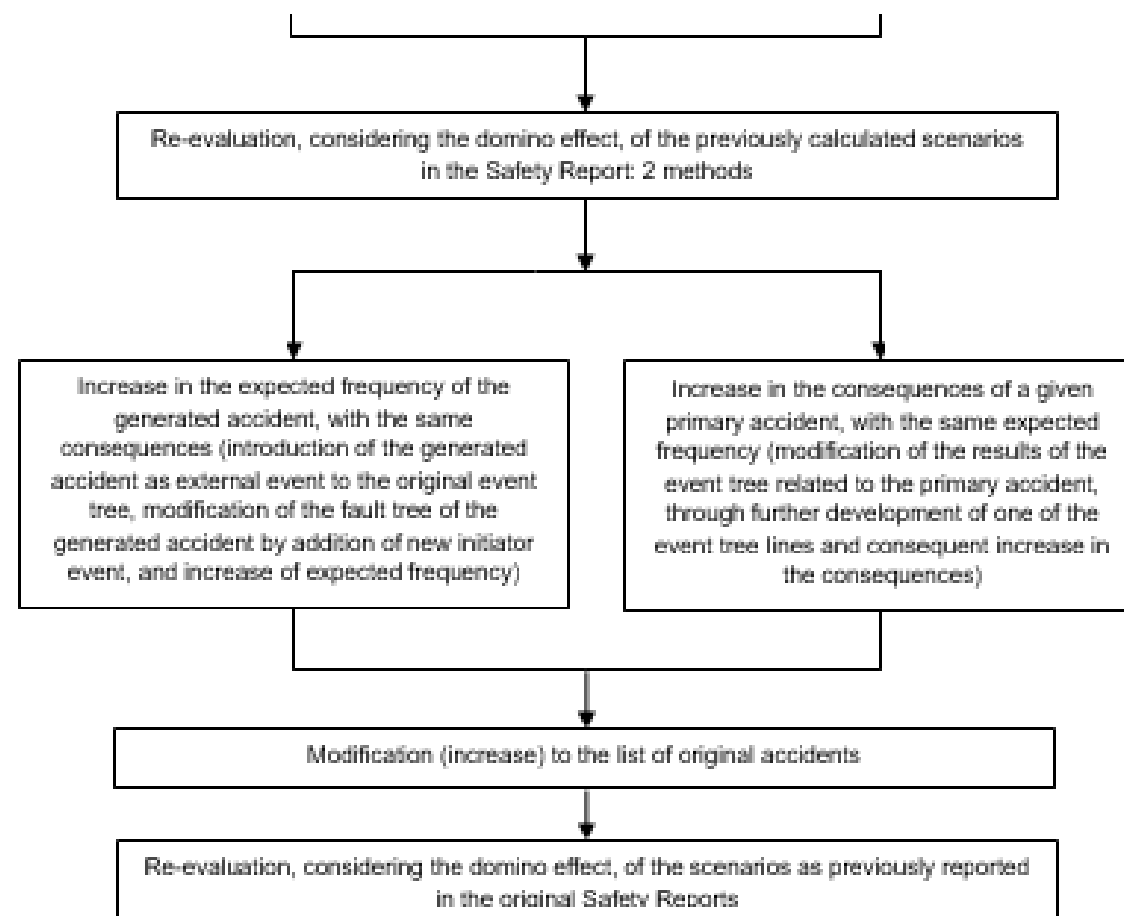
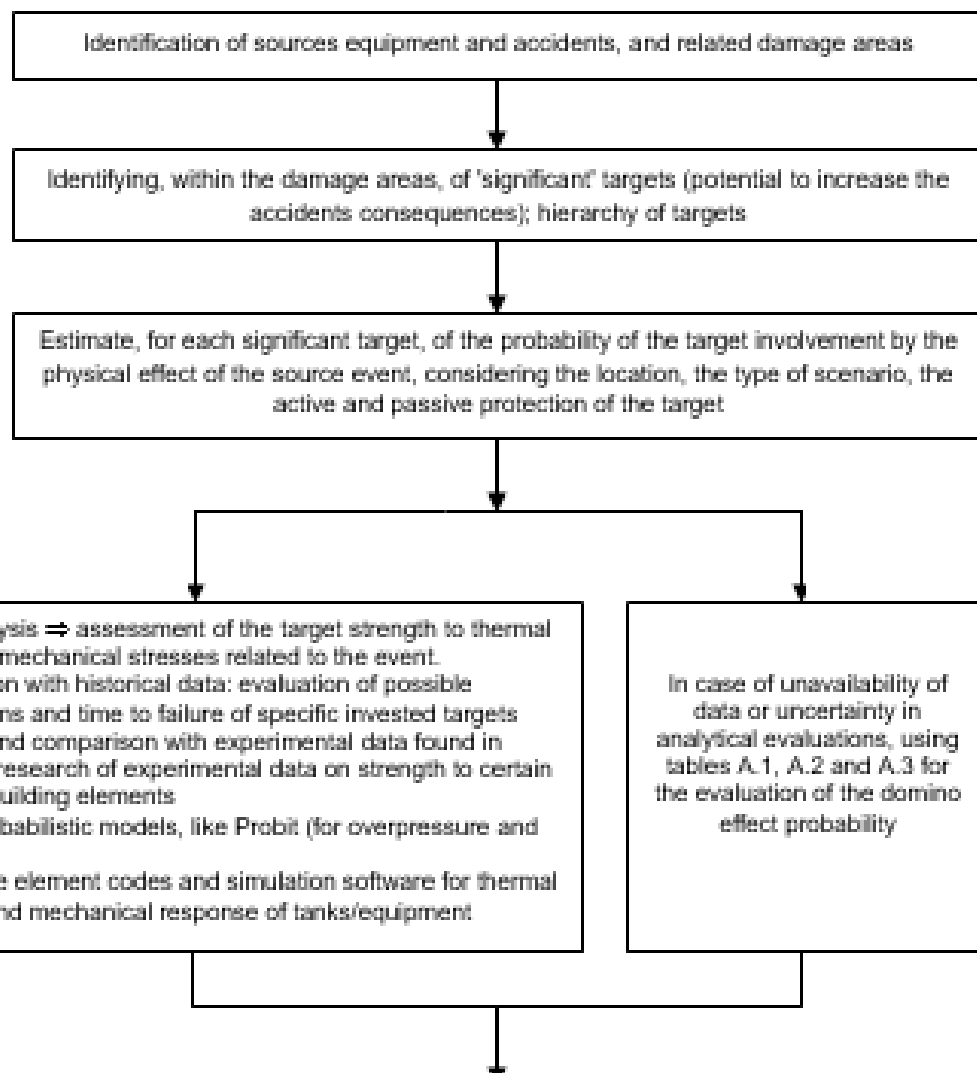
- **Clusters** where there is the **actual possibility** of the occurrence of **domino effects**, **updating the list of establishments** included in domino Groups

