Municipal Emergency Plans in Italy: requirements and drawbacks

Safety Science Special Issue Article: Risk and land-use - 85 (2016) 163–170

Municipal Emergency Plans in Italy: Requirements and drawbacks

Eleonora Pilone [a], Paola Mussini [a], Micaela Demichela [a], Gianfranco Camuncoli [b]

[a] DISAT – Dipartimento di Scienza applicata e Tecnologia (Department of Applied Science and Technology), Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Italy

[b] ARIA s.r.l., Corso Mediterraneo 140, 10129 Torino, Italy

Abstract

In order to highlight the strengths and weaknesses of land use planning and emergency planning policies and strategies in EU, the Italian regulations and guidelines are used as example to discuss the distance between the European and national regulation and the disaster management and post-disaster procedures, that together with the land use planning are often conceived for a Municipal scale.

Both anthropic and natural risks are dealt with in the emergency planning, but risk information derive from very diverse sources, with different levels of detail – from the risk assessment of major risk plants to the representation of risks provided by sectorial plans, each one focused on a single type of risk (i.e. flood, seismic, fire…). Emergency plans should aim at correlating the various risk evaluations, thus being able to provide a comprehensive emergency programme, both for people and territorial safety, but indeed the land use is often regulated by a completely different legislation and designing system. This lack of linkage between the procedures for Emergency and for Land Use Planning makes the emergency management less effective towards the achievement of a real safety of territories, as proved by recent disastrous events in the European territory.

In order to solve these critical issues, the paper aims at providing hints on how to achieve a different approach both in land use and emergency planning, conceiving risk assessment as part of an integrated process composed by many important and interrelated phases, not only post-disaster emergency, but also structural interventions for the long- term prevention.

Introduction

The UN/ISDR – United Nation Office for Disaster Risk Reduction (2004) defines disaster risk management (also known as emergency management) as "the systematic approach of using administrative decisions, organization, operation skills and capacities to implement policies, strategies and coping capacities of the society to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards" (Nivolianitou Z. and Synodinou B., 2011). This effort engages both the normal endeavours of government, together with the voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs (Leaning, 2008, Alexander, 2000).

The present work aims at reading and evaluating the current Italian emergency planning system, with its regulatory and operative references, on the basis of the abovementioned definition, also highlighting both managerial and methodological criticalities, that can be used as reference for the emergency planning in other Countries.

In brief, the paper explains on one side how the designation of Regions and Municipalities as authorities in charge for emergency planning produced within the whole country a basic lack of a clear and univocal technical legislation and on the other side the contents of the Emergency Plans are analysed in detail: they don't include recommendations for the implementation of structural mitigations able to contain and/or prevent disasters, but work as a basis for rescuing operations only. In the end, the Italian approach seems to reflect only partially the UN/ISDR definition (UN/ISDR, 2009), and indeed many unforeseen catastrophic events recently interested the Italian country, focusing the attention of the Government and the public opinion on the deficiencies of the Emergency management.

The paper is organised as follows: the state of the art of emergency management is presented and later examined in depth, introducing for exemplification's sake the regional guidelines in Municipal Emergency Plans issued by Piedmont, one of the Italian northern Regions; then the relationship between emergency planning and land use planning is described, with a focus on sectorial risk management plans.

On the basis of this review, some possible solutions to improve Emergency Plans as tool for territorial long-time programming are proposed.

Strength and weakness of national EP systems

Over the last decade international authorities such as the European Union (European Commission, 2010) and the United Nations have diffusely worked to improve the overall level of risk preparedness of the member States, proposing specific regulations (the so called Flood Directive 2007/60) and supporting the implementation of specific plans to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses (Hyogo Framework for Action, 2005).

Different projects at European scale devised methodologies and developed tools in order to maximise the effectiveness of emergency management, with a glance to the difficulties related with trans-boundary events (Nivolianitou Z. and Synodinou B., 2011). In particular, the latter project recognised, among the factors that can significantly influence emergency management, the role framing – intended as undertaking actions that are closely related to the profiles of the organization and the skills of its members – and the contextual knowledge – intended as the consolidated knowledge of all the aspects of the emergency.

Within the project outcomes must be noted that most of the people involved in emergency management and interviewed for the project stated that more resources should be devoted to prevention rather than spent for immediate emergency response.

These three main aspects will be later discussed in the paper with respect to the Italian emergency planning system.

The Italian emergency planning system aims at addressing both anthropic and natural related risks, deriving from risk assessments carried on at different scales and level of details and represented in different plans, issued by different agencies, focused on different territorial scales. Emergency plans are therefore a very critical document where all these prescriptions and limitations should be effectively combined into a comprehensive strategy from emergency and land use planning, referring to a long series of national and international regulations and guidelines.

