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Translating the risk of major accidents into opportune safety distance from dangerous establishments: recent developments of national European regulations

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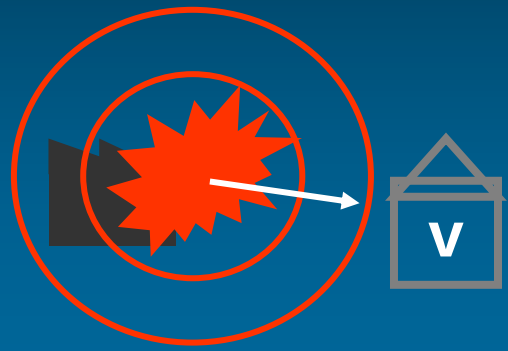
Summary

1. Research background: implementing Art 12 of Directive Seveso II on dangerous substances, Control of Urbanization



2. Research method: the MAHB questionnaire and the Piombino case-study (Italy)
3. Critical comparison: why different LUP methods?

4. Trends LUP regulations: the French and Italian case
5. Conclusions and recommendations for further research

1. Research background

- Art 12 of Directive Seveso II requires to Member States (MS) to consider, within their land use planning policies (LUP), *the need of maintaining opportune safety distances between Seveso establishments and surrounding urban and environmental vulnerable areas in the long-term;*

- In 2003, the first amendment to the Directive required to the Commission to define a d-base of accidents scenarios for supporting MS in their LUP evaluations;

- Under the coordination of the Major Accidents Hazard Bureau (MAHB) of JRC, a research project aimed at elaborating Guidance for implementing Art.12 and supporting *Roadmaps* was launched

2. Research method

- The MAHB questionnaire:

  > systematic method for land use planning around Seveso sites;

  > urban / environmental vulnerability assessment;

  > procedures and principles of “good practice”.

- The Piombino industrial area case-study (Italy):

  > four European LUP methods were applied;

  > common & different aspects of LUP evaluations were analyzed.

2.1 the MAHB questionnaire

CONSEQUENCE-BASED METHODS

$C = f(Ef) = f\,M * V$

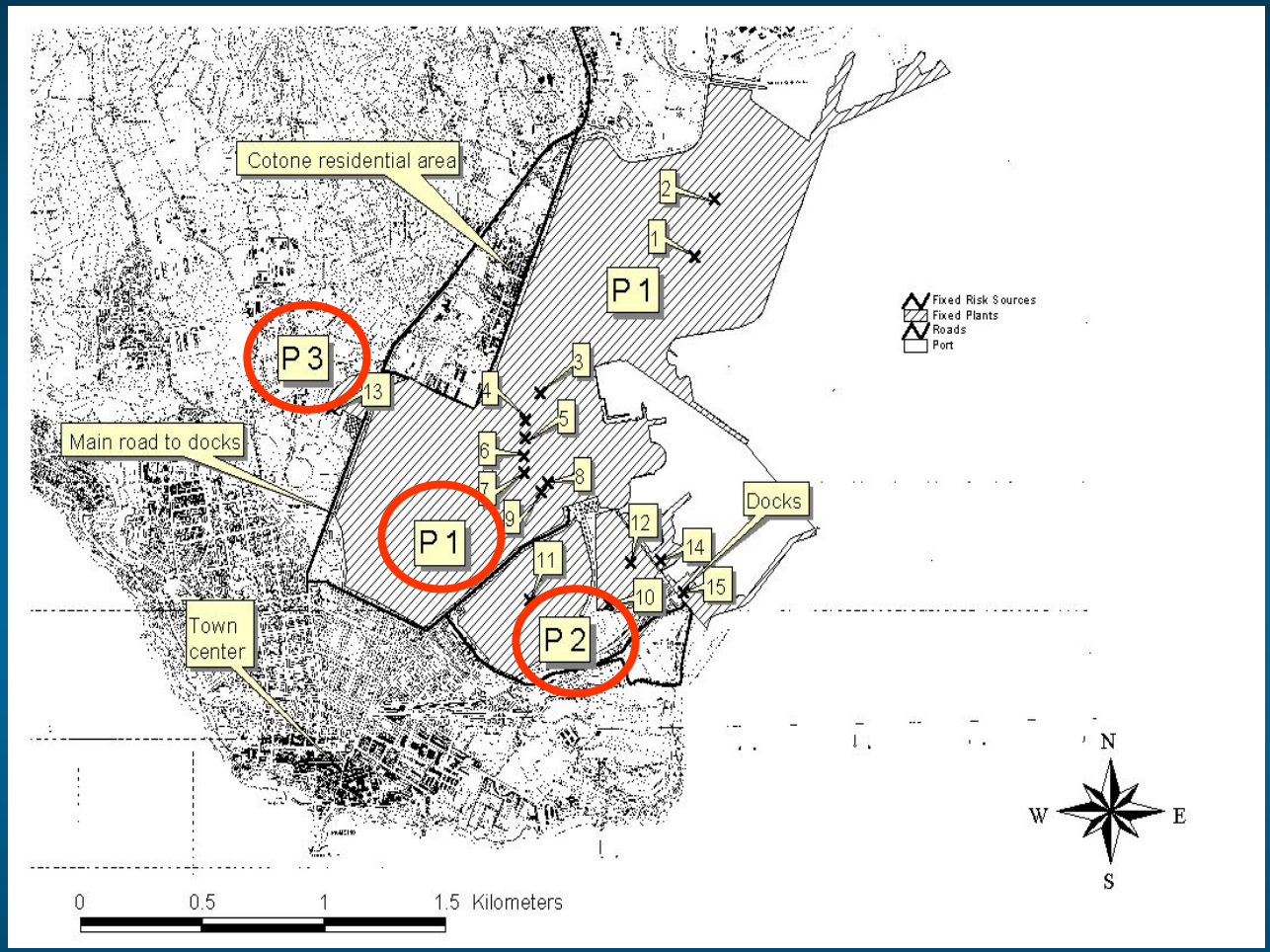
Germany, France (before 2003)

