Flanders
State of the Art

Risk based zoning and controls on Domino-effects

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ENVIRONMENT
& SPATIAL
DEVELOPMENT

Background

Flemish Governement
Department of Environmental & Spatial Development

Our Team Mission:

“To play a central role in the preparation, the optimization and evaluation of the Flemish Land-use safety planning policy and to cooperate in the implementation of this policy. (linked to Seveso Directive)”

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Agenda

- **Challenges land-use safety planning**
- Seveso-siting and modifications in Flanders (short)
- LUP new developments around Seveso-sites

  → **sensitive populations**
  → **sources of possible domino-effects**

Challenges (Flanders)

- Land-use safety planning (Flanders) historically focused on
  - → siting of Seveso-establishments
  - → modifications to Seveso-establishments

- A ‘Seveso centered’ risk assessment framework is built
  - → QRA- was developed to quantify the risk /Seveso-establishement
  - → The risk criteria have been built /Seveso-establishement
  - → QRA experts are trained for Seveso
  - → Authorities are familiar with criteria for Seveso-establishments

  - → Principle of proportionality is logically applied for Seveso-establishments

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Challenges

- What is an appropriate safety-distance between a
  - → sensitive development near a Seveso-establishment?
  - → primary risk source that could generate a Domino-effect at a Seveso-site?

- Often, this is “Seveso-centered” reframed
  - → How does this new development influences the risk assessment of the existing Seveso-establishments?
    - × How to recalculate the QRA?
    - × When to recalculate the QRA?
    - × Does the evaluation of the calculated risk (of the Seveso-establishments) against the criteria changes? (what does this means?)
  - → Questions reframe the acceptable risk-problem as a acceptable Seveso-site problem.

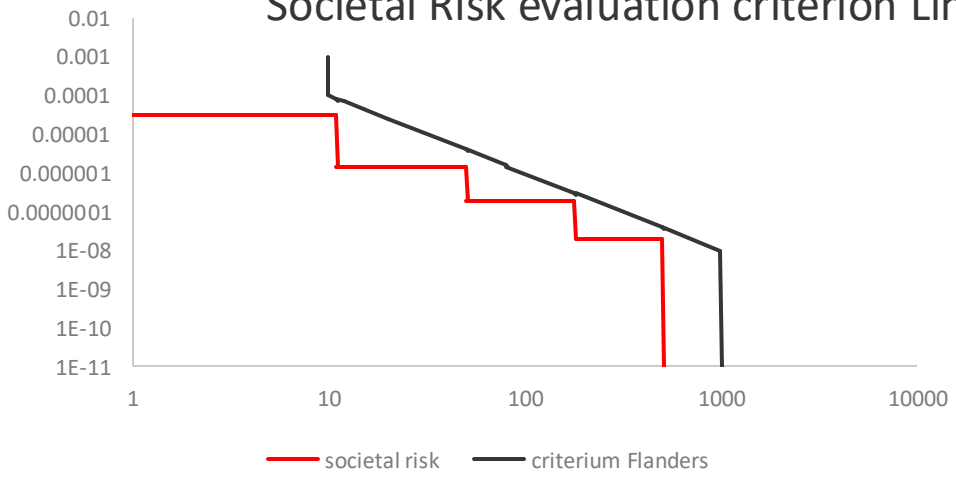
Seveso siting in Flanders (HT)

- Safety report including Risk Quantification (QRA)
  - → Technical expert following Guidelines
  - → Validation by Flemish administration
- Assessment framework in a code of good practices
  - → Localized risk
  - → Societal risk (FN-curve)
- Concrete assessment and decision by the licensing authority, with certain policy margin
  - → Often used as pass or fail

Localized Risk evaluation Criteria

population:	Fatality prob./year
External presence	10^{-5}/year
Residential area	10^{-6}/year
Vulnerable population	10^{-7}/year

Societal Risk evaluation criterion Line



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Control of (Sensitive) populations

- Drawbacks of a ‘Seveso-centered’ framework: (localized risk criteria are ok)

How does this new development influences the risk assessment of the existing Seveso-establishments on the aspect of societal risk?