The national disaster preparedness system integrates all levels of government, from the central institution (Italian Civil Protection Department) to the local authorities (Provinces and Municipalities). Each authority is in charge of different activities and programmes, related to their proximity to the event and territory. The Civil Protection Department has an overall guiding role on risk management procedures, providing guidelines and rules, implementing projects and

activities aimed at the prevention, forecast and monitoring of risks. It also coordinates all the interventions after events “that can’t be coped with ordinary powers and means, due to their intensity and extent” (the so called C type events as described at art. 2, Law 225/1992). Key institutional strengths and uniform planning strategies underlie this capability, in particular the Civil Protection ‘Operational Committee’, and the “Augustus” planning method[1].

With the introduction of Law 59/1997[2] civil protection became a matter of concurrent legislation, making Regions and local authorities (i.e. Provinces and Municipalities) responsible for the implementation of studies and programmes aimed at managing possible risks and prevent consequent damages. The D.Lgs. 112/1998 introduced a compulsory tool for managing emergencies at local scale, the Municipal Emergency Plan, which provides a survey on the state of conservation of the territory based on existing risk analysis and on superordinate plans indications; and then set up the operational activities, the materials, capacities and means needed to deal with possible emergencies. This focus on the Municipalities was further stressed by the latest Civil Protection Law (n. 100 July 12th 2012) that widened the responsibilities of local administrations in the field of disaster and emergency management: Mayors were identified as the main local authority of Civil Protection, and therefore responsible for the implementation of plans.

The national guidelines by the Department of Civil Protection containing a methodological approach able to define the contents of the Emergency Plans were issued only in 2007 (Dipartimento della Protezione Civile, 2007), when many Emergency Plans were already been prepared on the basis of different indications, on the basis of guidelines previously provided by some Regions.

The lack of an unique legislation provokes criticalities for the coordination of the emergency operations that concern different Regions and different Municipalities; moreover, it has to be specified that only 15 Regions out of 19 have prepared their guidelines so far, and many Municipalities still lack of a plan. In particular, some of the Regions considered at highest risk

[1] Civil protection planning follows the so called "Augustus" method, which was implemented in 1997 to face complex emergencies through a standardised and easy-to-implement approach. The Augustus method provides a framework for emergency planning linking coordination centres at all (local, provincial, regional and national) levels, referred to specific "support functions".

[2] “Delega al Governo per il conferimento di funzioni e compiti alle regioni ed enti locali, per la riforma della Pubblica Amministrazione e per la semplificazione amministrativa” (Mandate to the Government for the transfer of functions and tasks to Regions and local authorities, for the reform of public administration and administrative simplification).

because of their specific geomorphological features, seem to be the less prepared. At present only 77% of the Italian Municipalities already adopted an Emergency Plan.

Another shortcoming is the lack of a legislative requirement to verify and approve the contents of emergency plans, make these instruments partially ineffectual. The plan's legitimacy is limited to the immediate response to emergencies, not providing operational input on how to address and increase the safety level of the territory, suggesting proper compensation and mitigation measures.

The partial inconsistency and ineffectiveness of such type of planning was proved by different cases of disastrous events happened in recent years in Municipalities that, though equipped with a specific Emergency Plan, weren't able to properly face and manage extensive impacts. A clear example is represented by the city of Genova, hit by three major floods between 2010 and 2014 (photos of the impacts in Figure 1): the Municipality of Genova had an Emergency Plan approved in 2010, whose evaluation were based on analysis dated back to the beginning of the 2000s (Comune di Genova, 2010). Though outdated and not always precise in the extent, the considerations that structured the Plan have already pointed out the elements and the vulnerabilities which were hit the most during the three floods, that are highlighted in red in the map of flooding vulnerable areas in Figure 2. Even if extreme weather conditions were repeatedly blamed for the heavy consequences suffered by both the population and the environment, only a short-sighted management of the territory can be retained fully responsible, because despite of the Emergency Plan highlights, no preventive intervention and preventive measures were taken in advance by the Municipality.

After each catastrophe, the Emergency Plan was updated bit by bit with some additional "detailed plans", concerning specific areas or infrastructures, and finally a structural intervention on the creek which caused the flood was programmed.