RISK-ORIENTED METHODS

$C = f(P, Ef) = f(P)\,M * V$

United Kingdom, The Netherlands

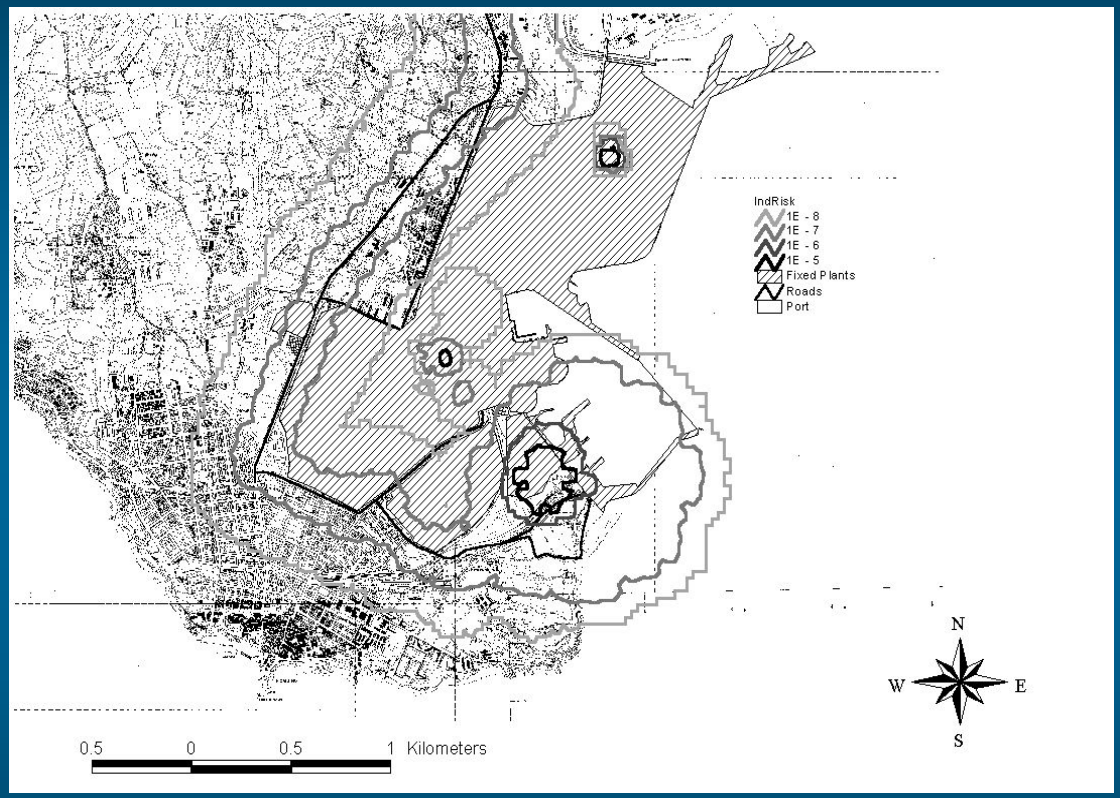
2.2 The Piombino case-study



- 3 Seveso establishments (a complete QARA study was available)
