INVESTIGATION OF THE POTENTIAL HAZARDS GENERATORS IN THE VICINITY OF THE MUNICIPAL LANDFILLS

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Abstract:

Areas situated in the proximity to landfills have several features of great importance in further, as some of these areas can get changing in the future to residential destinations. It is therefore important to determine the quality of environmental components in these areas and to identify all hazards that may create risks for the area analyzed. Complex investigations carried out in the proximity to landfills will have as a final risk estimation, one of which shows the importance induced by the emissions of methane that may migrate into soil / subsoil in the vicinity of the deposit. This paper presents a methodology for assessing risks with the following steps: the documentary stage involves collecting relevant information on the landfill site, site history, and the date on geomorphology, geology and hydrogeology of the area. In the subsequent stages, it identifies the potential sources of the gaseous emissions in soil / subsoil and the potential migration pathways and receptors proceed to investigate complex area. As a case study was chosen site of a landfill in Bucharest, which was crossed methodology of investigation: they made wells and the gas collection were measured in situ the concentrations of gases (CH4, O2, CO2, CO and H2S) with a portable analyzer, were made boreholes to determine the groundwater flow conditions and analytical investigations on the environmental quality of components (soil, groundwater, surface water) in the proximity of the landfill.

In terms of the methodology, the risk estimation is based on the identification and the expression of two categories of factors, including the likelihood and effects on receptors that highlight risk levels resulting in a scale with five levels of risk, at a very low risk to high risk levels. The risk can be quantified by the indicator "Gas Screening Value", which is the product of the maximum concentration measured in gas borehole and the measured flow.

Applying the methodology for the selected location as a case study allowed the identification of hazards and risk generating, the risk assessment, elements necessary to development the measures of protection required are taken in case the future of location will be for the residential.

Key words: biogas, landfill, waste, methane, risk, assessment.

INTRODUCTION

This paper had materialized the results regarding the quality of the environmental components in order to investigate the environmental dangers thet may generate risks near al landfill located in bucharest, the district Giulesti – Sarbi.

Site location: *Giulesti district* is located in the north-west of the Bucharest. Currently, the district is bounded to the East of Blvd. Constructorilor, in the North of Calea Giulesti and Butuceni streets.

Giulesti Sarbi area still retains a deep-rural character, this being the first locality in which began urban development, also utilities networks was recently built in this area. As a brief history Giulesti district was originally a village that is bordered by the city of Bucharest. Historical records are since 1548.

The main occupation of residents was, in ancient the agriculture. This work was facilitated by the presence of Dambovita River. Construction of the “*Lacul Morii*” lake, completed in 1986, raise serious problems in the contruction of housing, because ground water presents a high level and the lands are flooded in southern Giulesti path.

Constantin G. Giurescu notes in "History of Bucharest", as Giulesti estate, at a time, a certain Giulea, hence the current name of the neighborhood.

The new neighborhood was built on the estate Tigania, plot for the housing construction.

Estate division was part of the systematization of Bucharest plans, aimed at extending to the region surrounding the city. Systematization was started in the late nineteenth century and continued until the first half of the twentieth century.

Although in ancient times, the area was known as Giuleşti the 1920-1940 period was called the Great Prince Mihai Urban village, and between 1945 and 1952 was named “February 16”th. After 1950 the territory was included in Bucharest city limits.

Giulesti Sarbi municipal landfill worked in the years 1970 until 1990. During its operating period household waste were stored, contruction rubbish and other wastes that were deposited in a low area, swamp, which later turned into a form of positive terrain, with relative elevations generated to anthropogenic to 10 meters. The area occupied by the deposit is estimated up to 68 hectares.

The location of the deposit can be viewed in Figure 1.

