ANTHROPOGENIC ACTIVITIES FROM THE MOTRU MINING BASIN TRIGGERING EMERGENCIES

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Abstract: The anthropogenic activities and especially the mining ones from the Motru mining basin cause drastic modifications in the morphology of the region, in the continuity and the evolution of the vegetal soil, in the unfolding of the flora and fauna assemblies, in the economy and agricultural and forestry use of the lands, with significant effects on the local microclimate.

The mining activity generates uncertainties or even the reduction of the urbanisation and modernisation rhythm of the localities and the individual households, because of the lack of future development of the extractive activities.

The influences related to the energy coal revaluation on the territory of Motru Municipality has had important implications on the fund, on the ecosystems regarding agriculture and forestry, as well as the ones regarding the hydrology, the communication ways, the ones related to the human settlements, as well as the ones related to the flora and fauna of the minable perimeters.

1. Introduction

The problems related to the protection of the environment have occurred in the last decades, when the disturbance of the natural balance between the components of the biosphere was discovered, as a consequence of the strong development of the industrial processes and the absence of the measures to maintain that balance.

The development of the anthropogenic activities has numerous direct and indirect implications on the environment and it is a source of its status change through various impact forms.

The issue of the emergency situations has become one of the most common ones at world level due to the climatic changes and the disasters with humanitarian consequences, to the actions or inactions of some members of the society that have as a result the occurrence of effects that are especially harmful to the social and natural environment.

The category of emergency situations may include the impacts on the environment due to the emissions, discharges or evacuations into the air, on the ground or in the waters of the wastes, the liquids or the harmful energies (radiations, vibrations, noises, excessive heat) or due to the poor management of these wastes or energies released, following technological faults, fires, explosions, etc.[4].

The events generating the emergency situations, in their majority, can be prevented, and the ones that cannot (such as the earthquakes) can be managed, their effects could be reduced through a systematic process involving the setting of measures and actions meant to contribute to the reduction of the risk associated to these phenomena. A feature of the emergency situations management is the fact that the predictability of the place or of the area of occurrence of the respective situations determines the possibility of warning the local authorities, the economic operators and the persons that may be in the areas that may be affected.

2. The description of the Motru mining basin

The Motru mining basing (fig.1) appeared in the toponimy and the geographic reality in the year 1960 when the first coal mine was opened (Horăşti mine). The name of this exploitation perimeter was taken from the natural frame, from the hydrography of the area. The very wide valley of Motru that set very good conditions for small urban localities is also the one that has lent its name to the entire basin. The main element for the identification of this basin besides the relief, which it overlaps, is the hydrography[1].

The Motru mining basin is located on the middle course of Motru river and its tributaries. The connection between hydrography and coal is a favourable one. First of all, because the rivers, through erosion, have discovered the rich layers of coal that crop out their banks, as it happens in Meris on Motru Valley, in Ploştina on Valea Cireşului. First, because the valleys have offered communication ways that are favourable to the extraction of the rich coal deposits.

The majority of the mines, from the surface as well as underground are located along the courses of different rivers: Lupoaia on Lupoiței Valley, Ploştina on Cireşului Valley, Roşiuța on Potângul Mare and Potângul Mic Valleys, Horăşti on Fântâna lui Cuțui Valley, Leurda on Leurzii Valley, Boca on Matca Boca Valley[5].

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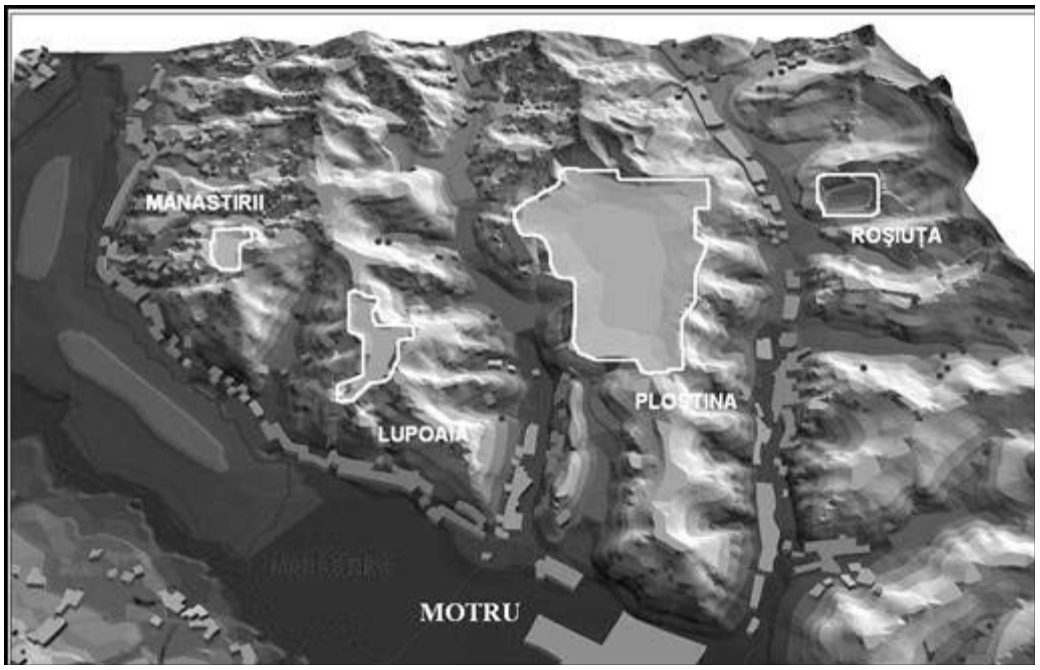