- 1 commercial harbor;
- 1 tourist harbor;
- 1 residential area (Cotone)

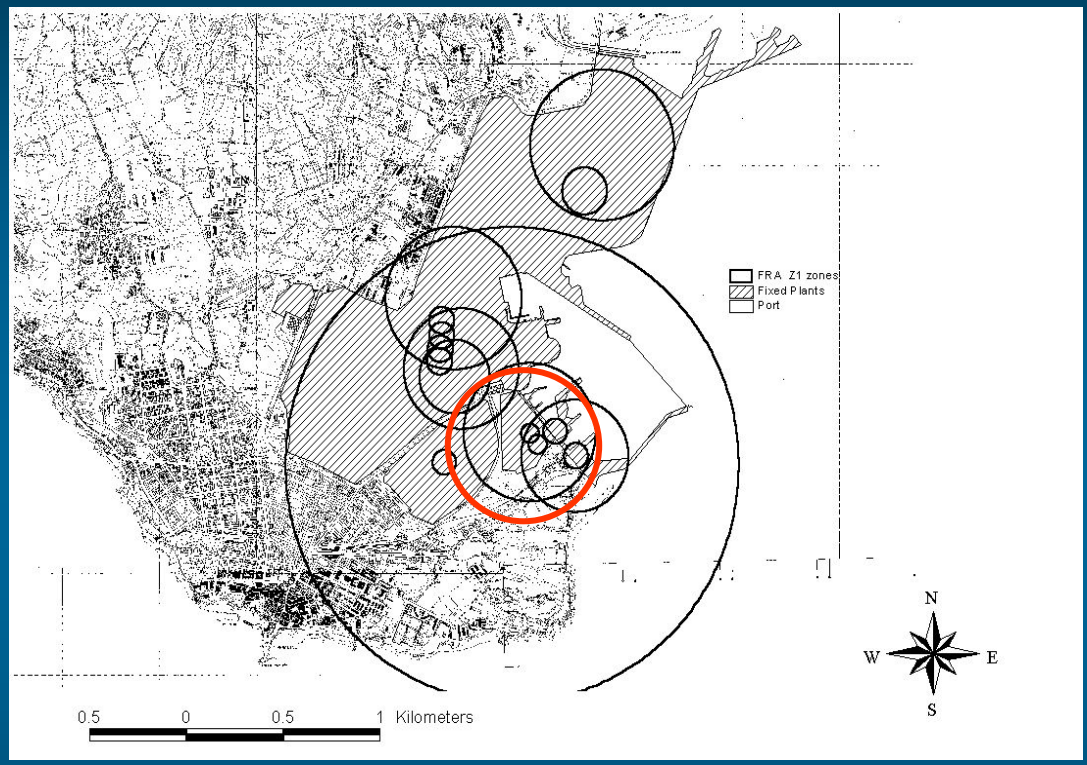
2.3 Current situation and HRA

Indiviudal risk (Aripar-GIS software):



