



# Application of « SEVESO II » Directive in France

## *Land-use Planning around Industrial Facilities*

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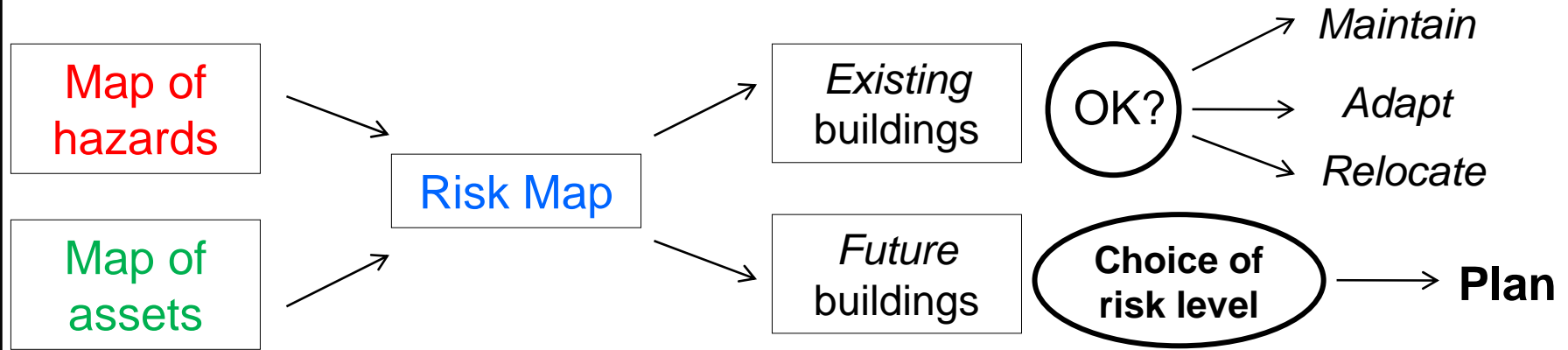




## Introduction

- Land-use planning as tool for disaster mitigation
  - Mapping hazards: past and future (e.g. consequences of CC)
  - Mapping assets + Monitoring / reducing exposure to hazards
  - Guiding vulnerability reduction (e.g.: retrofitting measures)
- A feature of most guidelines for disaster mitigation
  - UN initiatives: IDNDR (1990-2000)+ UN-ISDR; Hyogo Framework...
  - EC Directives (e.g.): 1996 “Seveso II”; 2007 “Floods”; ...
  - Guidelines and working groups: MAHB; JRC-Ispra;...
- Land-use encompasses several issues/dimensions
  - Technical / organisational: risk analysis; hazard assessment
  - Institutional: adaptation of national Law is required
  - Governance: land-use planning as constraint to local development; dialogue/negotiation needed

# Land-use planning in hazard-prone areas



- Figure: *Generic* process for land use planning in hazard-prone areas
- Sources: UN agencies (e.g. UNESCO) + IDNDR documents

# Industrial Facilities & Land-use Planning in France

- French Law: an early consideration of impacts of industrial activities, yet only progressively focussing on...
  - Well-being of riparian inhabitants: sanitary / noise, smell... (1810)
    - Casting facilities away from cities – « countryside industry »
  - Well-being of workers: focus on process safety *within* plants (1917)
  - Citizen safety (major accidents; acute/sudden pollution)
    - Safety report as precondition to industrial operation
    - Instructions for land-use planning near plants (two-tier basis)
- + Domestic drivers include:
  - Major accidents (Feyzin 1966; Toulouse 2001)
  - Public opinion / civil society; actual - or perceived - expectations
- + Foreign drivers include:
  - Integration of EC Directives into the French legal framework
  - Sectoral + international good practices for a safer industry

