THE SYSTEMIC IMPACT ON THE ENVIRONMENT OF THE CLOSURE OF THE ŞOTÂNGA MINE EXPLOITATION, DÂMBOVIŢA COUNTY

Mădălina Nicoleta FRÎNCELEASA, Ovidiu MURĂRESCU, George MURĂTOREANU

Valahia University of Târgovişte, Faculty of Humanities, st. Lt. Stancu Ion, no.34-36, 130024, Târgovişte, Dâmboviţa, tel: (04) 0245206105, Romania

Abstract

The Şotânga mine belongs to S.N.C. S.A. Ploieşti and includes several exploitation areas located in the central part of the Dâmboviţa County. The lignite deposits are hosted into the Neogene strata (Miocene and Pliocene) of the Şotânga – Gheboieni anticlinorium, in the contact area between the sub-Carpathians and the piedmont plain. The Şotânga 2 mine is situated in the Şotânga commune and is an area where underground mining activities were conducted between 1954 and 1994. The closure of the 2 Şotânga mine through the Government Ordinance 816/1998 was done in compliance with the Environmental Quality Restoration Program. Even though the final closure, mine conservation and post-closure monitoring (GD nr.926/2003, phase VII) have complied with the requirements, after 15 years many of the environmental problems persist or are amplified. Among them stand: changes in the surface dynamics revealed by low intensity land subsidence; compaction phenomena due to local dewatering processes that induced the appearance of a wavy relief (without fractures); small slips in the fertile soil surface (spread in order to facilitate the rapid development of vegetation) caused by a deficient management of pluvial water or poorly consolidated retaining walls; disorders in the natural habitat that impact the ecosystem. After 2010, the abandoned buildings and the adjacent land were the target of scrap metal thieves who left behind traces difficult to remove from the landscape which is still in a full recovery stage.

Keywords: mine closure and post-closure monitoring, environmental problems

1. INTRODUCTION

Mining generates a series of environmental problems caused both by the extraction process itself, and also by other activities or infrastructures connected to mining (transport, storage, administrative activities – social and technological precincts, electrical transformer installations, etc.). In the context of a sustainable development devoid of strategy, the negative direct or indirect impact on the environment appears in all the stages of the mining process – prospecting, development, exploration, extraction, preparation, closure and post-closure.

The exploitation activity of the jet mining works of Dâmboviţa County took place in the Şotânga-Cârbanaru-Gheboieni coal basin, being carried out by the National Coal Society Ploieşti SA through the mines and quarries of Şotânga and Mărgineanca-Gheboieni. After 1990, this activity was submitted to ample changes and restructuring after the diminution of the demand of the
main economic beneficiary - Termocentrala Doicești (The Steam Power Plant of Doicești), or after the resources were depleted. At present, the brown coal is no longer extracted from the underground, but only at the surface, from quarries, the mines undergoing a post-closure period of ecological reconstruction. The mining activity of Șotânga began in 1883, along Valea Popii, and resisted in the area until 2006, when the last galleries went into the conservation stage, but were actually deserted.

As in all the places where coal was mined and exploited for a long period of time, the problems affecting the local natural ecosystems of the area of the Șotânga-Gheboieni exploitation did not cease as soon as the exploitation activity ended, but continued after that as well. The lack of consideration for these risks pertaining to the closure and post-closure period sometimes led to accidents or even catastrophes, either for the environment or directly for the human communities (Damian & Oros, 2000).

2. GEOGRAPHIC AND GEOLOGICAL LANDMARKS CONCERNING THE EXPLOITATION

The Șotânga Exploitation is located in the NW of Dâmbovița County, in the administrative area of the Șotânga Commune, as far as the Șotânga Mine is concerned, and Tătăranii, Gheboieni Village, as far as the Mârgineanca Mine is concerned. The geographic limits of the mining area are the communes Cândești, Voinești and Vulcana Pandele to the north, the communes Doicești and Aninoasa to the east, Mânești Commune and Târgoviște City to the south, and Ludești Commune and Argeș County to the south-west.

Belonging to the hydrographic basins of Ialomița and Dâmbovița County, the area of 9,895 ha covered by the exploitation has a relief that is characteristic for the Subcarpathians of Prahova and the piedmont plain, being dominated by low hilly massifs, accessible depressionary corridors, terraces and well-developed riversides. In point of altitude, it is situated between 425 m and 350 m. The pedogenetic conditions (lithological variety, intense slope modeling processes, high humidity differences) favored the appearance of a mosaic of soils – among which there are luvic brown soils and the acid brown soils with null or moder (Ilugă & Zăvoianu, 1974). The area is largely covered by evergreen oak and beech forests, in association with hornbeam, common maple, elm, lime, oak, along with fruit-bearing trees and specific hayfield vegetation. The climate is continental-temperate.

