

EUROPEAN COUNCIL OPEN PARTIAL AGREEMENT

EUROPEAN CENTER FOR NEW TECHNOLOGIES OF RISKS MANAGEMENT

(ECNTRM)

2018 ACTIVITY REPORT

Director

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In 2018 the EUROPEAN CENTER FOR NEW TECHNOLOGIES OF RISKS MANAGEMENT was implementing three activities:

Activity 1 - Recommendations for the establishment and management of the social networks volunteers community

Activity 2 - Methods of revealing signs of emergency threat, creation of models of specific threats to be used in the future to justify the algorithm of processing social networks volunteers' messages about the threats associated with the risk of emergencies

Activity 3 - Methods of verification of messages in the social networks about the threat of emergencies

INTRODUCTION

The current state of the world is characterizing by the increase of natural and manmade threats. The largest accidents, catastrophes and natural disasters of the recent decades have claimed hundreds of thousands of lives, causing great and often irreparable damage to the environment.

Direct economic losses and the costs of emergencies consequences elimination reach hundreds of billions of dollars. Efforts at the governmental and departmental levels are often insufficient, episodic and always aimed at responding and eliminating the consequences of emergencies.

Besides, these efforts are much more expensive than developing capacity to deal with the threats and consequences of emergencies at the local level. Numerous financial studies underscore the urgent need to move from response to reducing the risk of emergencies and natural disasters. According to UNESCO 1 dollar spent on reducing the risk of emergencies helps to save \$ 25, which otherwise would have to be allocated to the compensation for damage. Thus, it can be argued that the identification and prevention of threats associated with the risk of natural and manmade emergencies is an actual scientific and technical task.

The issue of natural and manmade emergencies prevention is currently the subject of many studies. Basically, these scientific studies are aimed at developing mathematical models for the emergencies prediction. Despite the fact that many important results have been obtained in emergencies modeling and forecasting, number of problems remain unresolved to date. Existing forecast models are not equally effective and are applicable for different kind and size of objects.

It should be noted that most of the models and methods are based on longterm observations and are designed for long-term forecasting; as a result, the accuracy of the short-term forecast obtained by these methods for small areas is reduced.

To predict emergency the materials of remote sensing from space, recording materials using unmanned aircrafts and other flight-lifting equipment, the data

obtained from the meteorological observation, mobile and fixed means of video monitoring are used.

Large number of heterogeneous spatial data requires effective methods for their processing. However, the methods of automatic processing and analysis of information from these sources in the interests of preventing emergencies do not allow solving this problem with the required quality and are inferior in effectiveness to the analytical abilities of the man. The analysis and lessons learned from previous experience of dealing with the emergencies effects show that the vulnerability assessment areas and mechanisms of overcoming their consequences should be carried out with the active participation of people at risk of emergencies or witnessing the signs of these situations occurrence threat.

If the local population is involved in the risk assessment process, it also provides an opportunity to increase their awareness of potential threats and promptly initiate emergency prevention process. Thus, there is need for a large number of people to have at their disposal an instrument to improve the effectiveness of combating the threats of emergencies, collectively solving the following tasks:

- registration of reports on threats related to the risk of natural and manmade emergencies;
- discussion of emergencies monitoring results;
- analysis of heterogeneous spatial data to identify signs of threats associated with the risk of natural and manmade emergencies;
- accumulation of statistics on registered messages about threats and response results;
- people social activity increase, individual and collective skills improvement in identifying and preventing threats of natural and manmade emergencies. Such a tool can be the System for collective processing of spatial data (System), based on the technology of threat identification based on the collective analysis of spatial data. The reliability of obtained results is ensured by the correct application of

the probability theory and mathematical statistics, expert evaluation methods and is confirmed by the verification of the results obtained from other sources.

The System of collective processing of spatial data is designed to identify and verify threats and risks of manmade and natural emergencies and to prevent these emergencies in terms of ensuring response to identified threats and monitoring its status. The System is an automated information system that provides collection, processing and storage of disparate spatial data in order to identify threats through the collective processing of spatial data carried out by voluntary users of the System, as well as the organization of volunteer activities to identify these threats and the subsequent response to identified threats. The purpose of the System is to increase the responsiveness to the identified threats and thus to prevent the above-mentioned manmade and natural emergencies, contributing to reduction of:

 \checkmark number of victims and casualties in emergencies;

 \checkmark emergencies economic damage;

 \checkmark damage to the environment from anthropogenic activities;

 \checkmark economic damage from the illegal use of natural resources and construction works and other illegal activities.