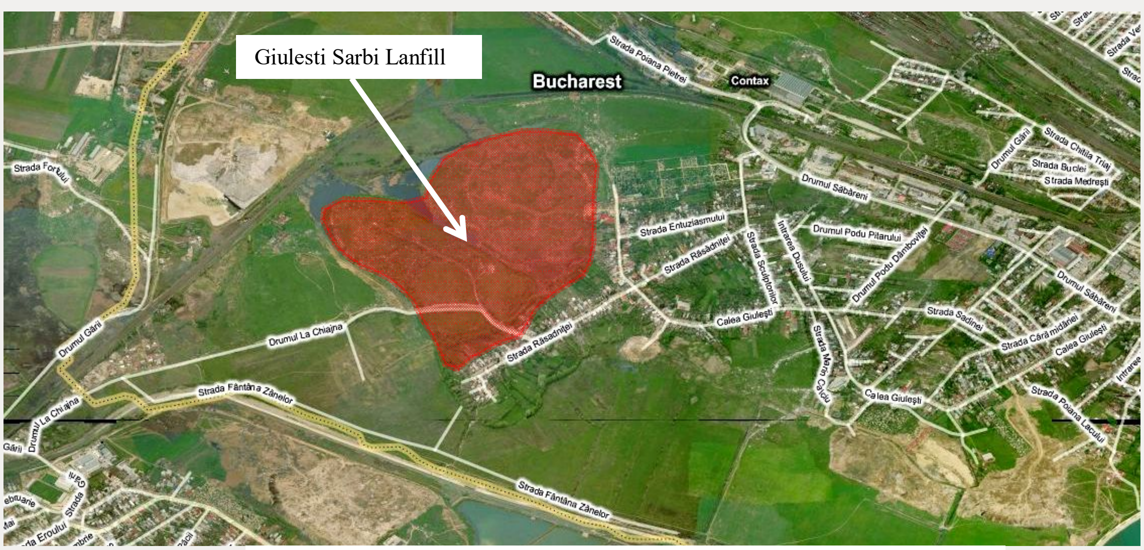

Figure no.1 – Location of Giulesti Sarbi landfill (source: BingMaps)

Elements of Geomorphology: territory analyzed from geomorphologically point of view in plain meets the central part of Vlasiei, subunit of the Romanian Plain (central part of it called Bucharest plain). (figure no.2)

