

## ROMANIAN TECHNOLOGICAL RISK OBJECTIVES (SEVESO). EFFECTS ON LAND USE AND TERRITORIAL PLANNING

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**Abstract:** Industrial objectives generating a technological risk (SEVESO) has a significant impact on land use and urban and territorial planning. Knowing the details related to identifying, monitoring and managing the potential technological risks are becoming priorities, provided that the objectives under the SEVESO Directive sets a significant fingerprint over the territory where they are situated with respect to the safety and health of population and economic losses. The article analyses the status of industrial objectives with a technological risk in relationship to the built environment and the manner in which the provisions of SEVESO Directives are implementing in the planning of development in the neighboring territories. The study analyses the spatial distribution of technological risk objectives, position within urban areas, chaotic distribution, perspectives of changing the land use through urban and territorial plans, the correlation between their typology, the risk category and potentially affected population, and the conflict between SEVESO objectives and urban and territorial planning. The national practices pinpoint the existence of legislative and institutional lacks in modelling the use of lands with an already constituted function situated close to technological risk objectives and planning for the position of future enterprises posing a technological risk.

**Keywords:** SEVESO sites, spatial distribution, technological risk, land use, territorial planning

### 1. INTRODUCTION

The problem of identifying, locating and supervising industrial economic objectives presenting a technological risk (SEVESO) has a significant impact on land use and urban and territorial planning. European economic objectives on the control of major-accident hazards involving dangerous substances (SEVESO Directives) have a significant influence over the territories where they are situated with respect to the safety and health of population, but also material losses generated by them. The perspective of impacts of SEVESO objectives on land use and the mechanisms of urban and territorial planning is double in Romania, but it has, in both cases, a significantly diachronic character. One the one hand, the impact must be assessed in relationship to the moment when the

SEVESO Directives become mandatory for managing technological risks in Romania (2007, year of accession to the EU), and, on the other hand, with respect to the manner of changing or instituting the mechanisms involved in changing land use (first, planning of territories from already urbanized areas, and second, un-built areas where SEVESO objectives were placed later), with their specific uses.

The article assesses and demonstrates the impact of the presence of SEVESO sites on land use and planning in Romania. The perspective includes a spatial analysis of the distribution of SEVESO sites, in correlation with their typology and the population potentially affected by technological risks, a critical analysis of urban and territorial planning practices and instruments, and spatial diachronic assessments within few specific areas with a technological risk.

SEVESO II Directive and the experiences of implementing it in the EU with respect to managing the technological risk are analysed from the perspective of legislative and institutional provisions and spatial planning policies (Wood, 2009). Land-use planning with respect to major accident hazards is one of the most important requirements of SEVESO II Directive (Cozzani et al., 2006; Debray et al., 2006). Solving problems related to territorial planning and involving people in the decision making process related to land use is a priority related to strengthening the dialogue of businesses, public authorities and communities on risk-related issues (Contini et al., 2000; Basta et al., 2007).

In the process of spatial expansion, human communities, along with increasing and concentrating their population, transform natural systems in anthropicized systems. This first phase is followed by urbanization, based on the consumption of primary eco-energies (Ianoş et al., 2011). The process is joint by changes called, due to their worldwide importance, 'global changes'; the term includes climate changes, land cover and use changes, and alteration of energy flows (Dale et al., 2011). Among them, land cover and use changes reflect the consumption of primary eco-energies (Ianoş et al., 2011), and are proportional in magnitude with the urbanization process (Petrişor et al., 2010; Petrişor et al., 2014). Correct spatial planning can reduce land cover and use changes with negative impact over the environment, while unwise planning or its absence can amplify these adverse effects (Tudor et al., 2014). Controlling urbanization around SEVESO objectives and planning for the land use of the areas including them rely, in some studies, on a deterministic approach accounting for the real consequences of an incident involving one of these objectives (Merad et al., 2008). Planning for the land use around SEVESO sites and managing their risk for potential hazards was based in the EU on different relevant case studies (Papazoglou et al., 1998; Delvosalle et al., 2006; Fiévez et al., 2009; Camuncoli et al., 2013). Potential land use conflicts are analysed under different aspects, including their relationship with the environment (Lambin et al., 2003; Wester-Herber, 2004). In this respect, unwise waste management has negative impacts with serious consequences against the development, whilst a responsible management is a warranty for sustainability (Ianoş et al., 2010).