The CA may request integrative information to the operators involved

- **Assessing** the domino effects and **cumulative effects** of the **interventions**

### 3. Identification of the domino effect

# Analytical identification of the domino effects



# Estimation of the probability of equipment collapse: Radiation

Tabella A.1 - Probabilità di effetto domino per irraggiamento		
Effetto sorgente	Probabilità di effetto domino	Nota
Interessamento da jet fire con durata inferiore a 5 min	0	
Interessamento da jet fire con durata tra 5 e 10 min	0.5	
Interessamento da jet fire con durata superiore a 10 min	1	
Irraggiamento superiore a 37.5 kW/m <sup>2</sup> con durata inferiore a 10 min o interessamento da pool fire con durata inferiore a 10 min	0	(1)
Irraggiamento superiore a 37.5 kW/m <sup>2</sup> con durata superiore a 10 min o interessamento da pool fire con durata superiore a 10 min (per obiettivi tipo serbatoi e apparecchiature atmosferici)	1	(2)
Irraggiamento superiore a 37.5 kW/m <sup>2</sup> con durata superiore a 10 min o interessamento da pool fire con durata superiore a 10 min (per obiettivi tipo serbatoi e apparecchiature a pressione e tubazioni)	0.5	(2)
Irraggiamento superiore a 37.5 kW/m <sup>2</sup> con durata superiore a 20 min	1	(2)
Irraggiamento inferiore a 12.5 kW/m <sup>2</sup>	0	(1)
Irraggiamento tra 12.5 e 37.5 kW/m <sup>2</sup> con durata inferiore a 10 min	0	(1)
Irraggiamento tra 12.5 e 37.5 kW/m <sup>2</sup> con durata superiore a 10 min	vedi nota	(3)
Irraggiamento tra 12.5 e 37.5 kW/m <sup>2</sup> con durata superiore a 20 min	vedi nota	(3)