→ Bucket of risk approach

- ✕ Permissible for developments that increase the consequences of a major accident when the societal risk curve is far below the criterion line
- ✕ How to deal with the development that is ‘the straw that breaks the camels back’? here is the criterion too strict

→ The increase in risk is hard to stop

→ An ‘appropriate safety distance’ between a Seveso-establishment and a type-development is variable

→ Unpredictable for developments in the vicinity of Seveso-establishments; a type –object at a location can switch in time between licensable and not licensable

→ Impossible to put the limitations on maps

Research project: to develop an assessment framework for sensitive developments

- Suitable for inclusion from the very beginning in
  - → Area development processes, vision development, planning processes
  - → Scoping and search for alternatives
- Transparant
  - → It must be mappable
  - → Comprehensible

Approach:

- ⇒ vulnarability levels for land use ≈ Italy, UK, France
- ⇒ Risk-based zoning (vs effect zoning) ≈ UK, France
- ⇒ Compatibility matrix ≈ UK, France, Italy

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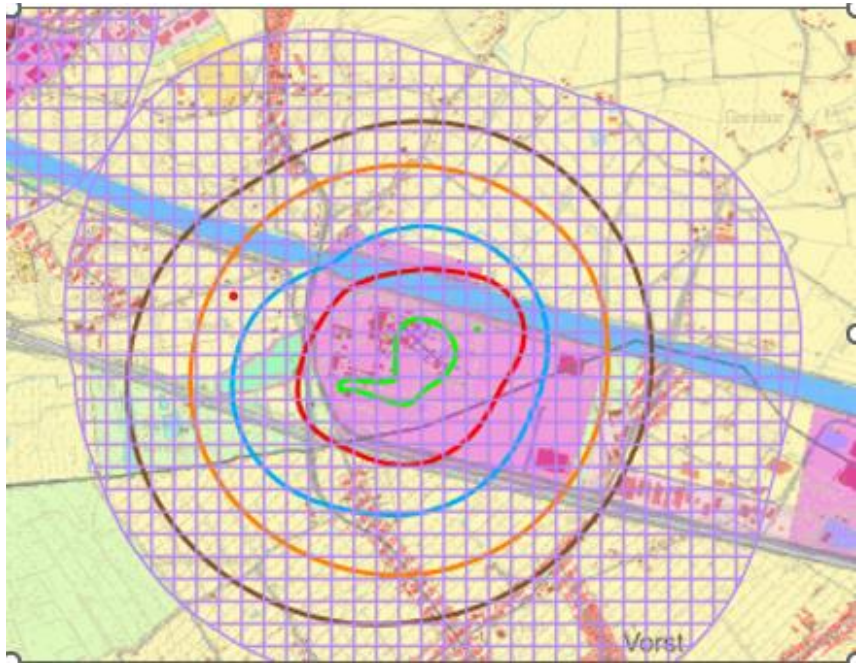
Assessment framework for sensitive developments

- Developments divided into 5 vulnerability levels
  1. >1000 people
  2. Highly vulnerable: schools, hospitals, etc., and large vulnerable buildings
  3. Vulnerable: residential areas, publicly frequented locations >400 m², medium-sized offices >100 people
  4. Limited vulnerability: individual homes, industrial activities, limited or functionally limited offices, publicly frequented locations <400 m²
  5. Not vulnerable: Functions and activities intended for industry similar to Seveso-compliant companies. Few or no people are present in these locations
     - × People inside must be protected from incidents
     - × People must be able to reach safety by escaping or seeking shelter.

Assessment framework for sensitive developments



- ☑ 20240506_IRC10-5
- ☑ 20240506_IRC10-6
- ☑ 20240506_IRC10-7
- ☑ 20240506_IRC10-8
- ☑ 20240506_IRC10-9

	iso-risk contour (IRC)				
Vulnerability	10-5/year	10-6/year	10-7/year	10-8/year*	10-9/year*
>1000 persons					
Highly Vulnerable					
Vulnerable					
Limited Vulnerability					
Not vulnerable					

* The goal is to differentiate for risks for people outside vs inside buildings

	Not recommended
	Explicit motivation is required
	Sufficient safety distance

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Assessment framework for sensitive developments

- Further implementation of assessment framework
  - → Preparation of Guidelines for risk assessment for developments near Seveso-establishment
  - → Minor adaptations in guidelines for Seveso establishments

  - → Risk based zoning must be made available on maps
  - → Preparation of Guidance for risk assessment when explicit motivation is required