Fig.1 *Motru mining basin*

3. Anthropogenic activities in the Motru mining basin and their impact on the environment

The anthropogenic activities have an impact on the environment as a result of the transformations in the use of the territory, of the construction of productive installations and infrastructures, of the emissions of chemical compounds in the atmosphere, of the discharges of waste waters in the natural receivers, of the use of chemical substances in agriculture or of other dangerous substances, etc.

The mining industry is the main source of pollution of the environment in the Motru mining basin. Among its negative effects on the environment and on the health, we have to mention the pollution of waters, with a high content of residues, mainly inorganic, the pressures on the quality of the soil resulted from the mining activity, the landslides (such as the ones from Bujorăscu Valley and Ştiucani Valley), etc.

The current mining exploitations from the Motru mining basin have a varied and complex influence on the environment as follows:

- the temporary or permanent coverage of some surfaces of land affecting, in some cases, the hydrogeology and the neighbouring relief;

The achievement of the industrial mining objectives from the mining basins of Oltenia implied the removal from the agricultural and forestry circuit of large surfaces of land. In the period 1952-2001 over 17,000 ha of land were removed from the circuit, of which 76% agricultural lands and 24% forestry lands. Of the agricultural ones, 61% were arable, 23% natural meadows, 9% grasslands, and the rest was unproductive. The orchards represented 7% and the vineyards 1%.

Related to the current brown coal mines, the extraction and the dewatering activities lead to the reduction of the phreatic layer, not only in their perimeters but also on large surfaces, affecting the water supply of the economic units and the neighbouring localities.

At the same time with the movement of the working sites in the quarries, the fields from the meadows and the forested hills from the hill area disappear, and the initial heaps of debris represent a degradation of the landscape.

- the degradation of the soil, the pollution of the air and of the waters;

The current mines affect the fertile soil and the normal continuous development of the flora from the area at the same time[3].

The removal of the vegetal soil from the surfaces of the future quarries, even if it is performed with great care, leads to its degradation from a physical and chemical point of view. In addition, the presence of the heaps of debris along some valleys, but also in former meadows, under the form of irregular geometry deposits, gives these areas a moon-like landscape appearance. In general, the current mining activities lead to the profound change of the relief in the respective area.

The quarries and the heaps of debris during the extended drought and wind produce the pollution of the atmosphere. The environment may be influence by the heaps of debris and the deposits that burn.

The waters from the quarries may have different quality and by discharging them may lead to the degradation of the quality of the water as well as the destruction of the flora and the fauna. the partial or total degradation of the soils and of the landscape.

- the change of the hydrographical conditions;

Both the current mining activities and the constructions and installations from the surface often impose important hydrographical changes in the area through the deviation of courses of rivers or the execution of special hydrotechnical works.

Thus, in the mining basins of Oltenia, the courses of rivers like Jiu, Tismana, Jilț and Motru had to be deviated, on lengths ranging between 5 and 40 km as well as the building of retention and reduction dams, such as the one from Rovinari.

- the change of the social conditions of the people from the areas affected by the mining activities;

These changes consist of the movement of localities, the destruction of old localities with which the inhabitants have been connected for generations, even if the living conditions do not correspond to the new social changes in the majority of the cases. Giving up the native places is very difficult.

Villages like Rovinari, Bălăceşti, Ceauru, Bohorelu were moved in their entirety, others only partially. Over 2000 households were moved in a period of over 50 years and other shall be moved in the future, such as: Roşia de Jiu, Timişeni, Găleşoaia and others. New localities have appeared: Băleşti-new village, Drăguţeşti-new village, Ceauru, the towns of Motru, Rovinari and Berbeşti.

- the sound pollution

The noise produced by the operation of machines from the current mining activities frequently disturbs the environment, especially the conveyor belts located near the human settlements.

The energy industry related to the Motru mining basin is responsible for the *emissions of gases* with a major impact on the environment. Thus, these activities produce 50% of the methane and carbon monoxide emissions, 97% of the carbon dioxide emissions, 88% of the nitric oxide.