**NOTE:**

(1) Salvo i casi in cui sia ipotizzabile una propagazione dell'incendio a causa di materiale strutturale o componentistico infiammabile (es. pannellature di materiale plastico, etc.) ovvero un danneggiamento di componenti particolarmente vulnerabili (es. recipienti o tubazioni in vetroresina, serbatoi o tubazioni con rivestimenti plastici, etc.) per i quali si assume una probabilità pari a 1.

(2) Nel caso in cui siano presenti sistemi di protezione attivi (raffreddamento) automatici o manuali, aventi probabilità P di mancato intervento su domanda o di efficacia per tutta la durata dell'effetto sorgente, le probabilità di effetto domino vanno moltiplicate per P. Nel caso in cui siano presenti sistemi di protezione passiva (fireproofing, interrimento, barriere tagliafiamme), le probabilità di effetto domino sono trascurabili per durata dell'effetto fisico pari o inferiore a quello eventuale di resistenza del sistema. Per la distinzione tra apparecchiature atmosferiche e in pressione, si può fare riferimento alla pressione di progetto, che per apparecchiature in pressione deve essere superiore a 2 bar assoluti.

(3) Probabilità interpolata linearmente rispetto alle probabilità corrispondenti ai due estremi del valore di irraggiamento.

# Estimation of the probability of equipment collapse: Overpressure

**Tabella A.2 - Probabilità di effetto domino per sovrappressione**

Effetto sorgente	Probabilità di effetto domino	Nota
Sovrappressione inferiore a 0.3 bar	0	
Sovrappressione superiore a 0.6 bar (per obiettivo serbatoi e apparecchiature atmosferici)	1	(1)
Sovrappressione superiore a 1.0 bar (per obiettivo serbatoi e apparecchiature in pressione e tubazioni)	1	(1)
Sovrappressione tra 0.3 e 0.6 bar (per obiettivo serbatoi e apparecchiature atmosferici)	vedi nota	(2)
Sovrappressione tra 0.3 e 1.0 bar (per obiettivo serbatoi e apparecchiature in pressione e tubazioni)	vedi nota	(2)

**NOTE:**

(1) Per la distinzione tra apparecchiature atmosferiche e in pressione, si può fare riferimento alla pressione di progetto, che per apparecchiature in pressione deve essere superiore a 2 bar assoluti.

(2) Probabilità interpolata linearmente rispetto alle probabilità corrispondenti ai due estremi del valore di sovrappressione.



# Estimation of the probability of equipment collapse: Projection of fragments

**Tabella A.3 - Probabilità di effetto domino proiezione frammenti**

Effetto sorgente	Probabilità di effetto domino	Nota
Frammenti da componenti minori (ad es. tubazioni, bombole, etc.)	Vedi nota	(1)
Frammenti da collasso di recipiente essenzialmente isometrico o equivalente (ad es. sfere, serbatoi verticali)	Vedi nota	(1)
Frammenti da collasso di recipiente a sviluppo longitudinale o equivalente (ad es. serbatoi orizzontali)	Vedi nota	(2)

**NOTE:**

(1) Probabilità pari a 1, dato l'impatto con l'obiettivo vulnerabile, fino a distanze dell'ordine di 200m.

(2) Probabilità pari a 1, dato l'impatto con l'obiettivo vulnerabile, fino a distanze dell'ordine di 800m.