This technology as a set of methods, processes and material resources involving:

- citizens community voluntarily willing to perform work to identify threats of manmade and natural emergencies risk on systematic basis and with acceptable quality;
- threats models related to the risk of manmade and natural emergencies and methodological recommendations for their use to identify these threats;
- algorithms for recording messages about threats related to the risk of manmade and natural emergencies, their discussion and verification,

taking into account the rights and roles of participants in these processes;

• technical capability to register threat messages, receive, store and analyze spatial data in order to identify threats related to the risk of manmade and natural emergencies in the 24x7x365 mode.

To identify threats based on collective analysis of spatial data, the following should be provided:

- recommendations for the establishment and management of the social networks volunteers' community
- \diamond methods of revealing the signs of emergency threat;
- methods of verification messages about emergencies threat

RECOMMENDATIONS FOR THE ESTABLISHMENT AND MANAGEMENT OF THE SOCIAL NETWORKS VOLUNTEERS' COMMUNITY

Large number of spatial data sources and their considerable volumes, large size of the territory requires that not only state structures' employees entrusted with the duty to identify threats of emergencies should be involved, but they should transfer some functions to the community of citizens - an indefinite number of persons willing to volunteer, systematically and with acceptable quality perform the work to identify threats of emergencies.

The current level of social communications information technologies development contributes to the effective solution of socially significant tasks, including the task to identify emergencies threats.

The analysis of the processes how to attract and manage the community in social internet projects, in network projects aimed at transformation of the urban environment, in Internet social services projects shows that the volunteers' community is an effective tool for collective solution of socially significant tasks.

To attract volunteers to the community of spatial data operators and the System users, as well as to manage their motivation and activity, recommendations are needed for the formation and management of the volunteers' community involved in identifying threats related to the risk of emergencies.

The mode of defining specification of the target audience, attracted to in the work of the System

The target users are the groups that have certain knowledge, competences and experience in prevention and elimination of emergencies, as well as citizens who have no special training, but with a tendency or experience of interaction with the executive authorities on various issues through special Web portals. It is recommended that the following **groups of target users** be involved in the volunteers' community:

Scientific staff, whose research interests include issues related to the development of scientific and methodological foundations for forecasting and preventing threats of manmade and natural emergencies.

After the registration, representatives of this group of target users on the Web portal of the System are assigned the role of **«the expert"**, according to which they are granted advanced rights with respect to ordinary users of the System.

When registering, scientist is to provide relevant information and copies of the documents to confirm belonging to this group of the System users.

Specialists with the practical knowledge and experience in emergencies prevention and response: employees of emergency services, emergency response services, supervisory authorities and departments involved in environmental protection.

When registering on the Web portal of the System, they are assigned the role of the "expert with extended rights" if they have provided information confirming their professional status and qualifications.

Profile universities students. After registration on the Web portal of the System, they are assigned the role of "the volunteer with the standard rights".

Representatives of non-profit organizations and voluntary associations interested in emergencies consequences prevention and response. After registering on the Web portal of the System, this group of target users gets the role and model rights of volunteers.

Citizens who do not have special training, but show an active social position in the matters of environmental protection, life safety.

▶ <u>Users of other social Web portals</u> that provide interaction between citizens and authorities on various issues When registering on the Web portal, they are assigned the role of the volunteers with standard rights.

Prior to the registration procedure on the Web portal of the System, all target users and casual visitors of the portal belong to the group of **"the unregistered users"** with minimal rights.

Defining user's roles and rights

In accordance with the selected groups, the target users may be divided according to their roles as follows: **registered** (users-moderators, users-experts and users-volunteers) and **non-registered** users. Further, in accordance with the proposed endowed roles to determine the right to perform certain actions on the Web portal of the System.

The role of the *"user-moderator"* has maximum rights. It is assigned to the registered user in addition to the role of an expert or volunteer. To gain the access to the rights of the moderator, the user needs to undergo the experts checking procedure. The role of the "user-moderator" assumes the following actions:

- \checkmark creating threat message;
- ✓ viewing existing messages;
- \checkmark commenting the messages;
- \checkmark confirming other users messages;
- \checkmark viewing data from a single spatial database (SSD);
- \checkmark adding data to SSD ;
- \checkmark deleting data from SSD;
- ✓ creating wiki-documents;
- ✓ reviewing wiki-documents;
- ✓ commenting wiki-documents ;
- ✓ creating surveys;
- ✓ participation in surveys;
- \checkmark viewing training materials;
- deleting of posts, issuing warnings to the users for the violation of conduct rules, blocking user's accounts.

The role of *"the user-expert"*, unlike " the user-moderator" does not entitle to delete messages and data from the SSD.