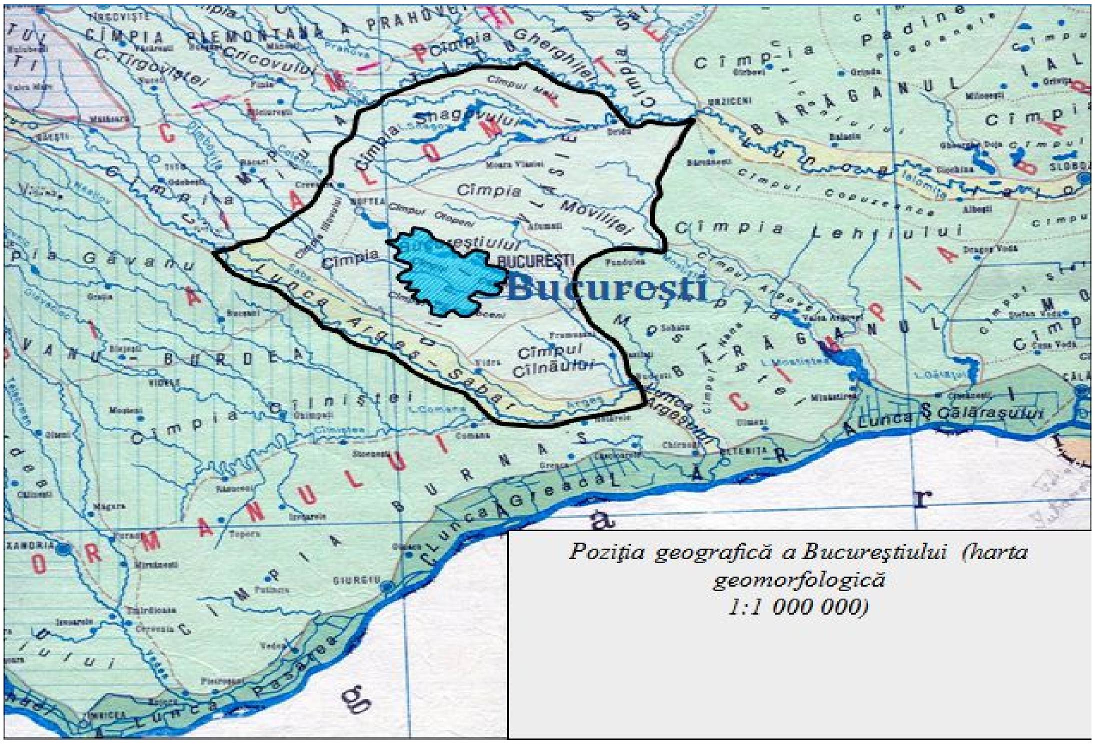

Figure.no.2 – Localization of Bucharest in the Romanian Plain

The relief of Bucharest is monotonous, witch altitudes between rates from 95 to 55 meters. Dambovita and Colentina rivers, with altitudes of meadows of 85 m upstream - 55 m downstream and downstream flow direction NW-SE, separated Bucharest plain into three relatively equal parts called fields: Otopeni, Cotroceni and Colentina. Each field is composed of "high" at 13-17 m altitude relative to three or two terraces (t3, t2, t1) to 12-10 m, 8-7 m and 5-3 m relative altitude

The microrelief presented is creeps, microbasins rounded or arched, sometimes elongated depressions formed by combining two or more creeps. In the north, mainly due the subsidence regime and a more humid climate, the paleosoils and their interleaving suite rocks wind loess formation, favors in rainy years, generating over sezonal aquifers, wich rises to the surface of land.

Elements of geology: the last formation in time of accumulation is *Loess* formed in Quaternary consists of a series of 1-5 extensive and continous layers separated by buried soils (*Enciu et al., 2008*) and have thicknesses very different from 1-2 meters about 30 meters. Loess clay deposits area characterized in the terms of the litology by varying the size of the elements: clay, dust (aleurite) and fine sand. These deposits are in the form of lenticular crowded more and less clay, with limestone and manganese- ferruginous sepations, concretions or bags of limestone powder and often nests or strips of sand. The color of these deposits varies from reddish to luish yellow and gray, color sequenceis highly disordered.

EXPERIMENTAL PART

For location was applied a methodology for risk assessment induced by gaseous emissions in underground nearest landfills.

In the following model is presented as a difference between a landfill and one non-compliant, as is the case analyzed deposit (figure no.3)