  Timing implementation; july 2026

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Domino effects (escalation events, indirect risk, …)

- A domino effect is a chain reaction where one event triggers a sequence of similar or related events
  - → There is a “primary event”, at a “primary installation”
  - → There is an escalation vector (e.g. heat radiation, explosion overpressure etc.), facilitating the propagation of the domino-effect
  - → At least one “secondary accident event” happens at a “secondary installation”
  - → With consequences worse than the primary consequences

Control of Domino effects

- Research study indirect risks : Start Q1 2024 for 2 years, draft conceptual approach:
  - → Installations that are functionally linked (pump and pipe) need no control of Domino effects.
  - → Focus on limited number of scenario's (how to determine?)
  - → Focus on new developments
    - ✕ Primary risk source
    - ✕ Secondary risk source
  - → Secondary consequences > primary consequences
  - → Avoid Catastrophes:
  - → Proportionality principle for risk acceptance primary risk source // alternatives

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Control of Domino effects

- LUP Goals domino-effects, escallation effects, indirect risk
  - → Primary goal:
    - × Keep new primary installations at an appropriate distance from existing secondary installations
    - × Keep new secondary installations at an appropriate distance from existing primary installations.
  - → Secondary goal:
    - × Account for indirect risks in risk assessment of secondary installation

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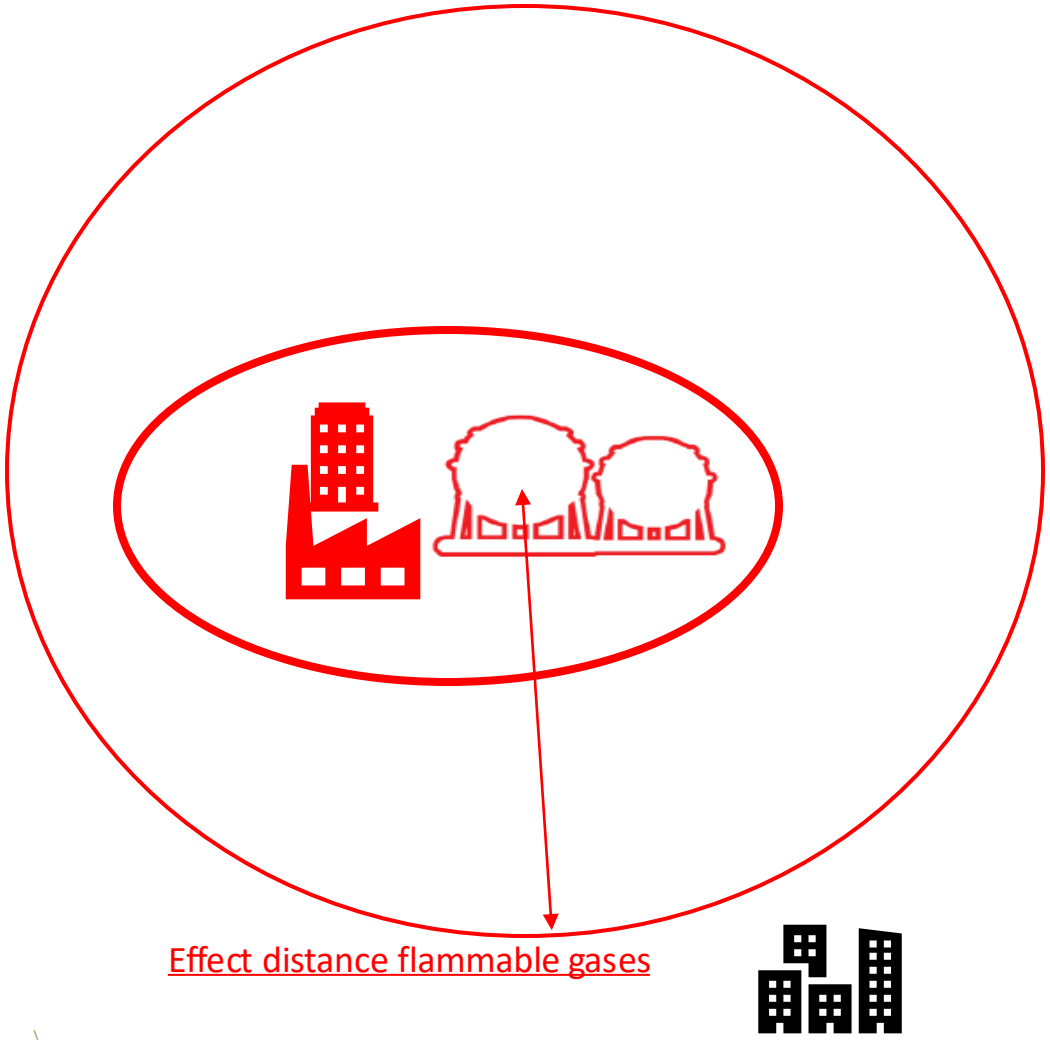
Control of Domino effects