The role of *"users-volunteer"* unlike "user-expert" does not give rights to participate in the creation of wiki-documents and questionnaires.

Non-registered users have the right only to view existing messages and training materials on the Web portal of the System.

Determining the users' target behavior on the Web portal of the System

Assigning roles and granting appropriate rights to target users implies the development of software algorithms, game methods and interfaces that motivate users to display certain targeted behavior on the Web portal of the System. In accordance with assigned roles, the following target behavior of users is expected:

<u>Non-registered users</u> - after studying the information on the main page of the Web portal register in the System;

Registered users-experts:

 \checkmark take an active part in the life of the expert community, in posting subject materials, initiations and discussions, creating and holding enquiry-inquiries;

✓ participate in confirming (verification) and commenting of received volunteers' reports on emergencies threat;

✓ post confirmation (verification) and comment of data received from the Internet;

 \checkmark register messages on identified signs of emergencies threats.

Registered users-volunteers:

 \checkmark register messages about detected signs of emergencies threats;

✓ participate in confirming (verification) and commenting messages received from other volunteers about the threat;

 \checkmark participate in confirming (verification) and commenting the Web data;

✓ undergo training to improve the knowledge and skills for upgrading to the status of an expert receiving extra rights to work in the System;

 \checkmark participate in discussions and inquiries carried out by the expert community.

Methods of attracting target users

In the course of this work, the experience of attracting target users to the popular Web portals, whose task is to delegate certain production, scientific or socially significant functions to a certain group of people for their implementation on a voluntary basis, was studied.

Analysis of this experience has shown that the key role in increasing the number of such users is played by building communications system using modern methods of information dissemination and virtual interaction: e-mail, social networks, blogs, individual media and mobile applications.

The results of the analysis show that the development of information technologies entailed significant change in the communication environment. This has had significant impact on many socio-political and cultural factors: the ways of forming social communities and their interaction with the state structures, forms of organizing economic activity, the types and principles of the population employment, the way of life and social attitudes of the large part of society.

To define the System's volunteers community formation and attraction of target users methods to perform certain functions on the Web portal we recommend the following:

develop creative concept, motivating to join the volunteers' community;

develop communication strategy and define communication channels with the System target uses;

determine the direction of carrying out PR-campaign.

The main idea of **creative concept** is that, being united, you can make the world safer and more comfortable. Focus on this is a teamwork, in which the involvement of every citizen is important. There must be a place where everyone could tell something at a time when it still "looks like" and has not yet happened, but needs attention.

Creative concept is to be implemented by creating Web portal of the System designed to consolidate citizens in the fight to prevent emergencies. The main task is to identify in advance signs of situations that threaten people's lives. Anyone who wants to improve their lives completely can become a user of the System.

The basic task of the **communication strategy** is as follows: referring to intangible values, unite citizens on the Web portal who are not indifferent to possible threats of natural and manmade emergencies.

To implement this it is necessary to use those communication tools that can:

 \checkmark involve the targeted users - future members of the volunteer community before launching the Web portal in order to prepare the first users of the System;

 \checkmark unite target users.

The tools are:

 \checkmark blog and official pages in social networks, which serve as a platform for uniting target users;

 \checkmark published materials designed to draw attention to the System target users;

 \checkmark personal meetings with the specialists with a view to their further involvement in the community as experts;

✓ PR-campaign, which is based on the presentation of the System at the profile conferences, in profile universities, as well as the preparation and issuing press releases for the federal media on major events.

The basis of the editorial policy is as follows: advance prevention of emergencies is the basis of the daily security of citizens. That is forming the new model of behavior for the country's inhabitants. Citizens are urged to pay attention

to the signs of emergency threats and to share this information on the Web portal of the Systems to work together to identify potentially dangerous events and report them to the appropriate service for a timely response.

The main message is: "Responsible attitude towards safety is the lifestyle of a modern person".

The main tasks solved with the help of a blog and official pages in social networks:

 \checkmark form around the System the community of experts and volunteers whose participants will be involved in the work at the time of launching the Web portal and become the first users of the System;

 \checkmark teach target users of the System to detect signs of threats, using surveillance and data from the SSD;

 \checkmark cover the results of the System work when the personal interest of people, action and information technology have helped to eliminate situation, which subsequently could lead to emergency situations.

Requirements recommended to the language style:

communication in not very formal "you"-mode, respectfully, but with the appropriate humor;

headings should be informative, sometimes intriguing, paradoxical and always attracting attention;

posts in information style, with the relevant inspirational vocabulary, especially in social networks; sometimes it is necessary to introduce popular science clichés and turns.