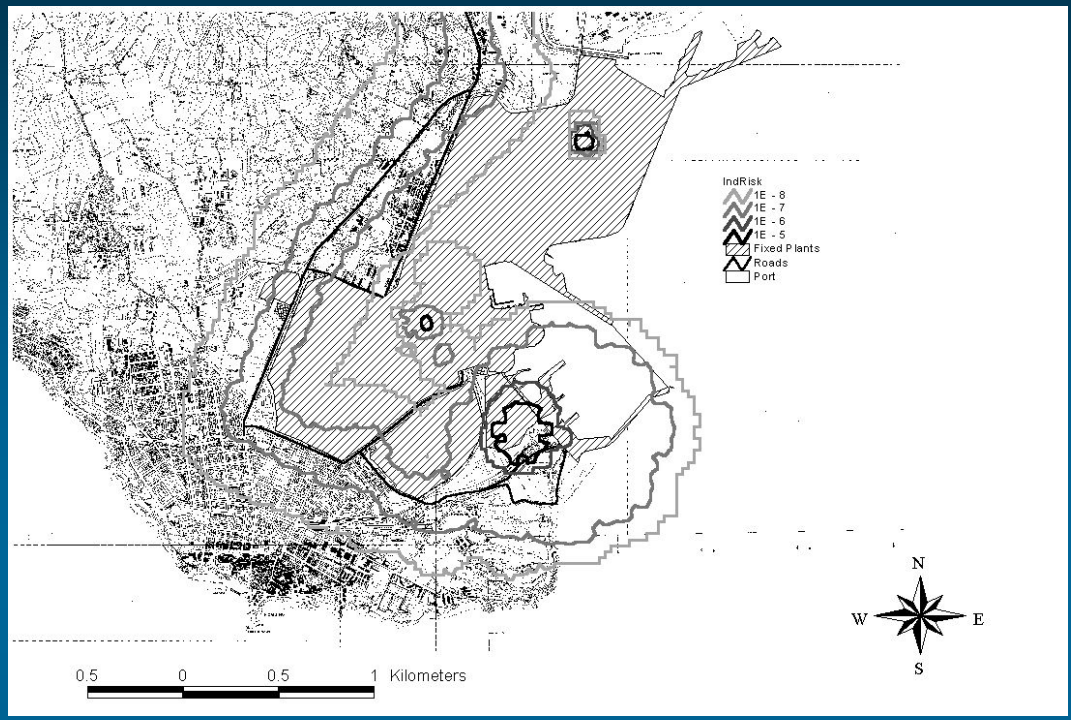
- The French, Italian, British and Dutch LUP criteria were applied;
- All methods (as regulated by relevant legislations) agreed on a unacceptably high risk level in the area;
- 4 risk reduction actions were proposed and further compared according to the 4 LUP methods.

2.4 Application of LUP criteria: France



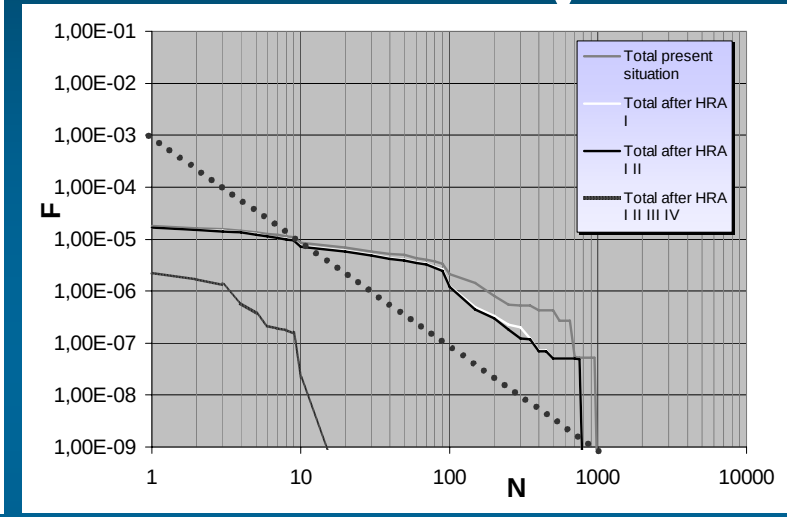
- the consequence-based French LUP criteria individualized the widest protection zones (Z1 / Z2);
- criteria do not include the risk due to transport of DS;
- priority for hazard reduction actions has to be given to inventory-reduction, namely: elimination of “fixed” risk-sources such as the ammonia nitrate storage (P2 plant)