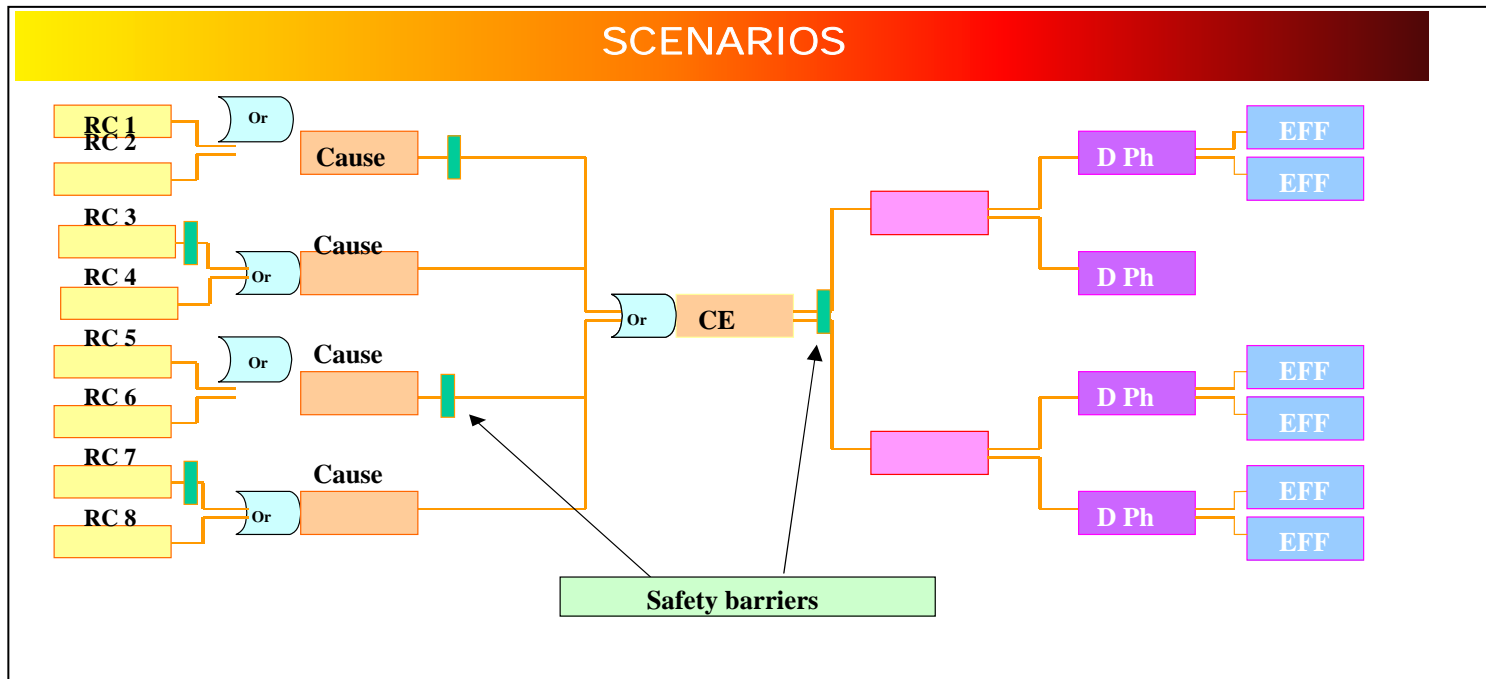


## Step 1: Granting an operation permit to industry

- Permit is delivered if the results of the **safety report** comply with acceptability criteria, as defined in a probability - gravity matrix
- What is a safety report in France?
  - a summary of an accident risk analysis;
  - a document describing all such risks generated by a facility;
  - a document whereby operators explain/prove that all safety barriers required for minimizing risks have been set up;
  - a decision support tool.
- For what purpose?
  - a basis for setting the risk matrix + permit to operate;
  - a basis for land-use planning process “PPRT”;
  - a tool for State inspection (“competent authorities”);
  - a tool for continuous improvement of safety in facilities

# Definition of an accident scenario / Bow-tie

- Scenarios identified in safety reports are based on risk analysis (HAZOP...)
- Scenario: sequence of events, from initial “root cause” to dangerous phenomenon



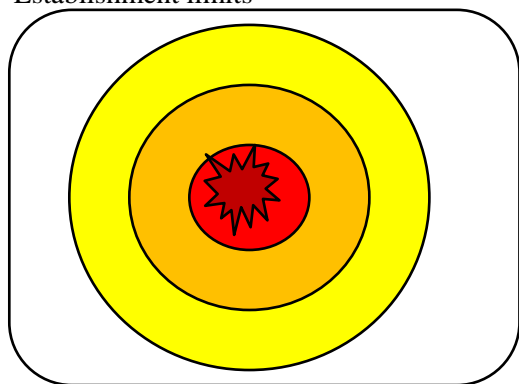
- RC: Root cause; CE: Central event; D Ph: Dangerous phenomenon (3)
- EFF: Effects (impacts on assets; severity)
- “Safety barriers”: 2 types + performance criteria

# Modelling impact distances of dangerous phenomena

- All physically possible events should be considered, before exclusion (if any)
- Modelling the effects of the worst case scenario (maximum intensity)