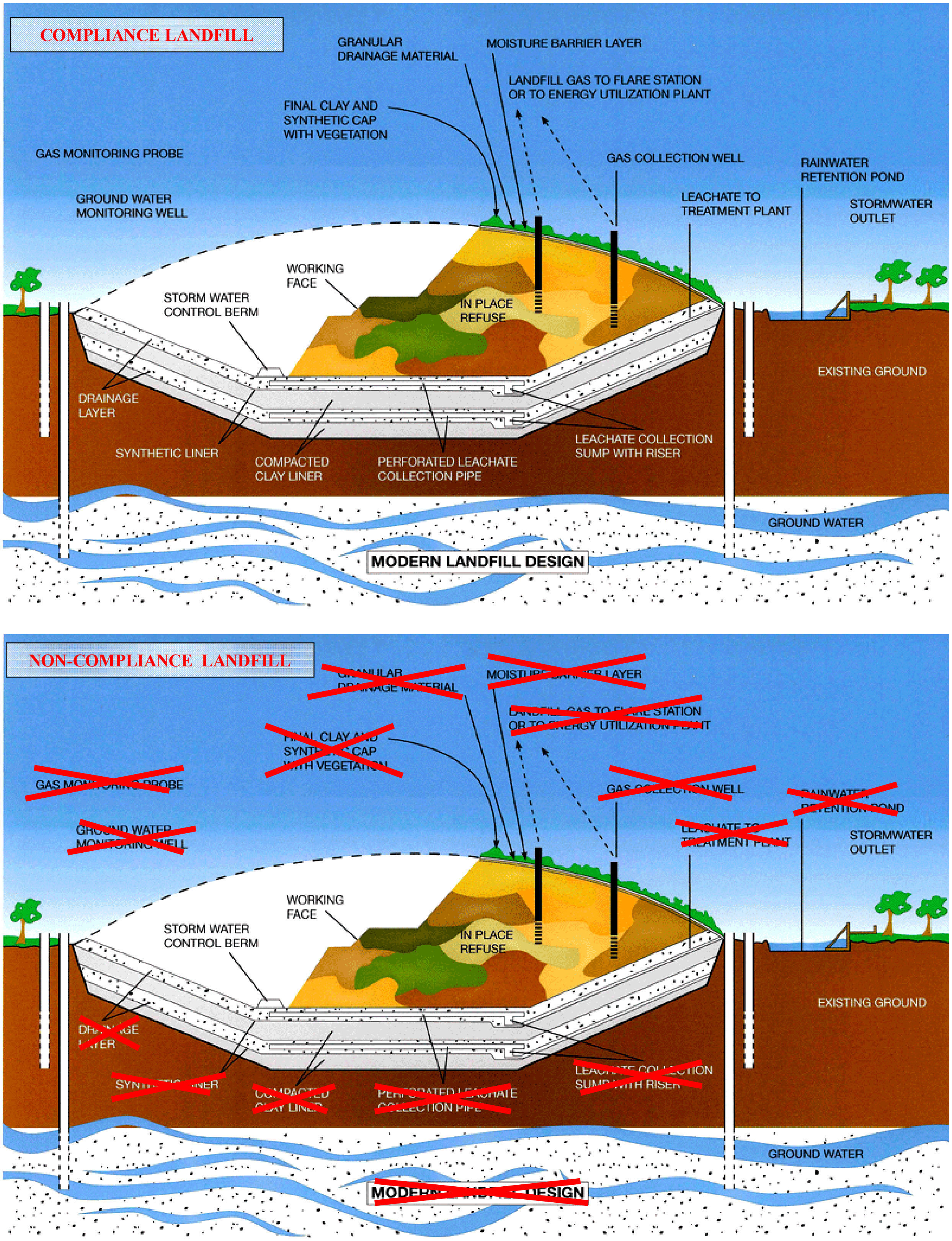

Figure no.3 – Compliance landfill vs. non- compliance landfill

The methodology involves investigating the environmental quality components to identify dangers can get risk generators.
Visit of the site revealed several features of the area:
-receivers are located very close to the landfill: people from Rasadnitei, Drumul la Chiajna and a part of Calea Giulesti streets. There are situations in wich the distance from landfill reported to local households is less than 4 meters;
-deposit does not have any facilities concerning environmental protection and rainfall waters that percolating de mass of deposit with formation of leachate are taken by the river network and/or by groundwater zone located near surface;
Investigations performed in targeted areas in the proximity of deposit:
-monitoring of landfill gas in wells: 2 wells were completed capture gas containment, provided with gas valve and hose tap. For measurement we used portable gas analyzer type GA2000Plus from Geotech Instruments Ltd. This measure simultaneously the concentrations of gases (CH_4, O_2, CO_2, CO and H_2S);
-soil quality in areas located in proximity of landfill: 4 soil profiles nearest landfill and 1 soil profile (blank probe) located to greater distance of deposit. From these profiles and samples were taken from levels 0-10 cm and 30-40 cm depth;
-groundwater quality: samples from 2 wells specially made in the vicinity of landfill with downstream position in the direction of groundwater flow and samples from wells of 2 households from Rasadnitei street. Also in wells was measured water table depth to establish the groundwater flow;
-surface water quality: 3 samples from surface water streams that cross nearby the landfill.