Romanian industrial SEVESO sites where analysed with respect to assessing their vulnerability and environmental risk (Preiss & Stuckl, 2011; Băbuţ et al., 2012). The Romanian legislation related

to the implementation of SEVESO Directives (I, II and III) imposes strict planning for emergency situations involving hazardous substances, evidenced by the means of a safety report, a major accident prevention policy and plans for internal and external emergencies for the objectives submitted to the legislative authority (Bâlcu & Trefaş, 2010). The elaboration of GIS-based risk maps is a national priority within the context of technological risk assessment, and due to the EU member state status (Contini et al., 2000).

## **2. THEORETICAL FRAMEWORK AND METHODS**

The context of rebuilding the legislation and operational practices related to land use and territorial planning during the post-communist period, as a consequence of abolishing the previous laws in December 1989, determined a delay in including the issues related to technological and natural risks in the new laws. In this context, changes in land use and minimal territorial planning interventions in areas with a technological risk were not correlated during the first post-communist decade, and the restrictions imposed by these objectives were not included in the planning provisions. The positioning of technological risk objectives preserved and was determined by economic criteria (resources, location, and accessibility) and later planning criteria (civil protection, compatibility of functions and zoning etc.).

After 1996, moment when the Romanian Government approved the General Regulation of Urban Planning, instituting a series of framework rules on land use within areas where building was allowed, the practices for analysing and conditioning territorial planning, including land use changes in relationship to the objectives and areas at risk, are expanding. The literature and institutional practice never included a diachronic analysis of the relationship between the technological risk objectives situated in Romania and those from the neighboring countries, i.e.: (a) an analysis of practices related to modelling the land use in areas with already constituted functions around the technological risk objectives, or (b) planning for areas or locations designated for technological risk enterprises in relationship to the specificity of the area.

In the next decade, along with extending and diversifying the legislative and operational framework on risks and territorial management (planning, environmental protection, and civil safety), the evolution of planning, economic and positioning

practices are bouncing between taking notice of and post-factum interventions (reactive) and anticipation and strategic planning (pro-active) examples. After 2004, given the EU pre-accession stages, the problem of technological risk objectives started to be transposed in the Romanian legislation. The perspective of the new regulations related to environmental protection and it was managed by the Ministry of the Environment, and focused on existing objectives (classification, surveillance, reduction of risk and change of technology). In practice, the problem of technological risks in Romania is situated at the institutional and operational interface between the environment, civil protection, and territorial planning. Nevertheless, territorial planning legislation does not include provisions or operational mechanisms dedicated for areas which, disregard of being built up or not, are situated in the vicinity or influence area of technological risk objectives. In this context, from a normative, operational perspective there are little limitations in modelling the impact of technological risk objectives on land use planning, and the situation can lead to environmental conflicts (Tudor et al., 2014).

The territorial analyses and identification of locations where based on data from the National Environmental Protection Agency – national inventory of SEVESO objectives, reported by Romania to the EU Commission in 2009. This database created includes the Romanian administrative units and SEVESO objectives, based on the following criteria: if sub-units were included, the objective was assigned to the higher rank unit. Also, uncertain locations were eliminated (i.e., a single location situated on the highway Bucharest-Giurgiu). In order to map the locations, the X-Tools extension of ArcView 3.X was used to transfer the data associated to a unit to its geometric center.