## CASE 1

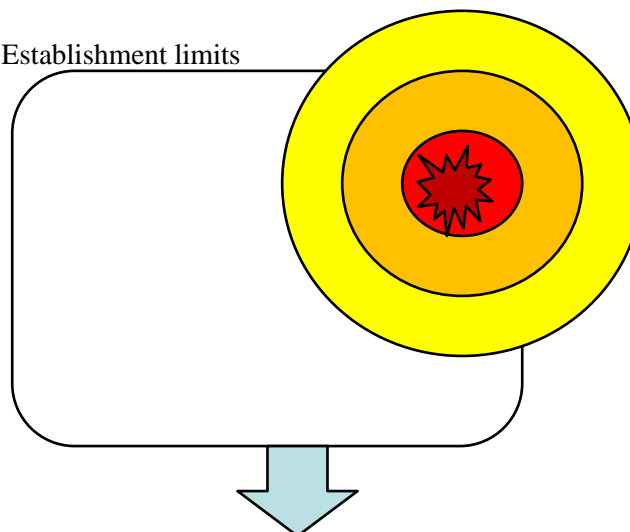
Establishment limits



No need for further analysis

## CASE 2

Establishment limits



DEVELOPMENT OF BOW-TIE/  
PROBABILISTIC ASSESSMENT

Option 1: possibility to maintain worst case assessment

Option 2: possibility to refine the assessment



## Step 2: Issuing land-use guidelines for municipality

- Land-use planning is defined by the “Plan de prévention des risques technologiques” (PPRT).
- This plan is applicable to both existing buildings and future land-use in the vicinity of SEVESO facilities
- PPRT guidelines are compulsory (i.e., surpass existing documents)
  
- What is new with the PPRT process
- Land-use planning is decided once all possible risk reduction measures have been taken at facility level
- Based on a probability-severity approach
- Reflects a willingness of the State to involve local authorities (municipality) in the decision process
- Sets co-funding as a principle for bearing the cost of land-use measures: industry + State + municipality



# Decision tools

Events +/- likely to happen



Political decision for setting rules on...

...which major accidents have to be considered in...

...which dangerous phenomena have to be considered in...

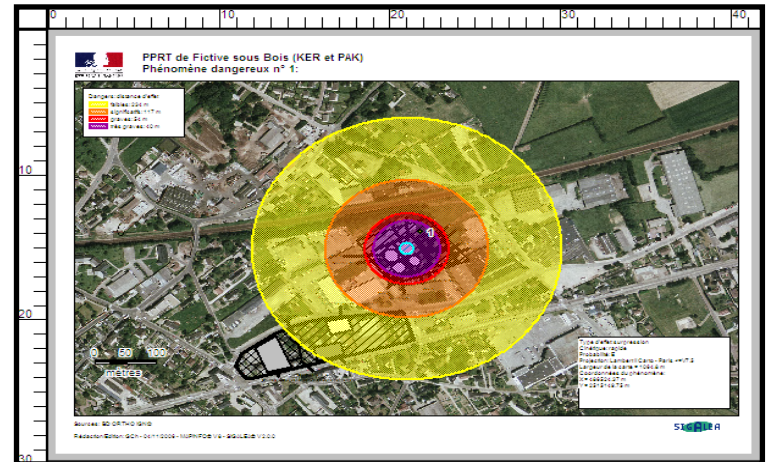
## Risk matrix – permit to operate

Is the facility compatible with its environment?

G	P	E	D	C	B	A
Désastreux		Non 1 MMR 2	Non 1	Non 2	Non 3	Non 4
Catastrophique		MMR 1	MMR 2	Non 1	Non 2	Non 3
Important		MMR 1	MMR 1	MMR 2	Non 1	Non 2
Sérieux				MMR 1	MMR 2	Non 1
modéré						MMR 1

## « PPRT » - Land use planning

- Considering the residual risk, does land-use require improvements in terms of mitigation?
- Is it relevant to plan further building in the area?



# Risk matrix

Effects	Level of effects			
	Significant lethal effect threshold	Lethal effect threshold	Irreversible effect threshold	Indirect
Thermal	8 kW/m <sup>2</sup> or (1800 kW/m <sup>2</sup> ) <sup>4/3</sup> s.	5 kW/m <sup>2</sup> or (1000 kW/m <sup>2</sup> ) <sup>4/3</sup> s.	3kW/m <sup>2</sup> or (600 kW/m <sup>2</sup> ) <sup>4/3</sup> s.	/
Overpressure	200 mbar	140 mbar	50 mbar	20 mbar

Probability class	E	D	C	B	A
Range of probability	0 to 10 <sup>-5</sup>	10 <sup>-5</sup> to 10 <sup>-4</sup>	10 <sup>-4</sup> to 10 <sup>-3</sup>	10 <sup>-3</sup> to 10 <sup>-2</sup>	10 <sup>-2</sup> to 1

Number of persons exposed

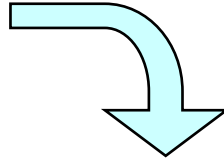
Gravity	Significant lethal effect	Lethal effect	Irreversible effect
Disastrous	>10	>100	>1000
Catastrophic	1 to 10	10 to 100	100 to 1000
Significant	1	1 to 10	10 to 100
Serious	0	1	1 to 10
Moderate	0	0	<1