## 4. The contents of the Integrated Area Safety Study

# The aim of the Risk Area Analysis

- Area risk assessment requires estimating the **risk associated with every source of damage** present in the area, then recombining and **overlapping the effects** into a **comprehensive view** of the risk represented by **establishments**, industrial **installations**, and other **contributors** (e.g. transportation of hazardous substances)
- The integrated area safety study adequately **considers the simultaneous presence** of multiple **risk sources** by graphically representing the **geometric envelope of the damage areas** of the various hypothesized **accident scenarios**, reassessing the **frequency** of occurrence, and consequently **recomposing the area risks**

# Object and scope of application of the Study



**Seveso Establishments**

**Transport of hazardous substances** by pipeline, road, rail, and ship in the area, **both to and from establishments and in transit**

Other **sources of risk**, with a significant presence of **hazardous substances**

Resident and non-resident **population**, including occasional **visitors** and those in **transit**

**Vulnerable** infrastructural and environmental territorial **elements**

# Phases, data, and reference elements

## *Development of risk data management tools*

- Development of **cartographic** bases
- Development of **thematic maps and database** for industrial risk mapping

## *Inventory, collection, and validation of risk data*

- Identification and characterization of **risk sources** (fixed installations; transportation)
- **Meteoclimatic** characterization of the area
- **Demographic** characterization of the area
- Identification of the area's infrastructure and other **vulnerable territorial elements**
- Identification of **vulnerable environmental elements**

## *Identifying domino effects*

- **Preliminary domino Groups** (pdG)
- **Exchange of information** among the pdG operators
- The **definitive domino Groups** (ddG)



# Phases, data, and reference elements

## *Selection and application of risk calculation and recomposition tools*

- Verification of the **level of completeness** and **consistency of the data**
- Accidents with **consequences for humans and structures**
- Events with **consequences** for the **environment**
- Consequences of accidents on **infrastructure**
- Analysis of **NATECH risks**
- Risk **recomposition**

## *Summary of elements emerging from the study and necessary additional measures*

- **External emergency planning**
- **Urbanization** control in the area
- Information to the **population**

## 5. Final considerations


# The scope of the identification of domino effects

- ✓ Re-evaluate the set of possible accidents
- ✓ Provide for the consideration of chains of accidents in the integrated area risk study
- ✓ Maintain distances of separation between critical plants to prevent the escalation of an accident or reduce the probability of propagation
- ✓ Allow preparation of the internal emergency Plans and procedures, concerning field interventions, and external emergency Plans
- ✓ Integrate the industrial safety requirements in the LUP procedures
- ✓ Make available to the public and nearby sites more comprehensive information on the major accident risks arising from establishments




# Interaction between Seveso establishments and measures

The technical and operational criteria, set out to respond to the Seveso III Directive, offer support to the CAs for the identification and management of domino effects, aimed at identifying prevention/mitigation measures

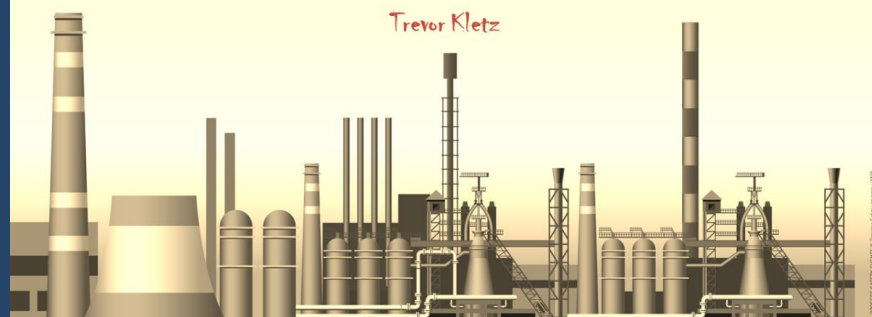


Necessary to evaluate the significance of this increase in risk, which may lead to adopting specific measures to reduce or eliminate the risk factors, according to the indications that an integrated area safety study highlights



The domino effect analysis plays a main role in an integrated area risk study, with many hazard sources, being a necessary stage for the better preparation of EEP, LUP procedures, and public information activities

*If you think safety is expensive, try an accident*



*Questions...???*

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**Thanks for your attention!!!**