It is assumed that the main theme and the content of the published materials in blogs and social networks should be the description of specific situations for discussion and analysis of volunteers-experts, success stories, educational materials, modern technology to help volunteers, testing surveys, as well as world experience of crowd sourcing.

Sources of transitions to the Web portal of the System for increasing the number of target users can be:

 \checkmark information partnerships with thematic resources and relevant audience;

 \checkmark exchange of links in social networks with the groups of relevant content and audience;

 \checkmark involving bloggers and opinion leaders for posting information on their pages in social networks and/or blogs;

 \checkmark address e-mail link to the database subscribing to the blog and contact database, which is formed as a result of participation in the profile events;

 \checkmark placement of targeted messages with the links to the System resources on thematic forums.

METHODS OF REVEALING THE SIGNS OF EMERGENCY THREAT, CREATION OF MODELS OF SPECIFIC THREATS TO BE USED TO JUSTIFY THE ALGORITHM OF PROCESSING SOCIAL NETWORKS VOLUNTEERS' MESSAGES ABOUT THE THREATS ASSOCIATED WITH THE RISK OF EMERGENCIES"

There are several ways to identify threats of natural and manmade emergencies risk. Threats can be identified either by applying mathematical methods and models of short-term forecasting of emergencies, or by processing and combining different spatial data, or by reporting eyewitnesses who documented the actual signs of a specific threat.

The use of all these methods requires the availability of adequate models of specific threats. Carrying out study to identify certain threat signs, assessing the extent of their impact on the emergency beginning is rather complex scientific task.

In this situation, which is characterized by the complexity, novelty, insufficiency of available information and impossibility of mathematical formalization of the decision process, it is advisable to refer to the recommendations of competent specialists who are well aware of the problem, to experts.

Their solution of the problem, argumentation and formation of quantitative assessments makes it possible to obtain well-founded structure of each threat model. Technology of expert assessments is the basis of methods of revealing the signs of emergency threats.

The methodology is designed to provide evidence-based signs at the threat of manmade and natural emergencies, creation of specific threats models, used in the future to justify both the card message structure about the threat in the Collective Data Processing System, and, in general, the algorithm for processing volunteers' messages about threats, related to the risk of emergencies.

For the study, two types of emergencies threats were chosen: **forest fires** and **collapse of buildings and structures**, for which there were identified signs of threat thereof.

There was defined the list of supervisory and regulatory authorities, competent to supervise the federal executive bodies, authorities of the Russian Federation subjects, local governments, organizations as well as officials and citizens implement the established requirements for the prevention of this type of emergency.

There was defined the list of regulations that govern control and supervisory agencies in their efforts to prevent emergencies.

On the basis of relevant regulations and with the expert opinion defined the list of primary characteristics of the selected emergencies threat type.

FOREST FIRES

Threat definition, characteristics

Natural fire is uncontrolled, spontaneously spreading process of burning land cover. Taking into account that forests occupy more than 60% of the territory of Russia, forest fires are most widespread in its territory. Each year, they cover from 800 thousand to 4.2 million hectares of forest area in the territory of Russia.

Fire frequency varies with the time intervals and the territory coverage. Forest fires occur during the fire season, which begins after the loss of snow cover and lasts until sustainable rainy autumn weather.

The duration of the fire season varies from 2-3 months in the northern regions of the country and up to 7-8 in the southern regions.

Threat sign	Description	Decoding	Territorial binding of the sign
1/ Deadwood	Dried up but standing at the root trees	Deadwood can be represented as single trees or groups, as well as whole shrinking forests.	Woodland
2/ Trampling windows in	Areas devoid of grassy cover.	Areas devoid of grassy cover, due to its trampling	Forest areas in the city

herbaceous cover		and characterized by high attendance of the forest.	and suburban area
3/ Clutter and littering of forest	Availability of debris, fallen trees, rags, felling residues and other objects that act as combustible materials.	Fallen tree trunks, remains of cutting, dense undergrowth of shrubs and low trees. Garbage, firewood and other material of anthropogenic origin.	Forest areas in the city and suburban area
4/ Forest works	Forest cutting, logging and so on.	Anthropogenic processes in the forest aimed at timber harvesting.	Productive and transportable forests, mainly coniferous.
5/ Dry grass	Availability of dry grass in the forest and in its surroundings	Availability of dry grass in the forest and in its surroundings	Cultivated land and pastures close to forests.
6/ Bare tree roots	Availability of trees in the forest with protruding	Visually observed abruption of the forest stand root system without ground (grassy) cover	Forests in urban and suburban areas

COLLAPSE OF BUILDINGS AND STRUCTURES

Threat definition, characteristics

Complete or partial sudden collapse of the building or structure is an emergency situation arising from the errors in the building or structure design, going back from the project in the course of construction work, installation rules violation, commissioning of building or parts of it with major failures, building operation rules violation, as well as due to a natural or manmade emergency.