Probability	E	D	C	B	A
Gravity					
Disastrous		Unacceptable	Unacceptable	Unacceptable	Unacceptable
Catastrophic	ALARP class 2	ALARP class 2	Unacceptable	Unacceptable	Unacceptable
Significant	ALARP	ALARP	ALARP class 2	Unacceptable	Unacceptable
Serious			ALARP	ALARP class 2	Unacceptable
Moderate					ALARP

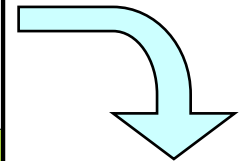
# PPRT – Hazard mapping phase

## Dangerous phenomena list

- Effect distances;
- Probability of occurrence;
- Kinetic

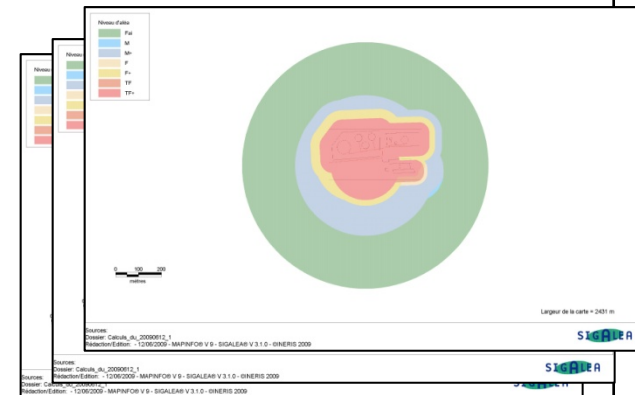


Maximum intensity of the toxic, thermal or overpressure effects on human at a given point	Very serious significant lethal			Serious Lethal			Significant Irreversible			Indirect
	>D	5E to D	<5E	>D	5E to D	<5E	>D	5E to D	<5E	All
Cumulative probability distribution of dangerous phenomena at a given point										
“Aléa levels”	VH+	VH	H+	H	M+	M	M	M	Low	



### Three hazard maps are drawn:

- Thermal;
- Overpressure;
- Toxic.



# Land-use I: Planning for the future

- On the basis of hazard levels, and vulnerability maps, regulation for **new construction** in the vicinity of SEVESO facilities are set.
- These regulations **are defined using a governance process**. However some guidance is available:

"Aléa levels"	VH+	VH	H+	H	M+	M	Low
Thermal and toxic effects	Ban on new construction		Ban on new construction but possibility to extend existing industrial buildings and infrastructure if they are protected		New construction possible depending on limitations on use or protection measures	New construction possible depending on minor limitation on use. Compulsory protection measures for public buildings and industries. No public building hard to evacuate	
Overpressure effects					Protection measures on new buildings	New construction possible depending on minor limitation on use. Compulsory protection measures for public buildings and industries. No public building hard to evacuate	

## Land-use II: Changes to current situation (exist. bldgs)

- Based on hazard levels and vulnerability maps, measures on **existing buildings** may be taken
- These decisions are made using a **governance process**. Available tools are:
  - Expropriation or relinquishment** in higher risk areas. These measures are paid using an agreement between the State, the operator and the local authorities. Some guidance is available for the definition of these areas:

“Aléa levels”	VH+	VH	H+	H	M+	M	Low
Expropriation	Automatic for housing buildings. To be defined for other activities	To be defined	No				
Relinquishment	Automatic	Automatic for housing buildings. To be defined for other activities.	To be defined	No			

- Additional risk reduction measures** may be investigated if their cost balances the cost of real-estate measures that is avoided. In this case these measures are paid using an agreement between the State, the operator and the local authorities.
- Improvements of the population protection** through consolidation of buildings and infrastructures. These measures are paid by owners of buildings and infrastructures. But their cost cannot be above 10% of the value of the goods.



## Conclusion

- Ca. 420 PPRT to be done in France; ca. 11 completed so far.
- Involving stakeholders: multiple goals
  - Making the risk management process more understandable
  - Integrating participatory considerations (e.g. Aarhus Convention)
  - Making land-use planning more acceptable + Reducing nr. of claims
  - Integrating accident risk in local development decisions
- Perspectives
  - Not all EU countries follow the same pattern for land-use planning
    - Definition of accident scenarios + Models for impact distances
    - Assessment of severity + Role played by probability
    - Decision capacity granted to local authorities
  - More comparative studies are required (e.g.: SWOT type)
    - Sharing good practice (technical + governance), incl. FP projects
    - Example: F-Seveso survey (8 countries), commissioned by CCA
    - Foster sharing of good practice (e.g. new MS)



Thank you for your attention  
Comments welcome

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