Figure 1. Brignole railway station: flood of 2014 and 1970

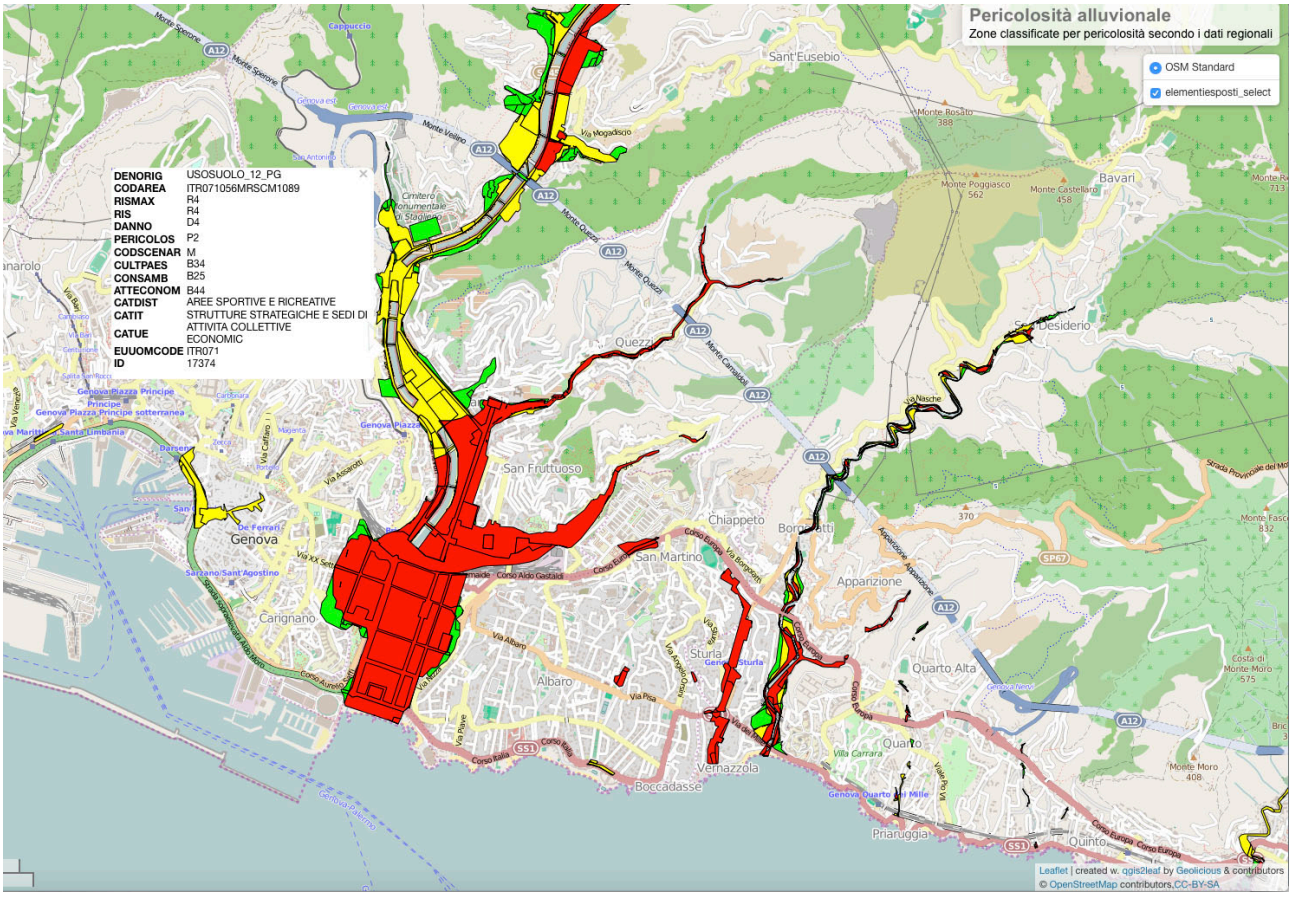

Figure 2. Map of areas vulnerable to flooding (http://www.opengenova.org/emergenza2014/utilita-degli-open-data-a-genova/ Apr. 24, 2015)

Recent events like Genova floods, the L'Aquila and Emilia earthquakes, or the Puglia landslide, have increasingly focused the attention of the Government and the public opinion on the flaws of the Emergency management system, so that proposals to return the legislative powers in this field to the State have been raised.

Local Emergency Planning guidelines and tools

In Italy, the Regional scale constitutes an intermediate step between the national planning, both of the emergency and the land use, and the local management; working at this scale should allow the decision making to be taken on the basis of more detailed and actual information.

One of the precursors in the field of emergency planning was Piedmont with the Regional Law n. 44/2000 (art. 72 -*Functions of Municipalities* - states that all the Municipalities "have to prepare and adopt a *Municipal* or *Inter-Municipal Civil Protection Plan*) and its related Guidelines, formally approved in 2004 (Regione Piemonte, 2004). According to the Piedmont guidelines, plans should include general information about the territory and its characteristics (Territorial analysis), an accurate risk scenario analysis, considering different types of hazards and vulnerabilities, as a precondition for each following provisional or operational action (Risk scenarios), and a

verification of the present structures, capacities and resources for emergency management (Organization and resources), on which an adequate configuration for emergencies can be set (Emergency procedures, Capacity building, communication and training). Mapping, in particular overlaying the maps of hazards and of vulnerabilities, is proposed as a powerful tool to highlight and clearly identify the most endangered areas.