Land cover changes were analysed using the CORINE Land Cover and Use Changes for 2000-2006 data available free of charge from the European Environment Agency via the Internet. The analyses included the following steps: (a) clipping the areas affected by land cover changes by the contours of administrative units using the Spatial Analyst extension of ArcView 3.X; (b) identifying the transitional dynamic for each change, based on the status in 2000 and 2006 (Petrișor et al., 2014); (c) automatic computation of the areas affected by each transitional dynamic within each administrative unit using the Spatial Analyst extension of ArcView 3.X.; (d) identifying the main transitional dynamic for each administrative unit as the one affecting the largest area.

### 3. RESULTS AND DISCUSSIONS

The Romanian industrialization was a communist priority; the location of industrial objectives was a privileged factor for the spatial planning policies. Placing industrial objectives without any logic based on access to the transport infrastructure and resources or potential impacts on the environment or population health. The excessive use of economic criteria for location determined a chaotic national spatial distribution in relationship to existing or planned built up areas. The process continued during the post-communist period, multiplying this logic against environmental, sustainable territorial planning, public health or civil protection criteria. The magnitude of land use changes and territorial planning determined, in some areas, a change of the previous industrial landscape, generating or multiplying some environmental dysfunctions, most disregarded by the territorial plans.

Therefore, based on their position in relationship with the urban areas, two types of SEVESO objectives can be identified: (a) those placed within, which appeared during the communist industrialization period and affected later, transformed into brown fields; their environmental and health risk can be major, and (b) those placed outside, specific to all settlements (especially the urban ones), usually abandoned, de-structured, or functionally converted.

The role of industrial units posing technological risks was crucial to the territorial planning and expansion of settlements, since the development of industry presumed developing the residential, transportation and other sectors.

In 2009, Romania reported to the EU Commission through the Ministry of the Environment 277 SEVESO objectives, under the incidence of SEVESO II 96/82/EC Directory. According to the inventory from the National Protection Agency, they are situated in 189 urban and 70 rural settlements. Based on the classification with respect to floods, two national categories can be distinguished: (a) those situated in areas with a minor flood risk (Fig. 1), and (b) those situated in areas with a major flood risk (Fig. 2).

Out of these, 162 are situated within areas with a minor flood risk (58.48%) and 115 (41.52%) within areas with a major flood risk. Most of the objectives within areas with a minor flood risk are situated in settlements within the hydrographic basins of Siret and Prut-Bârlad, and most of those within areas with a major flood risk are within the hydrographic basin of Jiu. The Center region of development has most

SEVESO objectives (42), compared to only 17 in the Bucharest-Ilfov region of development. The counties with most objectives are Braşov (19), Bihor (16), Hunedoara (15), Prahova (13), while the opposite situation is found in Caraş-Severin (1), Covasna (1) and Harghita (1) counties (Fig. 3).

As an effect of the industrialization and urbanization policies of the communist period, the main units at technological risk are situated in

administrative units concentrating industrial activities related to extraction, chemistry and oil processing, energy etc. Furthermore, many are placed in large urban centers, such as Constanţa (9), Timişoara (7), Bucharest (7), Drobeta-Turnu Severin (7), Ploieşti (6), or Oradea (5). Năvodari is the only average city (41 138 people in 2014) with 6 SEVESO objectives: Petromidia refinery, oil processing factory etc.