Sudden collapse leads to the building prolonged function loss, fires, destruction of building and energy services, debris formation, injuries and life loss.

Objects subject to threat:

- buildings or structures and their elements;
- engineering and technical support;
- elements of transport infrastructure.

Classification of the threat:

1. Collapse object:

- transport communications elements;
- buildings and structures of residential, social and cultural purposes;
- industrial buildings and structures.

2. Collapse degree:

• weak destruction – cracks appear in the stretched zone of concrete and brickwork;

• average destruction – secondary elements of the building (partitions, windows, doors) are destroyed, destruction of the compressed zone of concrete and brickwork begins in the main bearing elements, cracks appear in the walls;

• strong destruction – through cracks in the concrete of load-bearing elements, some faults in the brickwork, significant residual deflections of interstitial floors, but the structures do not collapse;

• complete destruction collapse and destruction of all elements, building is not subject to restoration.

3. Collapse time:

• primary;

• secondary caused by the impact of other natural or manmade emergency (flood, tsunami, fire, etc.).

4. Development scenario:

• gradual collapse with the gradual accumulation of stresses and deformations with subsequent collapse of load-bearing structures;

• progressive rapid collapse with possibly brief but significant overload of an important structural element.

Collapse causes:

Natural:

• seismic impacts;

• dangerous meteorological phenomena leading to increased wind and power loads on buildings (typhoons, tornadoes, hurricanes, storms, heavy snowfalls, downpours);

- natural fires;
- hydrodynamic effects (tsunami, floods);
- formation of potholes and sinkholes in the buildings foundations due to :
 - ground erosion caused by groundwater;
 - subsidence of natural voids in the ground.

Natural/manmade

Drawdown or collapse of the ground, the displacement of the foundation due to:

• soil erosion caused by the pipes water leaks;

• subsidence of natural voids in the soil;

 construction works in the area close to possible failure without prior geological expertise;

o deformation of dilapidated abandoned underground structures;

• resonance phenomenon when vibrating the ground.

Manmade (anthropogenic)

• explosions outside or inside the building (sources can be - domestic gas, explosive gas mixtures and liquids, bombs and other explosive devices used by terrorists);

- fires related to people's activities;
- transport accidents (road accidents, aircraft accidents);

• accidents of buildings and structures or significant damage to their load-bearing structures caused by one of the following reasons:

o errors in projects, including those caused by imperfections of SNiP

(construction norms and rules);

- wrong design solution;
- inadequate quality of engineering and geological work;
- inadequate works process (during construction, reconstruction and repair work);
- excess of design loads on structures;
- loss of load-bearing capacity by the junction assemblies due to defects and deviations from the design solutions;

• materials defects;

- o buildings and engineering equipment operation deficiencies:
 - technical operation of buildings and structures rules violation;

> negligence, incompetence and sometimes cases of vandalism of tenants, technical personnel or extraneous visitors of the building (in particular, unauthorized alteration of apartments with weakening of load-bearing structures).

Threat sign	Description	Decoding	Territorial binding of the sign
1/ Foundation destortion	Foundation is the construction bearing structure, part of the building, structure, which takes all the loads from the above lying structures and distributes them on the base. As a rule, they are made of concrete, stone or wood. Foundation destortion types: ground settlement - under load soil compaction not accompanied by fundamental changes in the composition of soil; subsidence– failure deformation, caused by fundamental changes in the composition of soil	Characteristic cracks wider than 0.2 mm Draft of the middle part of the building Draft of the far right part of the building The sludge of both side parts of the building Concomitant changes in the building (roll, skew, etc.)	Residential, social and cultural buildings; industrial buildings/structures; bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground
2/ Cracks in walls, overlappings and other constructions	Crack is a narrow deepening in break, rupture, etc. This feature is considered for: - concrete and reinforced concrete structures - stone and brick structures	Crack exceeding 0.2 mm in width	Residential, social and cultural buildings; industrial buildings/structures; bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground
3/ Buckling and curvature of	Deformation of walls, floors and other structural elements	Characteristic cracks wider than 0.2 mm,	Residential, social and cultural