Table 1 below shows the framework proposed by both the national and Piedmont's guidelines for the draft of Municipal Emergency Plans. It's important to notice that the guidelines later issued by the National Department of Civil Protection recall this same framework.

PHASE		PURPOSES	CONTENTS
1	Territorial analysis	To outline the basic knowledge of the territory and evaluate of the state of conservation based on current and historic analysis, punctual surveys and assessments.	• Administrative data • Demography • Physical and environmental features • Social and economic analysis • Infrastructures Culture
2	Risk scenarios	To envisage the possible consequences of a certain risk, in order to fully understand the extent of the impacts and the most vulnerable targets, to compare and overlay vulnerabilities and expected risks.	• Data collection on present risk and vulnerabilities • Rating and selection of main risks • Risk scenarios built with quantitative and empirical methods • Assessment of the level of resilience
3	Organization and resources	To plan resources related to precise functions and tasks and to define all the different emergency measures and interdependencies among authorities.	• List of all authorities involved and definition of their specific functions and responsibilities • Definition of the organization model (coordination of the support functions) • List of available and needed materials, instruments and spaces.
4	Emergency procedures	To collect al the guidelines and regulations describing the operations to be implemented in case of emergency.	• Intervention procedures • Activation of logistic and technical reference authorities • Administrative and financial procedures • Reconstruction procedures
5	Capacity building, information and training	To raise awareness among the citizens, to monitor the feasibility and effectiveness of the designed procedures, to increase the capabilities of the operators.	• Programme of the activities planned and already implemented toward the citizens and the operators • Definition of the preventive and emergency information methods
6	Attachments	To take record of all the analysis conducted and their results.	• Survey forms • Administrative and financial data

Table 1. Scheme of the Emergency Planning methodology proposed by the Piedmont Guidelines.

The above described guidelines, though very detailed with respect to emergency procedures, show a series of relevant drawbacks. First of all, they imply a very specific and detailed data collection method for the assessment of the state of conservation of single buildings, that

probably no administration would be able to implement in a convenient lapse of time and that could even prove to be almost worthless for the sake of emergency planning. Moreover, the guidelines lack of a quantitative approach for the definition of risks and vulnerabilities: hazards identification, level of danger, vulnerability and risk evaluation are suggested to be taken from already existing sectorial plans, such as Urban Development Plans, Hydrogeological Risk Plans, etc., as further detailed in paragraph Local Emergency and Land Use Planning.

Local Emergency and Land Use Planning

As anticipated in previous paragraphs, land management in Italy is delegated to Municipalities that are directly responsible both for the emergency programming and land use strategies. The Municipal Emergency Plan shares its basic inputs with the Urban Development Plan; that aims at norming urban and land functions, adapting the needs of urban development to the natural specificities of the territory (geomorphological, hydrological, etc.). Both plans adopt and should apply planning measures and constraints in response to risk assessment evaluations provided by superordinate sectorial plans (seismic, flood, etc.), but in the process of upgrade, some information frequently get lost. Furthermore, a correct application of the indications of the sectorial plans is sometimes affected by some typical issues directly related to the local scale: lack of resources and external interests could partially compromise contents and provisions of the Municipal plans.

A further drawback is that the plans built at local scale, though sharing the same basic indications, are often not mutually linked in the matter of long-term risk management: one is specifically related to the territory and the other to emergency, without establishing common preventive structural measures that could contribute to reduce risk and prevent emergency.

The management of territory applied at local scale is characterised by other critical issues:

- the information and analysis contained in larger scale plans could become obsolete in the stint between the release of the sectorial Plan itself and its integration in a Urban Development Plan, because a long time is required for the implementation, validation and adoption. The state of the territory shown in the large scale sectorial plans in some cases does not reflect the local situation, which is rapidly changing over time, and this could negatively affect e.g. the vulnerability assessment significance.
- Sectorial plans at a large scale (National, Supra-regional or Regional) usually analyse a single type of hazards; both Urban Development Plans and Municipal Emergency plans implement these evaluations but without assessing the possible effects of combined risks.

It should be noted that the methodologies used to assess the various risks are all different and therefore their results could be difficult compared and combined.

- Superordinate sectorial plans provide prescriptions and recommendations on how to reduce and contain related risks, but they cannot directly impose bindings on the territory; this regulatory function is proper of the Urban Development Plans. In any case, neither the supra-local legislation nor the local planning tools provide Municipalities with adequate means to intervene on ascertained high-risk situations, or on cases of incompatibilities between risks and existing urban functions. At the same time, these issues are not dealt with by Emergency Plans either, because they mainly aim at taking care of people after disasters happened. None of the Municipal plans is then able to set up and implement binding requirements on mitigation and compensation measures.