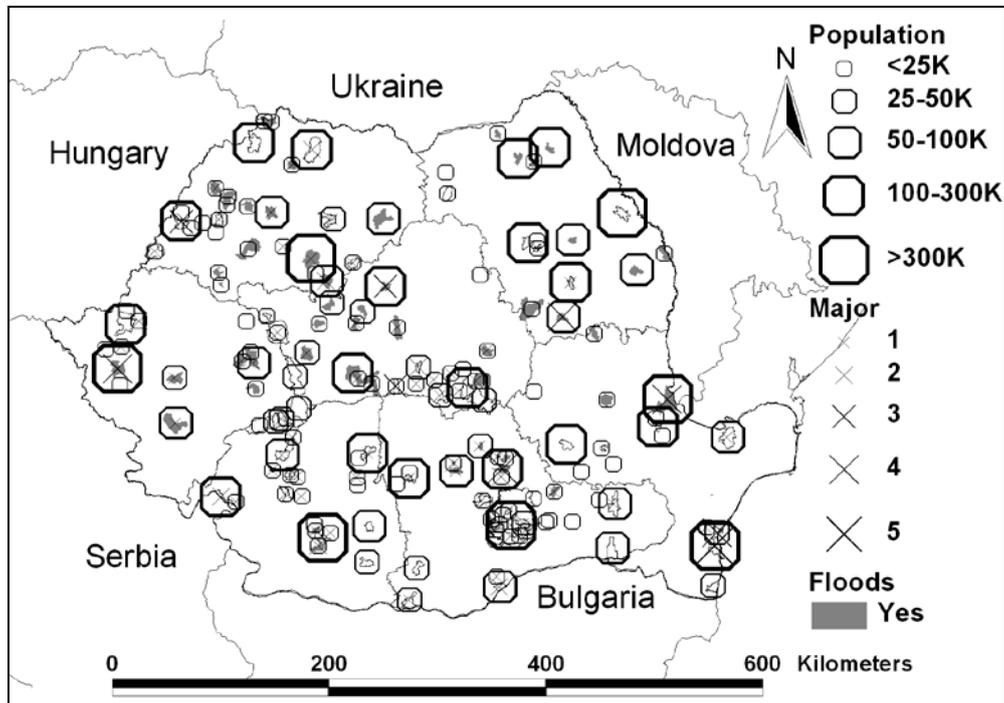


Figure 1. SEVESO objectives within areas with a major flood risk. Source: NEPA, 2015, with geospatial processing

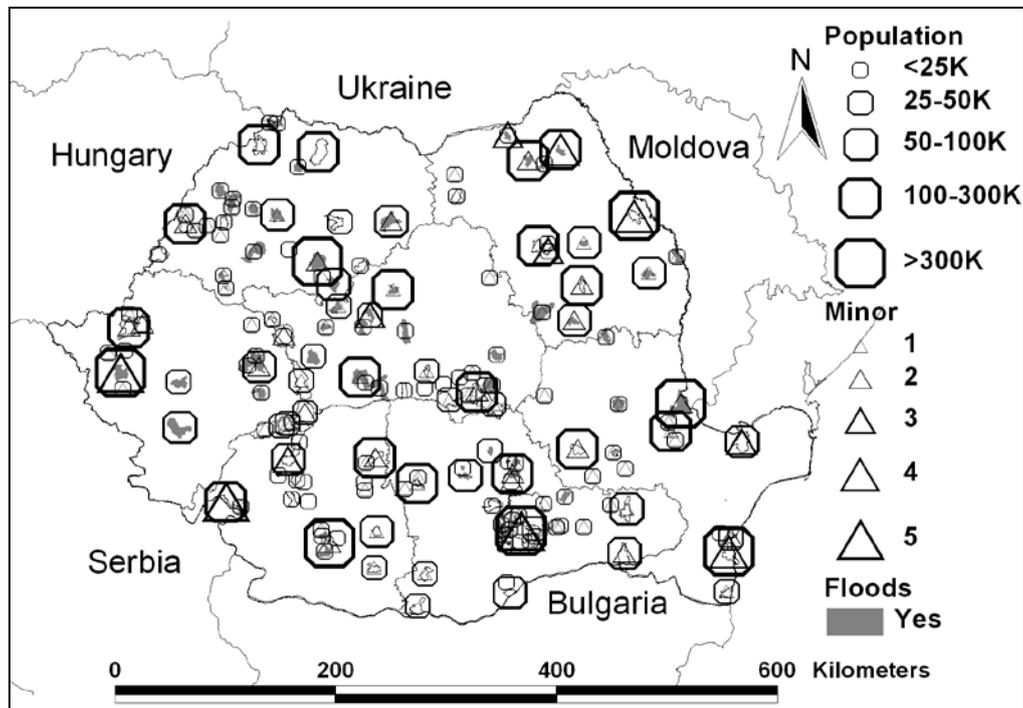


Figure 2. SEVESO objectives within areas with a minor flood risk Source: NEPA, 2015, with geospatial processing