Geologically, it belongs to the highly folded Neocene area, made up of Miocene and Pliocene formations (which include conglomerates, grit stones, marls, argillaceous or sandy stones, gypsums, bituminous plates, salt, coal strata, sands, gravels). They cover all the ages corresponding to the two epochs. The upper Dacian represents the productive complex, being made up of alternating strata of marls, grayish and greenish clays, sands and brown coal strata. It is followed by the Romanian. The stratigraphy of the layer highlights the three strata of economic importance. According to the data provide by the Agency for Environmental Protection, Dâmbovița (APMDb), they are: Stratum I, 1.20m thick, situated at the basis of the ore, is made up of 2-3 banks of coal, with thin intercalations of clay. The bed of the stratum is mainly sandy (drader) and, as one moves under the hydrostatic level, it becomes an active water-bearing horizon. Stratum II is the most important stratum, its average thickness per ore being of 3.10m and its calorific power being of 2,700-3,100 kcal/kg. It is made up of 2-6 banks of coal, variable as thickness, separated by clay intercalations. The bed of this stratum, which is 11m thick, is made up of clays, marls and fine marly sand, and its cover, which is 0-10m thick, has the same lithological content. The interval in between stratum I and II ranges from 10 to 20m thick. Stratum III appears at a 12-32m distance from the previous one, vertically. In the axial area, the Șotânga-Gheboieni anticline is up to 4m thick and its qualitative features are poor. The bed lithology is similar to that of other strata, marls and clays, but which, laterally, turn into sands with different variations of facies. The exploitation depths range from 80 to 170m.

Among the tectonic-structural elements of the region, the most remarkable are the anticlinorium Șotânga-Gheboieni (Mârgineanca anticline, Valea Plopii syncline, Gheboieni-
Şotânga-Cârbanuru anticline) whose general direction is E-W, and the local microstructures represented by minor faults and flexures. In this area there are also important oil resources.

Fig. 1. The position of the locality Şotânga in Dâmboviţa County (A); the mining perimeter (B) (Art-Zone.Ro., Google Earth, 2013)

3. LEGISLATIVE FRAMEWORK

The legislative history of Romania in point of environmental issues generated by the mining sector is still at its beginnings. The adhesion to the European Union required the consolidation of the legislative framework concerning the management and the implementation of the activity of closure and ecological restructuring of the mines. So, after the year 2000, the Romanian Government approved and adopted a series of laws and strategies necessary for the restructuring of the mining sector, and the creation of numerous operational organisms with a direct involvement in the strategic approach of the closure of the mines and in the solid management of the environmental problems induced by them. We shall recall: The Law of the Mines no. 85/2003, abrogating the Law of the Mines no. 61/1998, the Order no. 273/2001 for the approval of the Mine Closure Handbook, “The 2004-2010 Strategy for the Mining Sector” of April 2004, the Government Decree no. 644/2007, the Government Decree no. 1403/11.19.2007, the Government Decree no. 1408/11.19.2007. In the Economy Ministry (Ministerul Economiei - ME) operate the General
Direction for Mineral Resources (Direcția Generală Resurse Minerale - DGRM) within which there is the Central Group for the Closure of the Mines (Grupul Central pentru Închiderea Minei - GCIM) turned into the Direction for Skills Conversion and Ecological Programs in the Mining Sector (Direcția de Conversie Capacități și Programe Ecologice în Sectorul Minier - DCCPESM), which was abrogated in 2003 and its roles were assumed by the Group for the Coordination of the Program for Mine Closure and Ecologization (Grupul de Coordonare al Programului pentru Închiderea și Ecologizarea Minei - GCPIEM), with management roles (coordination, programming and legislative). At the same time, The Trading Company for the Mines Conservation and Closure (Societatea Comercială de Conservare și Închidere a Minei SA - SC CONVERSMIN SA), Romania, acting for and on behalf of the Economy Ministry in the sense of managing the annual funds allocated from the state budget for contracting the execution of the mines closure works, the National Agency for Mineral Resources (Agenția Națională pentru Resurse Minerale - ANRM), and the Agency for Environmental Protection (Agenția pentru Protecția Mediului - APM).

