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THESIS SUMMARY

Cercetări privind evoluția indicatorilor de mediu ca urmare a activităților miniere din Valea Jiului

Research on the evolution of environmental indicators as a result of mining activities in the Jiu Valley

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1. Introduction. The necessity, objectives and structure of the thesis

It is very important in everyday life to maintain a balance between a clean environment and a high level of human health. Performing daily activities, regardless of the effects on the environment, cause a number of malfunctions between the main elements of the environment, namely air, water, soil and vegetation.

With the passage of time and the development of human society, man has become aware of the importance of maintaining a clean environment and has begun to implement actions to protect and monitor it. Thus, the knowledge and monitoring of risk factors has become one of the most important elements for maintaining the health of the population.

Environmental monitoring involves an activity based on the recording, collection and measurement of pollutants, over a period of time and in a specific space so as to ensure pollution control.

The first environmental monitoring and protection program in Europe appeared in 1972, when the UN Conference on Environmental Protection was held. That was the first step towards the implementation of environmental monitoring laws and programs.

In Romania, this program began to develop with Romania's entry into the European Union, at which time we were required to create a national system for monitoring all components of the environment.

Romania's mission is to monitor, evaluate, warn and forecast the evolution of natural elements and systems, in order to be able to intervene in a timely manner to maintain a balanced state between systems, but even if this system has taken shape and experienced a strong development, it does not yet have the capacity to provide data from anywhere in the country.

For example, in our area there is only one air quality monitoring point that is part of the national network, a point that is responsible for the entire region, but which can only determine correct readings over a distance of a few square kilometers.

The problem of the evolution of pollutants and the quality of the environment in industrial areas, and especially in areas where the main activity is coal mining, is insufficiently monitored and highlighted by state authorities.

In the Jiu Valley, the main polluting factor was the mining industry, because no matter how the extraction, storage, preparation, transport and recovery of a deposit is carried out, various chemical and physical operations are required to obtain the sterile material and the material. useful, and this activity always produces negative effects on the environment.

Whether it is air pollution with various pollutants such as nitrogen dioxide, carbon monoxide, suspended particles, or we are talking about water or soil pollution, this activity produces pollutants that affect all components of the environment.

The most important sources of pollution caused by mining are industrial wastewater, thermal power plants, fan stations, car and road traffic, tailings dumps, fuel depots, abandoned buildings, etc.

The negative effects on the environment caused by this activity are represented by a wide range, and the most obvious are:

• Degradation of soil and relief characterized by deterioration of the landscape, abandonment of industrial buildings, storage of toxic substances directly on the soil surface, creation of tailings dumps, creation of tailings ponds, etc.

• Water degradation is represented by their impurity, by the discharge of water used in coal purification processes, by the discharge of toxic substances directly into river waters, etc.

• Air degradation is represented by all air pollutants produced by the activities of extraction, transport, storage, processing and combustion of coal.

• Noise and vibration are represented by industrial activities, transport activities, but even some human activities.

Chemical elements, residues and waste from mining activity end up in the environment where they interact with other toxic substances, thus affecting the health of the environment, living things and humans.

This paper aims to highlight and monitor the quality of the environment in the Jiu Valley area, by implementing measurement systems adjacent to those used by national stations.

The necessity to know environmental issues in order to stop or reduce them is the central point of this thesis, because once we know all aspects of the environment, we have the opportunity to act and avoid environmental disasters.

Therefore, the necessity for research on the impact of mining activities and the presentation of clear and precise situations of pollutants in the environment of the Jiu Valley is of particular importance in terms of irreparable degradation of the environment in this area.

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For the realization of the paper it is very important to know the current degree of environmental indicators, because the data obtained with the help of auxiliary instruments during the three years of studies will be superimposed on the current data in order to observe the fluctuations of environmental indicators.

For our area there are very few environmental quality monitoring stations, namely one located in the Municipality of Vulcan- air quality monitoring station, station that is part of the national RNMCA monitoring network and one for water quality verification, located at the confluence of two parts of the Jiu River.