An energy system is formed of a series of different activities, which deal with the production, the transportation and the distribution of the electric energy, each of these activities generating negative impacts on the environment.

The accelerated growth of the energy demand has been a feature of the human evolution ever since the industrial revolution, and, for several generations, this demand has been covered without taking into account the environment issues. Because of this, over time numerous accidents have been recorded being generated by the energy sector, which resulted in permanent ecological losses.

The emissions resulted from the energy sector contribute to the climatic changes, to the increase of the greenhouse effect, to the degradation of the ecosystems and have a major impact on the human health.

The identification of the maximum value of the quantities of assimilated pollutants in the environment and the definition of the sustainable development are necessary: the environment limits are the basic elements for the relative choice of production and the consumption of energy.

As we have shown above, the energy sector, together with the providing and consuming industries, is responsible for almost the entire quantity of carbon dioxide released in the atmosphere. The carbon dioxide emissions intensify the greenhouse effect and the consequences of this fact on the climatic changes of the planet. In 2003, the carbon dioxide emissions at a world level, coming from the burning of fossil fuels and wastes, reached a total value of 24983 million tons.

Agriculture contributes to the pollution of the natural environment through the use of a large volume of chemical fertilisers and pesticides, which reach, because of the surface flow, the lakes and the rivers and lead to the degradation of the fauna and the flora. The irrational exploitation of the lands has effects such as the degradation of the soil and the loss of surfaces from the agricultural circuit.

Transportation represents a major source of pollution by the placement of the communication ways and the release of the exhaust gases in the atmosphere.

4. Emergency situations generated in the Motru mining basin

Subsidence phenomena

Part of the brown coal deposits from the Motru mining basin was extracted through underground mining, applying various work methods and technologies.

The subsidence phenomena may be caused through the closing of the gaps remained after the underground extraction of the useful mineral substances and through the alteration of the hydrogeological conditions, due to the forced and high intensity dewatering of the aquifer system of the area[2].

When the underground excavations and especially the stopes exceed the critical dimensions from the point of view of the stability of the surrounding rocks and no support and closing the gasps measures have been taken, the covering rocks collapse triggering a complex of phenomena, known under the name of subsidence effects, which may extend along the thickness of the covering rocks, up to the surface.

The dimension of the surface degradation and the nature of the rock movement are influenced mainly by the following factors: the size of the gap created through extraction, the depth of the extraction, the thickness and the pitching of the deposit, the extraction method and technique

applied, the manner of directing the rock pressure, the geomechanical features of the rocks, the tectonic of the deposit, the duration of the extraction, etc.

We have to make the distinction between the dynamic effects that are produced during the extraction and the effects that last for a long time after the ending of the extraction, meaning that the new conditions of balance of the covering rock formations have been reached.

In the first case, the alteration of the surface structures (roads, railways, bridges, industrial and civil buildings, etc.) is caused by the both horizontal and vertical large deformations of the terrain surface.

The structures are subjected to the traction and compression efforts that may lead to destructions, as the case may be.

In the Motru basin, the vertical deformations, determined by the underground extraction of the brown coal deposits, varies between 100 and 3500 mm. In some cases, spectacular depths have been recorded whose value varies between 5000 and 6000 mm.

The brown coal extraction activity partially or totally affects the surfaces and the existing buildings from the perimeter under extraction and the ones from the perimeter needed to locate the heaps of debris and the infrastructure works.

These works have imposed the total or partial alteration of the villages from the location of the future mining or industrial buildings. It is estimated that a total number of 57 other localities shall be affected until the exhaustion of the mining resources.

Floods

The floods are very dangerous because of the effects they produce. Thus, the devastating floods on Motru river happen every 15-20 years. Moreover, the floods where the river water covered the entire major riverbed took place in 1979 and 1998.

Hydrotechnical works were executed in order to prevent the floods. Thus, deviation and river and stream regulation works were executed on a length of 76 km, protecting in this manner over 7680 ha from floods.

The Valea Mare dam is located on the upstream course of Motru, where its waters are deviated towards the accumulation from Cerna-Sat, with a hydroenergetic and flow regulation role. In the middle section, the course of the river was regulated between Glogova and Valea Mânăstirii and dams were built near the heaps of debris from Valea Mânăstirii.

After the floods from 1979, the protection dam delimiting a part of the Motru major riverbed between Lupoiței Valley and Ploştinei Valley near the town of Motru was resized in order to prevent such situations. The dam was built from battered ground, between 1964 and 1965, and it is covered with concrete plates towards the river, but the protection proved to be relative in 1998. Its role loss is due to the erosion and the lack of consolidation works, the water finding its way towards the urban space[5].