The International Bank for Reconstruction and Development (Banca Internațională pentru Reconstrucție și Dezvoltare - BIRD) financed the Project of Mine Closure and Environmental and Socioeconomic Regeneration, 16 December 2004–31 October 2012, concluded by the closure of 23 mines and 98 legislative modifications specific for the mining activities of which the most important have been three Laws, two Emergency Governmental Decrees and two Governmental Decrees.

4. ENVIRONMENTAL ASPECTS CONCERNING THE STAGES OF CLOSURE AND POST-CLOSURE. DISCUSSIONS.

The mine closure activity needs to be realized through the integration of the policies, knowledge and procedures concerning the closure of the mines in agreement to the best international practices applied taking into account the peculiar features of the area of implementation. The mine closure plan needs to constitute an essential part of the lifecycle of any mining project and it should be elaborated so as to assure (Sassoon, 2000):
• the long-term security and health of the population;
• the avoiding of the physical and chemical deterioration of the environmental resources;
• the efficient and sustainable use of the setting;
• the lowering of the socioeconomic side-effects;
• the maximal amplification of the socioeconomic benefits.

The closure of Mine 2 of Șotânga occurred via the Emergency Governmental Decree no. 861/1998. As the modifications of the air, water and soil quality represented temporary, relatively easy to remedy, environmental problems, the main pressure on the environmental factors exerted by this mine closure is the mechanical degradation of the environment. The morphological modification of the initial landscape represents the visual effect with the most important negative impact in the mining areas. Though the mine was closed respecting a Conformity Program meant to Restore the Environmental Quality (Program de conformare cu privire la refacerea calității mediului înconjurător - PCRCM) financed from the State Budget, the planning horizon concerning the ecologization of the area should be reconsidered so as to include several decennia of work both with the environment and with the people who use it.

According to the data provided by APMDb, for Mine 2, Șotânga, PCRCM comprised:
1. Decommissioning and removing the underground and surface equipment.
2. Cleaning/sanitation the area around the Ilfov pit enclosure and the bed of the canal for discharged mine and meteoric waters.
3. Re-introducing the land in the productive circuit, at a potential similar to the one it used to have before - reintroducing an area of 8ha into the forestry circuit (leveling of the soil surface and adaptation of plants to existing circumstances).
4. Strengthening the existing supporting wall.
5. Checking the spot heights/rates and the geodesic networks coordinates in the area.
6. Monitoring the evolution of the arrangements made for a 3 year period.

According to the protocols, the end of the year 1998 represented the conclusion of the first five stages of the Program by the people in charge of the Mines of Şotânga. Until 2001, they realized the monitoring of the environmental factors and of the ground arrangements of the mine. According to the Mine Closure Handbook, the monitoring action included the following, without being limited to them (Manualul de închidere a minelor / Mine Closure Handbook, p.23): monitoring the stability of the area; monitoring the water; monitoring the air; monitoring the stability of the sterile dumps and of the dam structures surrounding the decantation ponds; monitoring the ecosystems and the vegetation.

In the Governmental Decision no. 926/2003, it appears that the confirmation of the end of the works was on 19.04.2000 and their final confirmation, established by the same decision for 25 November 2002.

The condition of the surrounding environment in the area of the former Mine 2 of Şotânga is still affected by the impact produced by its closure. The evaluation of the morphological modifications caused by the mining works includes the analysis of three factors: extension, intensity or also duration of the morphological modifications. In the case of the area under analysis, the affected zone is not just the one of the mined area, because some adjacent zones are also affected; the intensity of the phenomena and processes is moderate, and the duration of the modifications varies depending on the factors involved – the modifications may be permanent and temporary. Out of the problems this area is still faced with, we shall recall:

- Modifications of the dynamics of the area manifested through subsidence of low intensity.
- Differentiated compression phenomena of low depth, caused by the local drainage processes, which led to the appearance of a wavy relief of little amplitude (0.5-1 m), without fractures.
- Some minor landslides in the area of the fertile soil spread on the former landslide in order to favor a rapid growth of the vegetation developed on a 5.5 ha area in the east of the perimeter, along with landslides given by the poor management of the rain waters or by the poorly consolidated supporting walls.

- The presence of funnels/craters and micro-depressions appeared in the landscape, which interrupt the normal water flows, generating cracks and uneven areas with a temporary impact.

- Areas that can no longer be used for the purpose they had before (agriculture, hay field) due to infrastructure works such as: access ways, technological and social precincts with a major impact on the soil.

- Changes in the natural habitat with influences on the ecosystem.

- Subsidence has affected the walls of one of the deserted buildings and of the access road.