Most objectives carry on activities related to oil and gas industry, extraction and processing industry etc.; energy, especially if situated in areas rich in coal and extraction and processing industry, totals a significant number of objectives. One of these cases is represented, on the one hand, by the energy centers in Craiova, Turceni and Rovinari, and on the other hand the objectives situated in the coal areas Motru, Rovinari and Berbești. In the rural areas, most SEVESO objectives (4) are within the Vladimirescu commune (Arad County), focused on oil and gas activities.

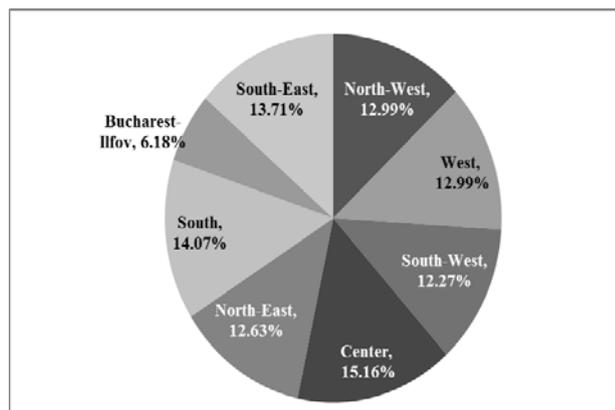


Figure 3. Share of SEVESO II Romanian objectives among the regions of development

Accounting for the fact that most SEVESO objectives are or continue industrial structures from the communist period, and the fact that at that time economic criteria associated to industrialization were a priority, most objectives are concentrated in or around urban areas. Therefore, the direct correlation between the concentration of industry and people (urbanization) leads to a large share of population affected by eventual pollution generated by SEVESO sites (47.46%), according to 2014 data from the National Institute of Statistics. In Romania, 84.54% of the population of urban areas including SEVESO sites is at risk for the pollution they could generate compared to 4.12% in rural areas. Large cities (over 300 000 people), such as Bucharest, Iași, Timișoara, Cluj-Napoca, Constanța, Craiova or Galați, national poles of development and administrative units with the most developed economy sum up to 43.04% of the total population and 44.83% of the urban population of 2014 Romanian settlements with SEVESO sites.

In the absence of detailed juridical and technical regulations, the relationship between the location of SEVESO objectives and territorial planning can generate all types of risks: technological, environmental, and economic (in relationship with the investments). In this regulatory

and institutional context, the issue of SEVESO objectives as technological risk factor is approached differently by private actors (owners of the objectives) and public actors with different responsibilities (specialized environmental protection and territorial planning institutions). Therefore, the existence of sectoral perspectives can generate territorial planning dysfunctions and economic or environmental losses, as illustrated by the following example.

In Târgu-Mureș, the Environmental Protection Agency of Mureș identified four objectives: S.C. Compania AQUASERV S.A., S.C. Depomureș S.A., S.C. Azomureș S.A., and S.C. Dafcochim S.R.L. In 2007, the City Hall of Târgu-Mureș approved, in compliance with the urban planning laws, the construction of Belvedere residential assembly including 295 houses (Fig. 4). Later, the construction works ceased due to the lawsuit of S.C. Depomureș S.A. (one of the four SEVESO objectives) due to the location of the project in the safety and protection area of gas extraction sites. In 2013, the works were restarted after completing the legal procedures, and based on the negotiation between the developer and representatives of the SEVESO objective, of the Emergency Situations Inspectorate of Mureș, of Environmental Protection Agency of Mureș and of the County Commissary of the National Environmental Guard. In this context, the safety and protection area was reduced from 450 meters (initial) to 50 meters.