The use of different sources of information rises the problem of the integration of data and approaches different in time frame and scale, that could only be integrated into a comprehensive multi-risk approach.

No mention of the resilience is made throughout the Guidelines: the whole assessment methodology does not analyse the response of the territory, so that is not even possible to verify the effectiveness of the designed prevention and mitigation actions.

The above discussed shortcomings, despite very specifically referred to the Italian situation, can be used as reference in order to learn from experience and avoid similar drawbacks in other Countries.

Sectorial plans for emergency and land use planning

In the follows, the main Italian Territorial Plans related to the management of hazards are discussed, together with the criticalities they produce on an effective management of risk and emergency situation at a local level.

1) SEISIMIC RISK: the Italian seismic legislation[3] proposed a 4 zones classification based on the values of Peak Ground Acceleration (PGA), with a 10% excess probability of occurrence in 50 years, calculated for a rigid soil (see Table 2). Later, in compliance with the CEN Structural Eurocodes, the Technical regulations for the constructions were released and imposed to architects and engineers to assess the specific seismic risk related to each new construction, by evaluating the specific

[3] Ordinanza PCM 3519 (28th April 2006) and D.M. 14th January 2008 (Norme Tecniche per le Costruzioni – NTC)

response spectres of the construction itself in relation to the kind of soil, the life-time of the building, etc.

SEISMIC ZONE	Peak ground acceleration on rigid soil with a 10% excess probability in 50 years
1	PGA > 0.25
2	0.15 < PGA < 0.25
3	0.05 < PGA < 0.15
4	PGA ≤ 0.05

Table 2. Seismic zones (OPCM 3159)

After the adoption of the Technical Regulations, the 4 seismic zones defined by the previous norm 3519 remained only as an administrative help for the Regions to identify the Municipalities with a potential higher risk, while the in-depth assessment of the seismic risk was delegated to the single building scale. As a consequence, currently no effective information on seismic hazard is available at local scale: a Municipality can't exactly know the seismic hazard of its territory because of two competitive problems. The 4 seismic zones and the hazard maps provided by the INGV - Istituto Nazionale di Geofisica e Vulcanologia are based on the parameter of a rigid soil: the entire Italian soil is assumed to be made of solid rock, which is a too general and not conservative condition if applied at a local scale; on the other hand the response spectres evaluated for each single new construction/building take into account the characteristics of that building and zone, and consequently are too punctual to be extended to the entire territory. Furthermore the Technical Regulation can ensure to a new construction/building a good level of protection against earthquakes, but securing an existing building to earthquakes is not compulsory per se. Indeed the Technical Regulations established some criteria for the seismic adaptation and improvement of existing buildings, but these activities can be imposed only if a structural intervention on the building itself is already programmed.

After the L'Aquila earthquake (6th April 2009) the above discussed shortcomings were partially overtaken, supporting the highest risk Municipalities (Zone 1) for the development of detailed analysis and mapping of the characteristics of their territory and soils, the so-called Micro-zoning studies. These studies should be integrated in the Urban Development Plans, but until now the technique is still in an experimental phase, it is not compulsory and it concerns only a small number of Municipalities (Bramerini et al., 2013).

2) FLOOD AND LANDSLIDE RISK: plans expressly dedicated to the assessment of the hydrogeological risks at river basin scale, named PAI (Piano per l'Assetto idrogeologico – Hydrogeological setting plan) have been available since 1998. PAIs adopted a simplified approach

for the risk estimation; the analysis were conducted in areas in which floods and landslides events were historically proven. Floods hazard has been classified according to 3 categories, with different probabilities of occurrence and four levels of risk were identified on the basis of the potential damages to different types of target (see Table 3).

FLOOD HAZARDS		RISK LEVELS (FLOODS AND LANDSLIDES)	
Cat. A	HIGH PROBABILITY FLOODS, return time ≤ 20-50 years	Cat. R1 (low)	Negligible social, economic and environmental damages
Cat. B	MEDIUM PROBABILITY FLOODS, return time ≤ 100-200 years	Cat. R2 (medium)	Minor damages to buildings, infrastructures and people, which don't affect people and building safety, and economic activities development
Cat. C	LOW PROBABILITY FLOODS, return time ≤ 300-500 years	Cat. R3 (high)	Possible damages to people safety, structural damages to buildings and infrastructures, which affect socio-economic activities. Relevant damages to the environment
		Cat. R4 (very high)	Death and severe injuries to people, severe damages to buildings, infrastructure and environment, loss of socioeconomic activities.