walls, floors and	associated with their change in	change of the walls,	buildings; industrial
other structures	vertical and horizontal planes	floors, construction	buildings/structures;
in the vertical	position	position	bridges, overpasses,
and horizontal planes		_	tunnels, pedestrian crossings underground/ aboveground
4/ Damage to	Damage to the outer layer of the	Weak damage -	Residential, social
the walling	walls, violation of the integrity of	damage of plaster,	and cultural
outer layer	the structural elements surface	paint, minor chips.	buildings; industrial
	Bitgal//tadstare	Average damage - the presence of biological damage in the wooden structures, the presence of fat and rust spots on concrete and reinforced concrete structures, the presence of shells and chips.	buildings/structures; bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground
		Severe damage - exposure of the working and constructive reinforcement, exposure of the internal masonry, formation of deep and through holes	
	And the second s		
5/ Metal	Corrosion is the spontaneous	Weak corrosion-covers	Residential, social
construction	destruction of metals as a result	small part of the	and cultural
corrosion	of chemical or physico-chemical	structure surface	buildings; industrial
	interaction with the environment.	(points, small cracks,	buildings/structures;
		separate spot). no	bridges, overpasses.

		surface changes; Medium corrosion- covers significant part of the surface, no surface changes or they are minor; Strong corrosion– covers large part of the surface design, there are strong changes of the surface (change of the form, holes etc.)	tunnels, pedestrian crossings underground/ aboveground
6/ Unauthorized redevelopment or re-equipment of apartments/ rooms/offices	Unauthorized replanning or reequipment of apartments/rooms/offices - re- equipment or redevelopment of residential buildings and apartments (rooms) leading to the violation of the strength or destruction of the supporting structures of the building, disruption of engineering systems and (or) installed equipment, deterioration of the safety and appearance of facades, fire protection devices disorder.	Selfmentained replanning of apartments/rooms/ offices by residents without the approval of the relevant supervisory authorities.	Residential, social and cultural buildings; industrial buildings/facilities; ;
7/ Sinkhole near the buildings, structures	Sinkhole—emergency incident in which there has been movement of soil leading to destruction of infrastructure created by man. It can be caused both by natural and human economic activity reasons. Sinkhole causes cavity in the earth's surface.	Visible damage to the building (signs № 1, 2, 3, 4, 5, 6). No visible damage to the building (signs № 1, 2, 3, 4, 5, 6). Dips, recesses, pits in the blind area, asphalt, other surfaces that are close to buildings, structures, elements of	Residential, social and cultural buildings; Industrial buildings/structures; Bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground

	Kedura ke	transport communications and exceeding the length of 15cm, width-60 cm, depth-5cm.	
8/ The presence of powerful sources of vibration in the building	Vibration – is mechanical oscillation that have tangible impact on humans, buildings, structures. Vibration occurs in a variety of technical devices due to it's design inperfection, improper operation, external conditions.	Internal source of vibration that affects the building can be: powerful machines, the work of which is accompanied by noise and vibration, strong mechanical shocks, construction work with the use of tools, the work of which is accompanied by noise and vibration. Such sources impact is dangerous if there are structural damages (curvature, cracks, etc.)	Residential, social and cultural buildings; Industrial buildings/structures; Bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground
9/ The presence of powerful sources of vibration near the building, structures (at a distance of 1 km)	Vibration – is mechanical oscillation that have tangible impact on humans, buildings, structures. Vibration occurs in a variety of technical devices due to it's design inperfection, improper operation, external conditions.	External source of vibration that affects the building can be: underground transport routes (subway, tunnel, mines), nearby transport routes (busy roads, railway tracks, airports), large-scale (with high noise, impact on the ground) construction works, including demolition of the house. Such sources impact is dangerous in case of structural damage (curvature, cracks, etc.)	Residential, social and cultural buildings; Industrial buildings/structures; Bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground

10/ Flooding/ underflooding of buildings, structures, etc	Underflooding is an increase of groundwater level that disturbs the normal use of the territory, construction and operation of facilities located on it. Flooding is a formation of free surface of water on the site as a result of increasing reservoir or groundwater watercourse level, as well as a result of of	Large surfaces covered with water for a long time, water stagnation, failures of engineering networks (leaks, pipes and cranes seal failure are dangerous.	Residential, social and cultural buildings; Industrial buildings/structures; Bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground
	engineering networks accidents (water pipes, sewers).		
11/ Climate conditions	Atmospheric precipitation (snow, rain, hail) is water in a liquid or solid state, falling out of the clouds or deposited from the air on the earth's surface and any objects. Temperature difference is sharp change in temperature as a consequence of the air masses movement.	Temperature drop over 15-20°C and above is dangerous if the structural is damaged (cracks, curvature, etc.). Ice, icicles, accumulated precipitation (water, snow) increase the load on the structure and its elements.	Residential, social and cultural buildings; Industrial buildings/structures; Bridges, overpasses, tunnels, pedestrian crossings underground/ aboveground

Assessment of the volunteer's opportunities to identify the signs of threats of emergencies of a certain type by analyzing the proposed spatial data

Using the volunteer's community, experiment was conducted to assess how easy is to detect the signs of emergency threat on the proposed list.