Research methods consist of taking samples from various environmental indicators, analyzing their quality to determine how they affect the environment, conducting documentation, research and specialized studies and presenting the results obtained.

In order to be able to carry out an efficient and continuous research on the environment, it was necessary to draw up an action plan that is carried out during several stages, namely:

- A planning stage;
- Identification of sources of mining pollution;
- Exact determination of monitoring and measurement points of pollutants;
- Location of complementary equipment for measuring pollutants;

- Monitoring, measuring and processing the data obtained.
- A stage of evaluation of the recorded data.
- Presentation of the final report

The main objectives of this paper were to conduct research on the elements of the environment in areas affected by the mining industry using a number of less used tools.

These tools have been chosen to be able to provide quality data at a low cost, to be used by anyone to compare the results obtained with data recorded by national stations using approved modules and elements, at a high cost and not accessible to the general public.

During the three years of studies, we monitored, processed and stored data on the main environmental pollutants, data taken from both the system and the national stations.

2. Synthesis of the doctoral thesis

The doctoral thesis is structured in 6 chapters and is extended to 131 pages that gather the results of scientific research. The obtained results are found in 49 tables with new and original data and information, respectively 53 graphical representations (diagrams, drawings, images) and 6 mathematical relations and formulas. The doctoral thesis presents the results of the documentation process, of the elements of conception and development of the theoretical and applied research necessary for solving the approached topic, presenting the results obtained in a clear and concise manner.

Chapter 1, entitled **"The current study of environmental quality in the Jiu Valley basin"**, presents the history and evolution of environmental pollution from ancient times, to the present day, both throughout the country and in the Jiu Valley. Thus, in this area, the main activity is coal mining, the environment is affected by the pollutants caused by this industry. The most important sources of pollution caused by mining are fan stations, industrial waters, thermal power plants, car and road traffic, tailings dumps, fuel depots, abandoned buildings, etc.

Chapter 2, entitled **"Jiu Valley",** provides a detailed presentation of the Jiu Valley. The totality of the important geographical elements is presented, such as the geology where the antiquity and the thickness of the sedimentary elements that build the Jiu Valley are presented, the relief where all the relief forms found in our area are highlighted, the soil where its zonal character is highlighted. depending on the altitude and the bioclimatic conditions. which presents a very rare phenomenon, namely that of thermal inversion, industrial activities and tourism.

Chapter 3, entitled **"Sources of environmental pollution in the Jiu Valley as a result of mining activities"**, presents a detailed description of the elements, studying each element of the environment separately. The purpose is to provide a detailed description and analysis of the pollutants and their sources of pollution. The analysis determined in this chapter provided a clear and concise picture of the elements of the environment.

Chapter 4, entitled **"Implementation of new methods and techniques for measuring pollution indicators and comparison of results with measurements made by national fixed stations",** is divided into three different parts, namely part of measurements made using national fixed stations, part of the measurements made with the help of complementary elements and part of the comparison of the obtained results.

Thus, the first part studies the specialized institution in Romania that deals with environmental issues, namely the National Agency for Environmental Protection, an institution that is subordinated to the Ministry of Environment and Climate Change. The National Agency for

Environmental Protection has put in place a number of national networks for measuring environmental quality, namely:

- air quality monitoring stations;
- water quality monitoring stations;
- soil quality measurement points;
- stations for measuring the radioactivity of the environment
- vegetation monitoring points, especially forest vegetation;
- health checkpoints for the population.

The second part presents how to create and implement new methods for measuring pollution indicators. Thus, an action plan was drawn up which was carried out over several stages in order to be able to achieve the desired monitoring system. The system is composed of a very small computer called a Raspberry Pi board, to which a series of sensors have been connected, namely:

- Sensors for measuring air quality type MQ 135
- Sensor for measuring carbon monoxide type MQ 7
- Sensor for measuring particulate matter PM10 type DSM501A
- Sensor for determining the pH of the air and soil
- Sensor for determining turbidity type SEN0189
- Noise and vibration sensor type DFR0034

In addition to the sensors that connect to the raspberry pads, we also used independent devices to measure the noise level, but also the pH level in the soil.