Table 3. Flood hazards, and Risk categories[4]

PAIs imposed specific constraints for the areas at highest risk, and these prescriptions were adopted by Regions and Provinces and finally integrated in the local Urban Development Plans (UDP). This led to a clear definition of the correct actions to save from hydrogeological risk new constructions or transformations to the existent ones, but the existent situations of incompatibility weren't addressed; only some urgent interventions were planned at a larger scale. Furthermore, PAIs don't deal with the management of emergency situations, and the period between their draft and integration into the UDP at a local level could be excessively long. As far as it concerns flood risk, the described framework is currently changing because of new regulations: to be compliant with 2007/60/CE Directive it is required to create new plans for the management of flood risk[5]. In Italy for the first time the Civil Protection has to be involved and therefore it will also deal with aspects of Emergency Planning.

3) INDUSTRIAL RISK: Seveso companies in Italy, as in Europe, are asked to present periodically Safety Reports related to their potential risk and their possible impacts. Since the adoption of Seveso II Directive2001, following the Ministerial decree 09/05/2001, even the Municipalities had some commitment related to the presence of Seveso plants on the territory, since the principle of the territorial and environmental compatibility of Seveso plants with urban development was

[4] D.P.C.M. 28th of September 1998.

[5] Dlgs 49/2010.

introduced. Municipalities which host Seveso plants have to draft a dedicated Plan called RIR (Elaborato Tecnico per il Rischio di Incidente Rilevante – Technical document on Major Risk Accidents), in which they have to evaluate the different vulnerabilities of their territory in relation to the hazard caused by the plants: 6 categories of vulnerability (A, B, C, D, E, F) are defined for population and strategic buildings, but the environmental vulnerabilities is less clear to be assessed.

Two levels of environmental damage are established, depending on the estimated time needed for a complete recovery: Serious (> 2 years) and Significant (< 2 years), and more in-depth evaluations have to be defined case by case. As shown in Table 4, the final aim of the vulnerabilities assessment is to establish the compatibility of Seveso plants and to define specific areas around them in order to ensure a safe cohabitation of both industrial and urban activities: the classes of accepted territorial activities range from more vulnerable A (hospitals, schools, high density populated areas, etc.) to less vulnerable F (industrial complexes) as better detailed in Demichela et al. (2014).

Probability of the accidental events	**Effects of the accidental event and accepted territorial categories**			
	HIGH LETALITY	START OF LETHALITY	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

Table 4. Compatibility of Seveso plants and territorial vulnerabilities (DM 09/05/2001)

A common issue related to the Seveso Directive is that no combination of natural events and industrial ones is taken into account in RIR, also because these Plans adopt the same principles of Seveso Companies Safety Reports, which consider negligible and don't take into account events with a probability lower than 10^{-6} (Antonioni et al., 2009). Furthermore the risk connected to dangerous good transportation are rarely considered despite their potential impact on the emergency planning and management, and also the availability of methodologies to deal with them, e.g. Fabiano et al. (2005) and Orso Giacone et al. (2012).

Discussion and conclusions

The analysis of the Italian situation for emergency, land use planning and management has highlighted different limitations and shortcomings that can be taken as reference for the enhancement of the tools and procedures, also for other Countries. Indeed current local

Emergency planning instruments resulted not adequate to face the frequent emergencies caused by a very vulnerable territory, exposed to increasingly extreme natural events. The Plans related to the assessment of the various risks, that can well address the criteria for the safety of new constructions, don't deal with emergencies management and don't consider the possible interactions between the different hazards or the changes induced by climate change.

In order to solve these criticalities, a new approach for the Emergency Plans is advocated: they should become a programming tool that, on the basis of an exhaustive and in-depth analysis of the risks, is able to provide not only indications on emergency management, but also to prioritize structural interventions on the most vulnerable areas. As a consequence, the current methodology for the draft of Emergency plans requires a development aimed at overlapping the different types of risk, with the possibility to estimate the derived risk increase. In particular, an Emergency Plan should be able to:

- group and analyse the main risks of the territory, highlighting which are the major risk areas, and where possible interactions between the hazards can provoke risk for the population / strategic structures / environmental and cultural heritage.
- Indicate the overriding situations that require an immediate intervention to avoid serious injuries / deaths /damages

Different research projects at national and European level were developed to identify and produce methodologies able to take into account and manage the different types of risk. Two main approaches can be identified:

1) Multi hazard assessment, seen as the process to assess different independent hazards threatening a common area and

2) Multi hazard assessment, seen as the process to assess possible interactions, triggering or cascade effects (e.g.FP7 MATRIX PROJECT , 2013, ESPON 2013 Programme, 2010, DESTINATION 2014).