2.5 Application of LUP criteria: the Netherlands



← INDIVIDUAL RISK

SOCIETAL RISK



- **The Dutch LUP criteria include the risk due to transport of DS and both individual and societal risk are calculated;**
- **priority for hazard reduction actions has to be given to the construction of a "buffer" parking area in the harbor and a new road for the transport of DS**

3. Critical comparison

CONSEQUENCE-BASED METHODS

- generally more conservative (particularly when based on worst-case reference scenarios);
- more sensitive to DS inventory;
- less sensitive to improvements in the Safety Management Systems in terms of hazard / risk reduction.

LUP DECISIONS: decrease of hazards

RISK-ORIENTED METHODS

- generally less conservative;
- less sensitive to DS inventory;
- more sensitive to improvements in the Safety Management Systems in terms of hazard / risk reduction.

LUP DECISIONS: decrease of risk and vulnerability

3.1 Critical comparison: why different methods?

"METHODOLOGICAL TRADITION"	**ALARP in the UK, BACT in Germany, etc**
LEGISLATIVE BACKGROUNDS	**Common law *vs*. Civil law, relevance of the Precautionary Principle to national constitutions (German case)**
TERRITORIAL / DEMOGRAPHICAL SITUATIONS	**Effectiveness of emergency plans, high population density, etc**
CULTURAL ORIENTATIONS	**UAI (Uncertainty Avoidance Index, Hofstede 1994) is higher in countries with a consequence-based regulation**

4. Trends in LUP regulations

FRANCE (2003):

After a long tradition of consequence-based regulation, after the accident of Toulouse and the new Law of 2003 a risk-oriented regulation, accounting probabilities of accidents and "alert levels" for defining safety distances and relevant urban measures was adopted:

Probability / Gravity	E	D	C	B	A
Disastrous	Non	Non	Non	Non	Non
Catastrophic	MMR	MMR	Non	Non	Non
Significant	MMR	MMR	MMR	Non	Non
Serious			MMR	MMR	Non
Moderate					MMR

ITALY (2001):

An hybrid criterion combining the effects of accidents (derived with a consequence-based approach) and probability classes (used as "mitigating factors") was adopted:

Frequency of the event (classes)	EFFECTS categories			
	Elevated mortality	Mortality	Irreversible damage	Reversible damage
$< 10^{-6}$	•DEF	•CDEF	•BCDEF	•ABCDEF
$10^{-4} – 10^{-6}$	•EF	•DEF	•CDEF	•BCDEF
$10^{-3} – 10^{-4}$	•F	•EF	•DEF	•CDEF
$> 10^{-3}$	•F	•F	•EF	•DEF

5. Conclusions and recommendations

• European LUP policies are based on different methodological orientations depending on the legislative, economical, demographical and cultural backgrounds of the various Member States;

• a European joint approach cannot ignore the “limits and horizons” represented by different national backgrounds;

• whereas limits are represent by the “methodological discretion” of Members States, common horizons may be represented by:

1. the agreement over standard reference scenarios and standards frequency values for accidents modeling (Cozzani et al 2006);

2. the definition of environmental and urban vulnerability assessment according to European minimal standards;

3. the creation of centralized d-base “mapping” the risk / hazards associated to Seveso establishments at national and European scale (ARMONIA, Espon Hazard, etc).

6. References

- **Basta C., Struckl M. and Christou M. (2007),** ***Implementing art.12 of the Seveso II Directive: overview of procedures in selected Member States and recommendation for 'Roadmaps',*** **JRC Technical Report (*In press*)**

- **Bandini R., Cozzani V., Basta C. and Christou M. (2006), Comparison of European LUP criteria: a case study on an industrial area, The Journal of Hazardous Material, Volume 136, Issue 2, 21 August 2006, Pages 170-180;**

- **Basta C., Zlatanova S., Neuvel J. and B.J.M Ale (2006), Risk Maps informing land-use planning processes: A survey on The Netherlands and the United Kingdom recent developments, The Journal of Hazardous Materials, Volume 145, Issues 1-2, 25 June 2007, Pages 241-249.**

Thank you for your attention!