Selected volunteers were provided the list of signs of emergencies threat in question and the typical example case description and exposure.

The results of the experiment on the volunteer's capability to detect the threats signs by viewing the proposed spatial data are presented in the table.

The degree of ease is defined as follows: ++ easy, + possible, - impossible.

Spatial data type Threat sign	Data of Earth remote sensing from the space	Text data received from the Internet and electronic media	Multimedia data received from the Internet and electronic media
Deadwood	++**	+	++
Trampling windows in herbaceous cover	++	++	++
Clutter and littering of forest	+	+	++
Forest works	+	+	++
Dry grass	-	+	++
Bare tree roots	-	+	++

FOREST FIRE

COLLAPSE OF BUILDINGS AND STRUCTURES

Spatial data type Threat sign	Data of Earth remote sensing from the space	Text data received from the Internet and electronic media	Multimedia data received from the Internet and electronic media
Foundation destortion	-	++	++
Cracks in walls, overlappings and other constructions	-	++	++
Buckling and curvature of walls, floors and other structures in the vertical and horizontal planes	+	+	+

Damage to the walling			
outer layer	-	++	++
Metal construction corrosion	-	++	++
Unauthorized			
redevelopment or re- equipment of apartments/rooms/offices	-	+	+
Sinkhole near the buildings, structures	+	++	++
The presence of powerful sources of vibration in the building	-	+	+
The presence of powerful			
sources of vibration near			
the building, structures (at a	+	+	+
distance of 1 km)			
Flooding / underflooding of			
buildings, structures, etc	-	++	++
Climate conditions	+	++	++

Received data will be used while finalizing the work on the "Methods of revealing the signs of emergency threat"

METHODS OF VERIFICATION MESSAGES IN THE SOCIAL NETWORKS ABOUT THE THREAT OF EMERGENCIES

The technique is necessary for the radical increase in the efficiency and reliability of the information analysis available and re-coming from various sources (primarily spatial data) in order to identify and prevent threats of manmade and natural disasters.

The threats identified by the volunteer community must go through the verification process to reduce the impact of "social noise" on the work of the government agencies involved in preventing emergencies. To solve this problem it is necessary to develop techniques for the verification of reports on the emergency threat.

The method should be designed to determine and increase the reliability of reports about the threat of emergencies received from those registered on the Web portal of the System's collective spatial data users. It will allow limiting the sequence of operations and methods for obtaining and analyzing information to determine the authenticity of the messages about the threat of emergency situations of manmade and natural character.

Approaches to the message filtering

Registration of the message can be carried out only by the user who has the account in the System, if he became the eyewitness of the disaster threat on the spot of the threat. To register a message, it is necessary to fill in the established message form on the System's Web portal (Fig. 1).

On the launch platform of the Web portal of the System, the name of the emergency threat is determined. It is selected from the proposed list of the emergency threat type that is necessary (defined earlier in this work). Further, in accordance with the selected type of emergencies occurrence a list of signs relating to the selected threat appears on the Portal. The user selects those signs, which he became the eyewitness.

After sending, the message is assigned the status of *message claimed*. It is not displayed publicly on the Web portal of the System and is accessible only to the users in the role of moderator.

Figure 1 - Form of the threat message on the Internet portal

	Threat	message
\smile		

Subject/Name

Type

, ype			

Load a photo or video file

•••	

Add one more file

Description

Characteristics of danger

Indicate signs that confirm message

✓ Sign № 1

- Condition № 1
- Condition №2
- Condition №3

✓ Sign №2

- Condition №1
- Condition №2
- Condition №3



Send a message

Format-logical control

The message declared by the user of the System in the role of a volunteer is undergoing the procedure of format-logical control, at the end of which the message is to be given the status of the *past moderation*. Post, declared from the System user as an expert, gets the status of message that passed moderation, avoiding the procedure of format and logical control.

The reliability of the received information is an important characteristic of the System. In order to increase the reliability of information, the format-logical control of messages is carried out. Claimed message received from the System user, acting as a volunteer, undergoes format-logic control. A System user acting as a moderator carries out this procedure.

When the format control the correspondence of received messages to the prescribed format is to be checked. Messages that have successfully passed the format control are subject to logical control, and messages with errors that have not passed the format control are not subject to further processing and the sender is informed of the errors made. At the stage of logical control, messages are checked for logical integrity according to the established rules and/or for compliance of the information contained in the System or in adjacent (external) information resources. In the case of logical control, operations are performed to access data stores, reference books, registries and other external information resources. An error message that has not passed logical control is not allowed for further processing in the System.