Currently many methodologies are still experimental, but it is possible to identify some common patterns between them: they usually consider a large territorial scale, so that the analysis of the territorial and environmental vulnerabilities are sometimes simplified; a purely quantitative approach could not be able to manage all the variables that should be taken into account related to the multi-risk assessment.

As stated in the previous paragraphs, the Municipalities and their planning instruments remain in many cases the frontline towards the risk management and the prevention and protection of the

population. Not many referenced methodologies at this scale are yet available, but the approaches used at a larger scale for the vulnerability analysis and risk analysis may result not adequate and too general to be effective at a minor scale: in example, in Italy are usually adopted the statistical data released by ISTAT – Istituto Nazionale di Statistica for the estimation the vulnerability related to the population, but they can't show the distribution of population and its density inside the territory of a Municipality.

Thus, in order to increase the effectiveness of emergency plans it is proposed a more in-depth analysis of the state of the territory at local scale, both for the identification of the vulnerabilities and of the risks.

- In particular for the population vulnerability it is proposed to consider the building ratio index in order to verify the density of the population itself, as in Demichela et al., 2014. Other aspects that could affect vulnerabilities should be taken into account as the age of the buildings, the roads attended by a high number of vehicles, etc.
- With reference to the risk, the sectorial plans on risk assessment are usually based on return times with wide intervals between each other; but the increasing frequency of catastrophic events due to the climate change results not compliant with the foreseen return times. At a local level, as far as it concerns floods and landslides, it would be useful to verify the accuracy of the sectorial plans through a detailed survey of the catastrophic events of the last 50 years. Even if earthquakes are not influenced by climate change, and an historical analysis of 50 years would be too brief in their case, still it would be possible to obtain a clearer comprehension of the seismic hazard of the territory of a Municipality through a systematic and diffuse application of the Microzoning studies.

  For the definition of the risk scenarios, it would be important to choose only the risks that could be more significant and that characterize the examined territory, adopting an approach similar to those suggested by ESPON 2013 Programme, 2010, Carpignano et al., 2006, FP7 MATRIX PROJECT , 2013, with the aim to obtain a final result more effective for the programming of direct interventions on the territory.

All this information should be inserted from the very beginning in a GIS tool, in order to obtain an immediate and easy to read overlapping of the different thematic layers (vulnerabilities and risks), able to show in a simple way the main points of risks interaction. Otherwise a risk recomposition methodology should be adopted as proposed e.g. in Antonioni et al. (2006).

The final aim of the proposed revision of the Emergency Plan should not be the definition of an unique risk index that summarizes all the risks, but rather the comprehension of the interactions between the risks, through the assignment of a "gravity rating", able to keep in account: what kind of risks are interacting and which is the level of risk; what are the vulnerabilities identified in the area, what are the mitigation measures eventually present (Rodriguez et al., 2012).

A new approach to the Emergency Plans towards the above mentioned objectives could be also useful for the studies related to the development of Emergency Decision Support System: particularly in Italy, various researches, like Fogli and Guida (2013) and De Maio et al. (2013) were developed in order to define the best approach to support the different authorities that intervene in an emergency, with the aim of coordinate all the stakeholders, and improve the efficacy of the decision-making chain. Therefore, the current examples of DSS mainly focus on the pure Emergency management and coordination of the rescue operations, while the introduction of the proposed Emergency Plans in this kind of system will allow to extent the decision-making also to a land-use planning for emergency. Indeed it would be possible to evaluate on the basis of the "gravity rating" which are the priority interventions, and where to address the public funds, finally achieving a real operational connection between emergency planning and land-use.

The table below (Table 5) summarizes the above-mentioned possible improvements to the current emergency planning framework, aimed at addressing more effectively the issues presented in previous paragraphs with reference to vulnerabilities and risks of the territory.

PHASE		**PURPOSES**	**CONTENTS**	**IMPROVEMENTS AND DATA SOURCE**
1	Territorial analysis	To outline the basic knowledge of the territory and evaluate of the state of conservation based on current and historic analysis, punctual surveys and assessments.	• Administrative data • Demography • Physical and environmental features • Social and economic analysis • Infrastructures Culture	• Preliminary collection of adequate data on vulnerabilities (i.e. demographic data are not sufficient to properly outline the urban density: the building ratio index could be used, as proposed by D.M. 09/05/2001) • Survey and inventory of recent and past events/disasters in order to balance the probability of occurrence assigned by sectorial plans and regulations • Creation of a GIS tool to organize and structure the information
2	Risk scenarios	To envisage the possible consequences of a certain risk, in order to fully	• Data collection on present risk and vulnerabilities • Rating and selection of	• Selection of the main risks insisting on the territory in order to simplify and expedite the emergency planning process

		understand the extent of the impacts and the most vulnerable targets, to compare and overlay vulnerabilities and expected risks.	main risks • Risk scenarios built with quantitative and empirical methods • Assessment of the level of resilience	• Set up of a corrective reliability index to mediate the probability assigned by law with the results of the survey of recent and past events and data related to climate change • Overlay different risk types and vulnerabilities following a multi-risk approach

Table 5. Proposed framework

References

Alexander D.E., 2000. Confronting Catastrophe. Oxford University Press, New York .