Sampling locations can see in fig. no. 4

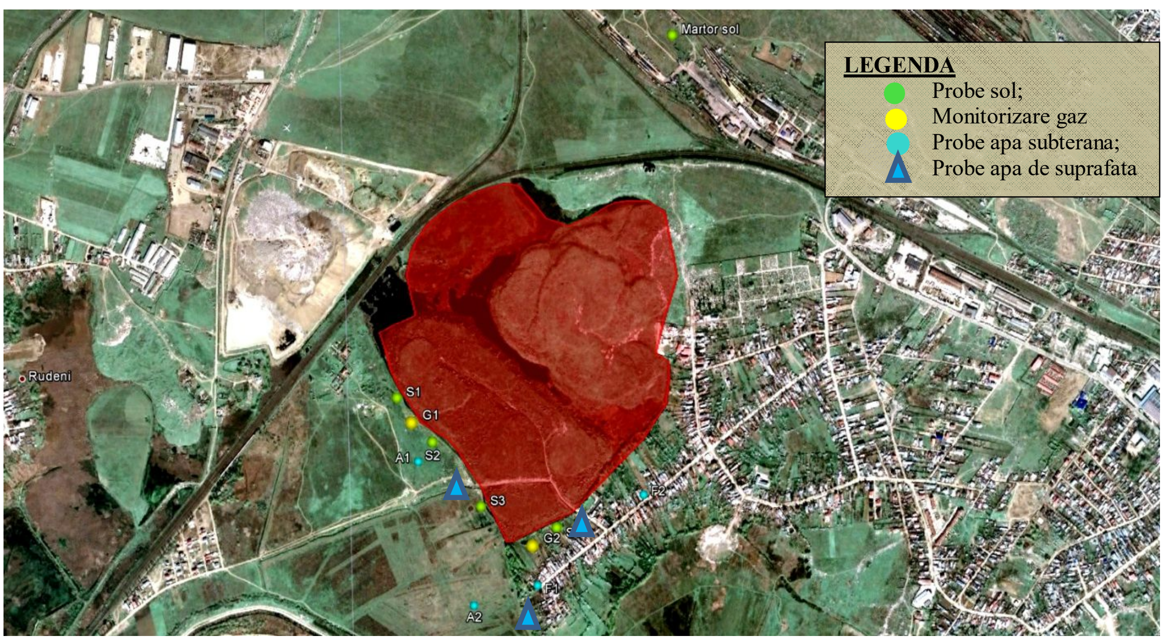

Figure. no.4 – Location of sampling points

For the identified dangers is proposed 4-stage scale as follows:

4 stages scale to classify dangers			
1	2	3	4

1-weak;
2-moderate;
3-moderate - high;
4-high.

RESULTS AND DISCUSSION

The results of investigations made, on the environmental components are summarized inTable 1-4.

Table no.1 – Soil investigations

Environmental component	**Indicators**	**U.M.**	**Min.**	**Max.**	**Conformation reported Order MAPPM 756/1997, category „sensitive use" and reported to blank probes.**	**Color code assigned**
SOIL	pH	unit pH	4,5	4,9	Insignificant pollution, soil environmental component does not experience the adverse effects of landfill Not generated danger that may induced risks.	
	Dry substance	%	91,01	97,31		
	Sulfates	mg/kg s.u.	164,18	377,62		
	Amonium	mg/kg s.u.	7,0	11,60		
	N Kjeldahl	% s.u.	0,12	0,48		
	Clorides	mg/kg s.u.	25,49	52,91		
	Nitrogen	mg/kg s.u.	40,93	143,40		
	CD	mg/kg s.u.	0,009	0,51		
	Cr (total)	mg/kg s.u.	14,68	39,30		
	Cu	mg/kg s.u.	17,37	41,39		
	Ni	mg/kg s.u.	29,64	48,65		
	Pb	mg/kg s.u.	15,82	36,97		
	Humus	% s.u.	0,13	1,38		