- The buildings that were once used for auxiliary and sanitary activities, the metallic structures, the abandoned equipments and the mine railroad constituted an attraction for the thieves interested in collecting recyclable iron, who, especially after 2010, destroyed the environment and left their marks, which are hard to remedy, on the security structures. After the company Carbonifera SA Ploiești entered its insolvency process, the phenomenon grew in intensity, because of a precarious security system and given the new socioeconomic conditions, so that the storage of a large part of the materials no longer in use from the galleries and the lack of concrete dams to secure the access ways to the underground created new opportunities for destruction. For a better management, the local authorities proposed the transfer of the buildings to the local administration for free or in exchange for the company's debts.
- The closing of the gallery access ways was not carried out so as to guarantee the security of the environment; consequently, the fall of the galleries that were not secured led to minor landslides.

Many of these environmental problems can be remedied; in this sense, what is needed is a good management and to assume the long-term responsibility for this area, on the background of a coherent legislation (Ştefănescu et. al, 2009). Recently, the accent of the management of the environmental aspects related to the closure has turned to the idea of mining for closing (Peck, 2005).

The solutions we propose are: reduce the dynamics of the rainwater and minimize the mobility of the soil particles; prevent the continuation of the landslides in the areas where these phenomena occurred through the modification of the upstream slopes; slightly modeling the landslide areas at the surface; unclogging and reshaping the rainwater drainage canals in the area of the landslides; continuing and extending the forestation independently from the forestation realized by the company managing the former mines of Şotânga (ex. through the program of the Environment and Forests Ministry “Împădurim România”/We Reforest Romania, in November 2012, a reforestation campaign was realized in this extremely vulnerable area, given its 100ha of degraded lands, not just for the supplementary stabilization of the surface); give the properties of the former mine (buildings, lands) to the local authorities for their reintroduction in the functional circuit, in order to facilitate the diminution of the social impact on the labor force and on the community; continue the consolidation of the existing supporting wall on larger areas, as the wall realized so far is insufficient; signal the dangers generated by the buildings no longer in use or by other specific mining infrastructure elements – wells, galleries, rugged land- by means of adequate warning signs.

Adjacent and dispersed compared to the area covered by the exploitation of Mine 2 of Şotânga, for which the ecological reconstruction program was under way, there are also areas with a potential impact on the environment that have undergone no ecological rehabilitation so far. Such is the case of the Valea Popii quarry, affecting 60ha of agricultural land, and which, abandoned by the managers of the mining resources, has turned nowadays into a huge hole which can store, in case of abundant precipitations, over 500,000 m³ of water. This constitutes a potential danger for the environment and the inhabitants in Şotânga Commune.

5. CONCLUSIONS

The mine closure plan proves to be a complicated one, as the activities related to the closure and ecologization of a mine are part of a very complex series of procedures and processes. There is a challenge in every closure and ecologization in turn, as each requires an innovating approach based on the lessons and the limitations imposed by the previously acquired European experience, applied to the demands and the needs of the local communities in point of environmental sustainability. The sustainable development – in the case of the closure of a former mine – provides opportunities and challenges, but, most importantly, it should provide viable solutions (Roosa, 2008).

The closure and the ecologization of the area of the Mine 2 Şotânga by means of technical solutions of closure and ecological reconstruction, according to the Best Available Technology (BAT), elaborated on the level of the European organisms did not mean the ceasing of the impact on the environment, but only its diminution. Sure, one could hardly hope to reconstitute the initial quality of the area affected by the mining activity, yet the actual closure of the mines in a way that would be acceptable from the perspective of the environment and of the diminution of the social impact can be realized.
REFERENCES


*Legea Minelor nr 85/2003
*Ordinul nr. 273/2001 pentru aprobarea Manualului de închidere a minelor,
* „Strategia pentru 2004–2010 pentru sectorul minier” din aprilie 2004
*H.G. nr. 644/2007 privind aprobarea închiderii definitive și monitorizării factorilor de mediu post-închidere a unor mine și cariere, etapa a X-a, și modificarea unor acte normative în domeniul închiderii unor mine și cariere
*H.G. nr.1403/2007 privind refacerea zonelor în care solul, subsolul și ecosistemele terestre au fost afectate
*H.G. nr.1408/2007 privind modalitățile de investigare și evaluare a poluării solului și subsolului
*H.G. nr.926/2003 privind aprobarea conservării, închiderii definitive și monitorizării factorilor de mediu postînchidere a unor mine și cariere, etapa a VII-a


*** http://apmdb.anpm.ro


*** http://www.minind.ro/domenii_sectoare/index4.html

*** http://ec.europa.eu/environment/waste/mining/index.htm