Antonioni G., Bonvicini S., Spadoni G., Cozzani V., 2009. Development of a framework for the risk assessment of Na-Tech accidental events" in Reliability Engineering and System Safety, no. 94.

Bramerini F., Cavinato G. P., Fabietti V. (Eds.), 2013. URBANISTICA DOSSIER: Strategie di mitigazione del rischio sismico e pianificazione: CLE condizione limite per l'emergenza, Vol. XVII, n. 130, 5-9.

Demichela M., Pilone E., Camuncoli G., 2014. Land use planning around Major Risks installations: from EC directives to local regulations in Italy. Land Use Policy no. 38, Elesevier, pp. 657-665.

Carpignano A., Di Mauro C., Golia E., Nordvik J. P., 2006. Redazione di carte tematiche di vulnerabilità e rischio – Metodologia per l'analisi di vulnerabilità territoriale su scala regionale. Rapporto finale. JRC/IPSC (http://www.bookshop.europa.eu Mar. 18, 2015).

Comune di Genova, 2010. Piano di Emergenza Comunale http://www2.comune.genova.it/portal/template/viewTemplate?templateId=9dcaka08x2_layout_xf184608x5.psml (Mar. 16, 2015).

Antonioni G., Bellezza F., Binda M., Contini S., Cozzani V., Giannotti E., Spadoni G., 2006. Quantified Area Risk Assessment: from the ARIPAR methodology to the related software tools, in: Prc. 8th International Conference on Probabilistic Risk Assessment and Management, NEW YORK, ASME Press, pp. 222 – 232.

De Maio C., Fenza G., Gaeta M., Loia V., Orciuoli F., 2011. A knowledge-based framework for emergency DSS. Knowledge-based systems no. 24, Elsevier, pp. 1372-1379.

Dipartimento della Protezione Civile, 2007. Manuale operativo per la predisposizione di un piano comunale o intercomunale di protezione civile" http://www.protezionecivile.gov.it/resources/cms/documents/Manuale.pdf (Mar. 17, 2015).

ESPON 2013 Programme, 2010. First ESPON 2013 Scientific Report. Cities, rural areas and rising energy prices.

European Commission, 2010. Risk Assessment and Mapping Guidelines for Disaster Management. http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2017833%202010%20INIT (Mar. 18, 2015).

Fabiano B., Currò F., Reverberi A. P., Pastorino R., 2005. Dangerous good transportation by road: From risk analysis to emergency planning. Journal of Loss Prevention in the Process Industries no. 18 (4-6), pp. 403-413.

Fogli D., Guida G., 2013. Knowledge-centered design of decision support systems for emergency management. Decision Support Systems no. 55, Elsevier, pp. 336-347.

FP7 MATRIX PROJECT, 2013. New methodologies for multi-hazard and multi-risk assessment methods for Europe, deliverables, 2010-2013.

Orso Giacone M., Bratta F., Gandini P., Studer L., 2012. Dangerous goods transportation by road: A risk analysis model and a global integrated information system to monitor hazardous materials land transportation in order to protect territory. Chemical Engineering Transactions, 26, pp. 579-584.

Leaning J., 2008. Disasters and Emergency Planning. International Encyclopedia of Public Health. Academic Press pp. 204–215.

Nivolianitou Z., Synodinou B., 2011. Towards emergency management of natural disasters and critical accidents: The Greek experience, Journal of environmental management 92 (10), pp. 2657-2665.

Regione Piemonte, 2004. Linee Guida per la redazione dei Piani Comunali di Protezione Civile. http://www2.regione.piemonte.it/protezionecivile/index.php/programmazione-e-pianificazione/piani-comunali-ed-intercomunali-di-protezione-civile (Mar. 6, 2015).

Rodriguez J. T., Vitoriano B., Montero J., 2012. A general methodology for data-based rule building and its application to natural disaster management. Computers & Operations Research no. 39, Elsevier, pp. 863-873.

UN/ISDR, 2009. Terminology of Disaster Risk Reduction. http://www.unisdr.org/we/inform/publications/7817 (Apr. 24, 2015).

UN/ISDR, 2005. Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. http://www.unisdr.org/we/coordinate/hfa (Apr. 24, 2015).