Table no.2 – Investigation of the underground water

Environmental component	**Indicators**	**U.M.**	**Min.**	**Max.**	**Conformation reported to limits imposed of quality indicators analised with Law no. 458/2002 – Drinking water, completed and modify by Law no. 311/2004.**	**Color code assigned**
UNDERGROUND WATER	pH	unit. pH	6,6	7,4	Polllution of undeground water induced by values of quality indicators: organic loading expressed by COD, ammonium, Ni and lead. Source of danger for local receivers: 2 samples from local wells (in one case the water is used to consumption)	
	COD	mgO_2/l	7,8	15,2		
	Ammonium	mg/l	0,58	1,35		
	Nitrites	mg/l	<0,002*	<0,002*		
	Sulphides	mg/l	<0,02*	<0,02*		
	Extractable substances with organic solvents	mg/l	0,10	0,17		
	Cr total	mg/l	<0,005*	0,35		
	Ni	mg/l	0,03	0,62		
	Pb	mg/l	<0,01*	0,18		
	Zn	mg/l	0,008	0,16		
	Cu	mg/l	<0,003*	0,54		
	VOC_s	µg/l	<0,05*	<0,05*		

Table no.3 – Investigation of surface water network

Environmental component	Indicators	U.M.	Min.	Max.	Conformation reported la ecological states Order no. 161/2006	Color code assigned
SURFACE WATER	pH	unit. pH	7,5	7,7	Very bad ecological state (V) induced by quality indicators ammonium and nitrates. Bad ecological state (IV) induced de by BOD indicators in all control sections. Bad ecological state induced by quality indicators clorides and nitrates. The influence of landfill is felt and induce a weak ecological state of the natural receiver. .	
	COD	mgO_2/l	28,8	48		
	BOD		9,4	1,9		
	Sulfates	mg/l	62,96	99,58		
	Amonium ($N-NH_4^+$)	mg N/l	9,18	14,84		
	Nitrogen ($N-NO_3^-$)	mg N/l	1,94	3,99		
	Nitrates ($N-NO_2^-$)	mg N/l	0,04	0,78		
	Cloride	mg/l	224,92	291,7		
	Extractable substances with organic solvents	mg/l	0,34	0,50		
	Cd	mg/l	<0,001*	<0,001*		
	Cr total	mg/l	<0,005*	<0,005*		
	Cu	mg/l	<0,003*	<0,003*		
	Ni	mg/l	0,03	0,04		
	Pb	mg/l	<0,01*	<0,01*		
	Zn	mg/l	0,008	0,01		

**detection limit of analytical method.*

Table nr.4 – Investigations of gases in sol/subsol (colected in wells)

Environmental component	Indicators	U.M.	Min.	Max.	Description	Atribuire cod culoare
Soil/underground (well collection gas)	CH_4	% v/v	0	0	Not identified landfill gas migration in soil in the vicinity of the deposit. No dangers were identified that can induce risks.	
	CO_2	% v/v	4,7	5,2		
	O_2	% v/v	14,7	16,2		
	CO	ppm	0	0		
	H_2S	ppm	0	0		
	Q	l/h	<0,3	<0,3		
	temperature	^0C	18,2	25,3		

SOIL	UNDERGROUND WATER	SURFACE WATER	SOIL/UNDERGROUND gas well

The performed investigations have highlited the dangers that can generate risks in the vicinity of Giulesti Sarbi landfill. They come from the environmental pollution of water (underground and surface) with specific pollutants resulting from waste disposal.

CONCLUSIONS

Giulesti Sarbi area situated in the proximity of landfill have several features of great importance in further, as some of these areas can get develop in the future.
Performing complex investigations to determine the quality of environmental components and indentify all dangers that made create risks for the area analyzed.

Completion of investigation and assessment methodology for the analysis revealed the existence of dangers level of medium to high risks of significant environmental component water (both surface water and especially groundwater). Although soil quality in the vicinity of the deposit is not affected should consider large area occupied by the store itself approximately 68 hectares.

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