This chapter demonstrates the main purpose of the research, namely to demonstrate that simple tools that fit within a limited budget can provide us with accurate data on the items being monitored. Thus, we used a series of sensors and very small computers that can be purchased by anyone to create and monitor the environmental situation in the Jiu Valley.

Chapter 5 entitled **"Synthesis of the evolution of environmental indicators measured and analyzed as a result of mining activities in the Jiu Valley",** highlights the evolution of environmental indicators studied. As we have shown in previous chapters, the monitoring of environmental elements can be done globally, regionally or locally and is represented by the collection, processing, transmission of data and production of warning messages if the pollutants exceed the limits imposed by law.

In our area, the monitoring is performed locally by the state authorities, but the monitoring is not performed on all components of the environment, and the monitoring stations located are few enough to be able to provide data with great accuracy.

I do not want to say that these stations do not provide accurate data, but as their manufacturers claim, they are of several types, and their radius is often a few kilometers, so there was a desire to analyze the components of the environment. in several points to have a clear picture of its elements.

By placing several collection and measurement points we were able to have an objective picture of several pollutants found in the environment.

The system was created in such a way as to record as many pollutants as possible, to record how they are spread and to make the most accurate and concrete measurements possible.

Chapter 6, entitled **"Conclusions, contributions, proposals",** presents the proposal offered by the author for determining the quality of the environment in mining areas, a proposal that

presents an increased accuracy of the data collected at a low cost of acquisition and maintenance. The purpose of this paper is to make known the current state of the environment in the Jiu Valley, so that we can act before the level of pollution exceeds the limits imposed by law. After performing the measurements and comparing the data we were able to get a clear conclusion on the quality of the environment and how it is monitored in our area.

The development of this low-cost monitoring system can be a step in the development of the local environmental monitoring system, because a more efficient and complex control of the environment requires useful information that is transmitted to the state authorities, thus being able to act in time. the case of exceeding the limits imposed by the Romanian and European legislation.

Starting from the research of the way in which the environmental indicators are affected by the pollution produced by the mining activities, we proposed the creation of a monitoring system for the polluting elements. This system had to take into account the laws of the country, it had to be able to measure and record a wide range of pollutants, all of which are at the best value for money.

Data collection, processing and analysis have produced a number of results that show that the area studied is a fairly healthy living environment, but some aspects can still be significantly improved.

Making a comparison between the quality of the environment 10 years ago and the current one can be seen a considerable improvement, improvement based on the involvement of state authorities, refurbishment of industrial institutions, but also the reduction of coal extraction and processing activities in the area.

This reduction in mining activity has led to a decrease in the quantity of polluting products, a decrease that can be seen very well in the cities of Petrila, Aninoasa and Uricani, where mining is stopped. In these areas, important aspects of the environment have begun the process of self-regeneration or with the help of man.

Even if the Jiu Valley is going through a critical period from an economic and industrial point of view, a period due to the closure of the mining industry in this area, it is very important to have a clear situation of pollution in the area because the quality of the environment directly influences the quality of life.

The proposal for the future is to create a local system, independent of the national environmental system, and this system should be used to provide us with accurate and quality data on the elements of the environment. The implementation of this system is both a plus in terms of education, but also in terms of economics, because the equipment used is very easy to understand and use.

For the mining industry, a proposal to reduce pollutants is to modernize all elements of mining technologies so that pollutants released into the environment are much lower.

Another proposal would be to use energy from renewable sources to carry out road transport or to heat homes, as this energy is very environmentally friendly, so that pollutant emissions are almost non-existent.

The doctoral thesis presents the conclusions obtained from the research described during the 5 chapters, conclusions that highlight the quality and manner of conducting research.