Figure 4. Belvedere residential assembly built within the protection and safety area for gas storage tanks belonging to S.C. Depomureș S.A. – national SEVESO objective  
Source: Vâlceanu, 2015

This is a atypical example of unblocking investment objectives based on scientific grounds (mathematical computation, risk and probability calculus), by reducing the safety and protection area such that initially approved investments are not

blocked due to their incompliance with spatial planning regulations.

The implementation of SEVESO II Directive in Romania, through the 2007 Government Decision on major accident dangers involving dangerous substances lead to the situation where the national area of protection and safety was arbitrarily set to 50 meters for gas storage devices belonging to Romgaz S.A. Mediaş and Depogaz Ploieşti S.R.L., 40-70 meters in other EU countries (France, Italy etc.).

The new project was stopped due to these legislative and institutional discrepancies; the location of the project within the safety and protection perimeter prevented the developer to obtain the environmental permit, and also the urban planning certificate required for the authorization of construction works.

In the absence of official digital maps with the limits of SEVESO objectives, the quantitative analysis on their impact on land use and territorial planning was performed at the level of administrative units. The results obtained looking at CORINE Land Cover and Use Changes pinpoint significant transformations of these areas. The main drivers of transitional dynamics of land cover changes within the administrative units including SEVESO objectives are urbanization (56% of the cases), deforestations (30%) and abandonment of agricultural land (10%) (Fig. 5).

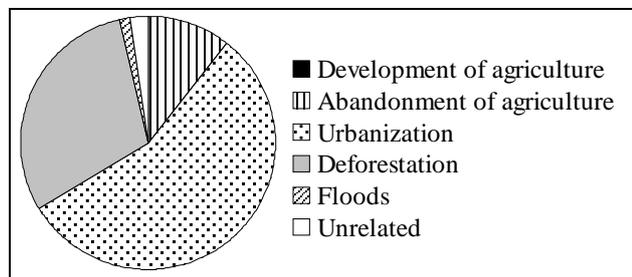


Figure 5. Transitional dynamics of land cover and use changes within administrative units including SEVESO objectives

It can be presumed that most SEVESO sites are situated within existing urban industrial areas or areas recently urbanized by expanding the area where building is allowed over the others through individual operations specific to unplanned or illegal development, associated to urbanization, in natural areas that were deforested to make room for the SEVESO sites, and on agricultural lands abandoned after the restitution of property. One of the limits of this study is its inability to pinpoint causality. Previous studies indicated that urbanization, deforestation and agricultural abandonment are the main transitional dynamics in Romania especially and

in transition countries in general, especially because the latest two are, at least in Romania, a consequence of property restitution (Petrişor et al., 2014). Another limitation is due to the issues associated with the use of CORINE data, including spatial resolution and definitions of classes (Pelorosso et al., 2009; Verburg et al., 2011).

#### 4. CONCLUSIONS

The presence of SEVESO objectives has a significant impact on land use and territorial planning, regardless of their position in areas previously urbanized or the relationship between their new location and urbanization. Similar to the other risks to be integrated in territorial planning, technological risks impose specific operational practices with respect to the location of new objectives or management of the existing ones, or for modelling the surrounding urbanized areas. The results prove, on the one hand, that the spatial distribution of SEVESO sites in Romania was based on economic criteria (urban industrial areas, availability of qualified human resources), disregarding their medium and long term economic and safety effects. On the other hand, as a consequence of delaying the process of harmonizing the legislation, and noncompliance with the technical and operational planning procedures regarding SEVESO sites, several new locations are using the same communist criteria. Moreover, the same effects result into a lack of fit between changing the use of surrounding lands and their specificity.

In this regard, the information on the effects of the presence of SEVESO sites on land use and territorial planning can be used for evaluating the specific operational and institutional framework, in order to complete and improve it. The technical and operational procedures and laws from different sectors should be harmonized in the process of locating SEVESO objectives and planning or changing the land use around the existing ones.

Only coherent territorial planning operations and procedures can ensure a sustainable development of the settlements including SEVESO sites, but also the safety of local population and economy.

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