Landslides

These have a high frequency within the entire Motru mining basin because of the geologic predisposition created by the presence of clays and marls alternating with the sands and the gravel.

The old landslides, currently stabilised, have been identified by the specific appearance of the level curves and emphasised on the land through the wavy aspect of the relief. They occur along rivers and have formed under the damaged stability of the slope because of the deepening of the valleys. Currently, they look like sliding waves, from place to place, these have been fragmented by erosion in small hammocks, such as the ones from Roşiuța, beyond Bujorăscu at Vârtopu, on Gârdoaiei Valley, at Ciovârnăşani, etc.[6].

The active landslides have a typical evolution, such as the ones from Upper Peşteana Valley, at Ciovârnăşani and from Lupoiței Valley.

Currently, based on the mentioned predisposition, we are witnesses to a new relapse of the landslides because of the mining activities. The underground mining activities, through the gallery collapse (collapse lines have appeared), have led to the reactivation of some old landslides (e.g. Roşiuța, Râpa, Lupoaia) or to the occurrence of new ones. Their feature is the disposition in narrow steps, creating over time a wavy relief such as the one at the north-west of Ştiucani village.

The quarries and the micro-quarries have produced very many landslides. These are minor landslides that occur on the slope, e.g. the landslide that affected the commune road Ploştina-Miculeşti caused by the micro-quarry from Ploştina in the north as well as large landslides, characterised by the movement of entire slopes because of the stability disturbance. Although these have a potentially high danger, luckily the movement is very slow, found in a relative balance.

The heaps of debris have generated the largest number of massive and dangerous landslides.

The Ştiucani Valley heap of debris of the quarry from Roşiuța, started up in 1988, is located in the upper area of Ştiucani Valley. Generally, the area is affected by landslides, but at the start of the

deposits is partially stabilised. Between 1983 and 1988, the Ştiucani Valley heap of debris was used by the quarry from Jilț Sud, which filled almost 70% from the upper area of Ştiucani Valley. During this period, the depositing was achieved without taking into account the specific technology, with ascending deposits. However, the easier descending deposit technology was used, but with serious geotechnical flaws, confirmed by the numerous instability phenomena. It is considered that the landslides and compaction phenomena of the rocks from the cover of the stopes have reactivated several stabilised landslides, contributing to the occurrence of other massive landslides. These instability phenomena have been the result of the combination between the landslides and the compaction phenomena with the depositing system. The descending depositing was used until 1991, when numerous landslides occurred, so that the heap of debris could not be controlled any more. Since 1992 the ascending depositing has been started by lowering the heap of debris installation, so that around 2000 the heap of debris became relatively stable[8].

Between January and March 2006, landslides occurred that threatened ND67 on the Bujorăscu hill, as well as several human settlements from Roşiuța locality. In May 2006, the heap of debris from Rogoaze Valley started to slide because of the deposits of the quarry from Roşiuța on several undrained lakes. It slid until it threatened ND67, and the traffic to and from Târgu Jiu had to be detoured (Motru-Apa Neagră - Târgu Jiu).

The materials that make up the heaps of debris of the quarry from Roşiuța are mainly clays and fluffy. Part of the water from the precipitations enters the body of the heap of debris, where, as a consequence of the reduced degree of permeability, its circulation is not possible, being absorbed by the clays that can take up a very large quantity. The bloating of the clay with water leads, on the one hand, to the drastic reduction of its mechanical resistance features, and, on the other hand, to the creation of a pressure in the pores, conferring the water a slightly ascending feature.

The muddy flows met in a natural environment, but with reduced dimensions, frequently occur at the edge of the heaps of debris

Creep - the slow flow process

It is recorded on the slopes formed of sand or sandy clays. It does not affect the stability of the slopes, only the forest vegetation. The trees lean in the direction or the directions of the movement, because of the root movement, together with the particles engaged in the movement, the forest gets the appearance of a "drunken forest". It occurs on the south-west slope of the Bujorăscu hill, as well as isolated on the majority of the slopes located along the valleys.

5. Conclusions

In our country, the interest for reintroducing the agricultural circuit of the degraded lands from current mining activities dates from 1968, numerous institutions from Bucureşti, Craiova, Petroşani and Cluj, drawing up large studies on this subject[7].

The emergency situations management is achieved through:

- preventive measures;
- urgent preventive intervention measures;
- rehabilitation measures.

In order to reduce the problems caused by the mining industry, but also because of other productive and household activities, the following should be considered a priority:

- The strict reduction of the acceptable limits for the exhaust gas releasing processes;
- The prevention of the degradation of the lands and the forests;
- The promotion of non-polluting technologies;
- The assurance of the proper transportation and deposit of the waste and the debris within the landfills;
- The planting (where possible) of the degraded lands;
- The creation of a planted protection strip along ND 67, between the inhabited area and the industrial and landfill platform.

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