Direct external human risk Seveso = 0

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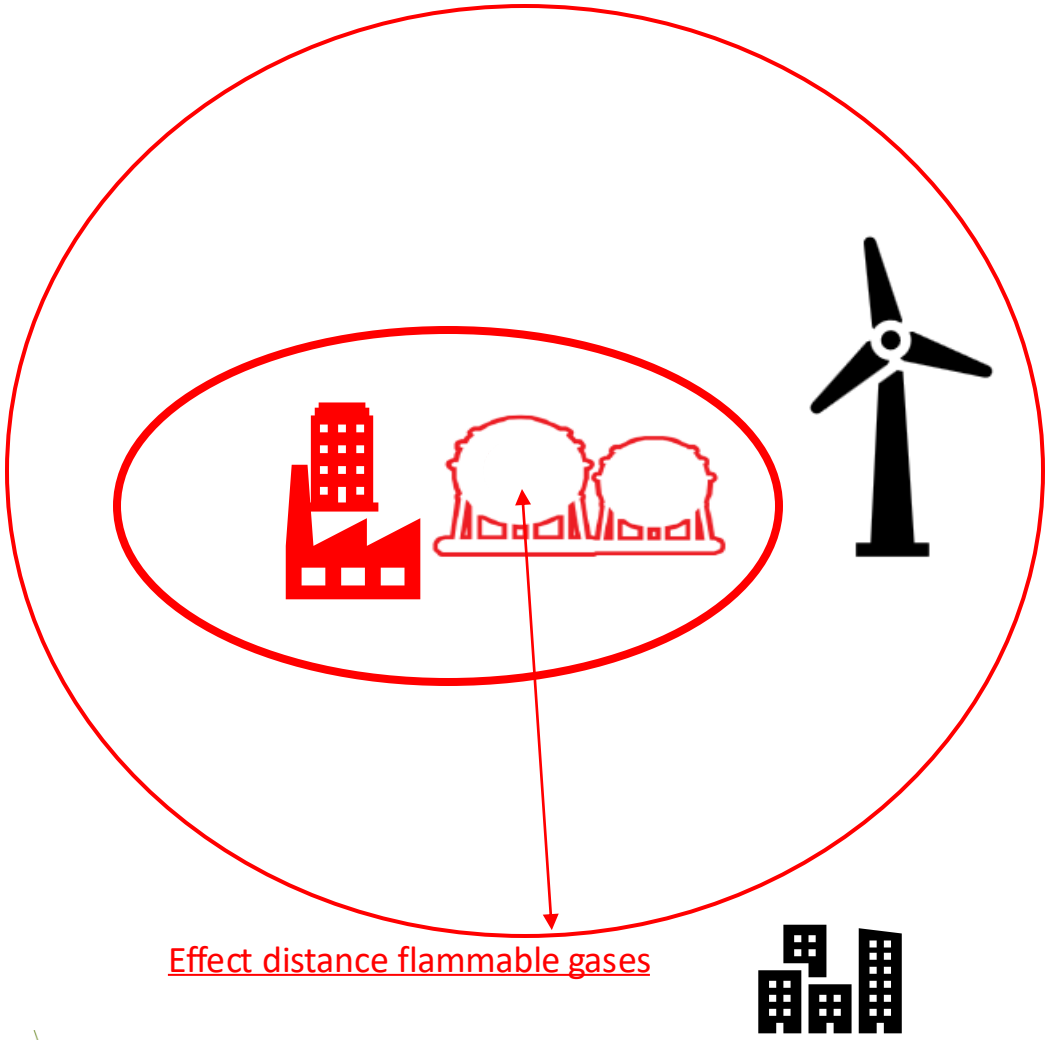
Control of Domino effects