Message that has not passed format-logical control is deleted from the System, and the moderator issues a warning to the volunteer who registered this message. The account of the volunteer who received 3 warnings is to be blocked.

As a result of this list of works, the declared messages containing spam, obscene vocabulary, as well as photos and video materials that are not related to the subject of the System, are filtered out and subsequently deleted.

Confirmation of moderated messages

This procedure is performed to obtain confirmation message from the users of the System, who are not the applicants of the messages that referred to in the report signs of threat of emergencies reflect reality.

The message is considered confirmed if *at least* two System users in the role of a volunteer or *at least* one user of the System in the role of an expert confirmed *at least* one sign of emergency threat, indicated in the message.

This requires the following steps.

The users of the Web portal of the System publish the message that passed moderation and require acknowledgment procedure in the public domain for the further confirmation.

Confirmation of the message is carried out by users of the System who are not applicants of this message with the roles of "volunteer" or "expert". To do this, they would have to become eyewitnesses of emergency threat sign. As a confirmation, they must attach photo or video materials or place on the portal the detected signs of the threat of an emergency by processing data from the single spatial database (SSD).

Message is considered confirmed if minimum two users of the System in the role of a volunteer confirmed the same sign of emergency threat, indicated in the message.

Message is considered confirmed if at least one user of the System in the role of an expert has confirmed at least one sign of the threat of an emergency, indicated in the message.

It is proposed that the message, which did not get feedback from the users of the System for the confirmation procedure for 3 days, is listed as requiring confirmation. The list is to be formed on the home page of the Web-portal of the System, and should remain there for 10 days until confirmation. If the message is confirmed within the specified time, then it is assigned the status of a *confirmed message*.

Message that has not received response from the users of the System for confirmation within 10 days is sent from the list of messages requiring confirmation to archive.

The System users send for reconfirmation message in which one or more signs, but not all signs indicated in the message are not confirmed.

Message in which all the indicated signs of emergency threat are not confirmed is sent to archive and the applicant receives notification.

As a result of this list of works, the level of reliability of the declared message increases.

Development of the message weight gain method for obtaining more reliable information on the probability of emergency threat

Messages weight is determined by summing up estimated emergency threat weight of signs registered and confirmed on the Web portal.

According to the results of the expert survey and the analysis of the results, a threshold weight was determined for each type of the threat. Threshold weight is suggested to be assumed as a weight of not less than 0.6 of the consolidated (total) weight for all of the features identified in the System for each threat of emergency.

To receive messages with a high probability of emergency threat, the following actions are assumed.

Message that received positive confirmation from the System users and has weight higher than the threshold are assigned the status *"highly probable"*.

Message that has passed the confirmation procedure, but does not have weight above the threshold, should be supplemented with new signs of emergency threat, and not indicated by the applicant of the message as well as from other users of the System. This increases the weight of the message. The System users having the role of the volunteer or the expert solve the task of increasing the weight of messages. They note new signs of emergency threat, if they have witnessed these signs and attach photo or video materials on the Website. They also indicate new signs of the threat of emergency if they discovered them by processing data from the SSD. It is also possible to search for the information in the Internet with the indication of the link to the corresponding information resource of the network.

It is proposed that the messages that gained weight above the threshold for 5 days are assigned the status of "highly probable" message.

Message that has not gained the weight above the threshold for 5 days is to be sent by the moderator to the message list, requiring raise of weight value, which is on the Website of the System.

Post, located in the message list, demanding higher weight values, that gained the weight above the threshold for 5 days, allocated the status highly probable.

Message, that has not gained the weight higher then threshold for 5 days while in the message list, demanding higher weight value, is to be sent to archive with the corresponding notification of the applicant.

As a result of these actions, the confirmed message gains weight above the threshold. This allows it to be sent to the response center in the future.

Sending a message to the response center

To send the message to the response center the System user is to follow these steps:

If the message gets the status of high-probability, System users having the role of the volunteer or the moderator on their own initiative sent the message to the response center.

Message that has received the status of highly probable, but not sent within 1 day to the response center is included in the list of messages requiring sending to the response center.

Message sent to the response center is assigned the status *sent to the response center*.

Messages received by the response center are given the status of *accepted* with appropriate notification of the sender.

As a result of implementation of this list of work, the message is transmitted to the response center for the subsequent transfer to the emergency services for the emergency response on the territory of the threat of emergency occurred (for example, system 112, management centers in crisis situations).

Algorithm scheme of the posts verification process is shown in Figure 2 below.