Direct external human risk Seveso = 0

Direct risk of the windturbine = 0

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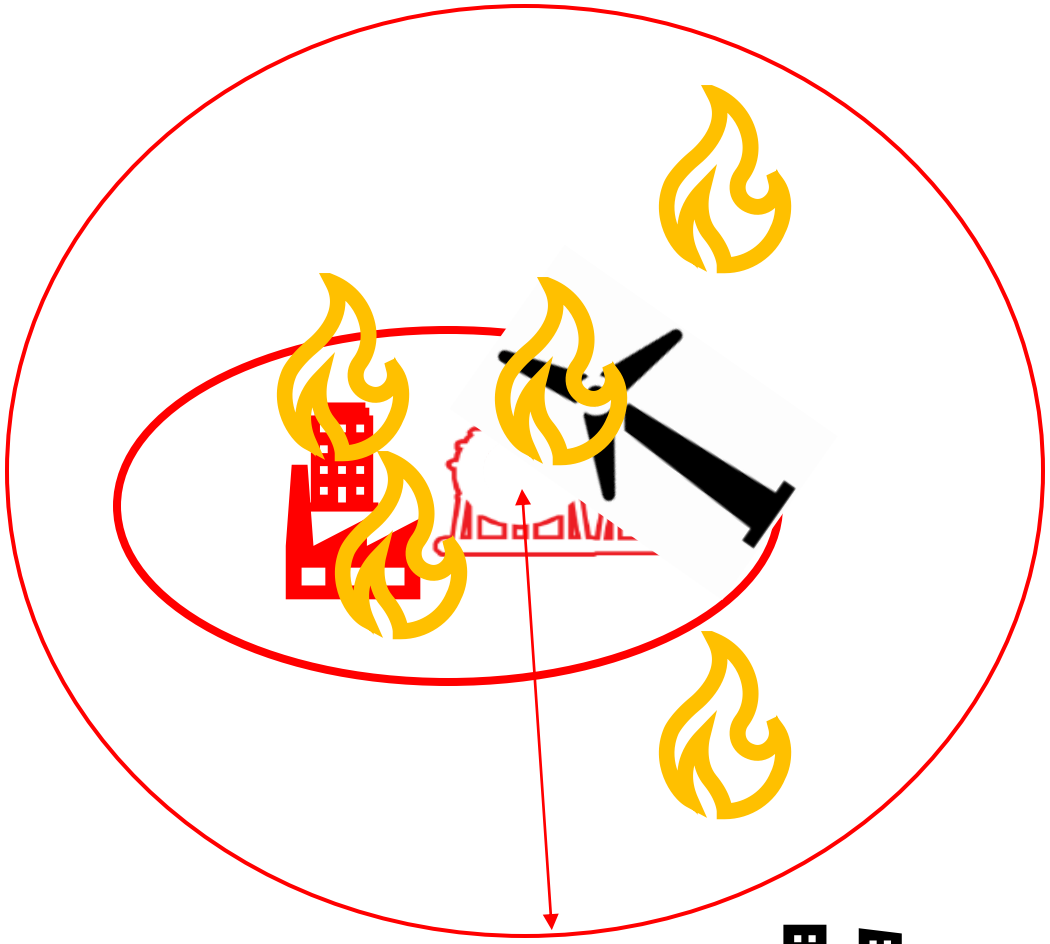
Control of Domino effects



Effect distance flammable gases

Direct external human risk Seveso = 0

Direct risk of the windturbine = 0

Indirect risk of the windturbine = f*

Total risk of the windturbine = f*

Total external human risk Seveso = 0

The Seveso-centered question

"How does this new development influences the risk assessment of the existing Seveso-establishments?"

does not provides an answer on the appropriate safety distance between the primary and secondary risk source.

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Conclusions

- Relevant general principles on risk are straightforward:
  - → Avoidable risk should be minimized
  - → Alternatives should be considered
  - → Incremental risk << risk of everyday life
  - → Tolerable risk should balance benefits

  - → Control of new developments near Seveso-sites ≠ influence of development on assessment of Seveso-site

- principles still need to be concretized in guidelines

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Questions?

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