

## Air Pollution in Deva-Hunedoara Industrial Area

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**ABSTRACT:** In central part of Romania there is a very developed industrial area. This industrial area consist of a great number of industrial companies developed in three cities. In this area are the following cities: Deva (80000 inhabitants) where are developed cooper mining industries including processing plants, building material industries, heavy industries and a power station based on coal burning; Hunedoara (80000 inhabitants) placed at 12 km to south of Deva where are developed iron mining industries, iron works, coking plants, manufacturing industries and heavy industries; Călan (10000 inhabitants) placed at 15 km to south of Deva where are developed iron works and coking plants; Simeria (10000 inhabitants) placed at 10 km to east of Deva where are developed railway transport and railway equipment plant. All this industries are very important air pollution sources. The emissions provide from all this companies are very complex. In air could be found solid particles like coal, ash, mineral particles, black carbon, iron, cement, and gaseous noxes like sulphur dioxide, nitrogen oxides, organic compounds. Also radioactive particles are present in air provide from coal ash dumps and from copper ores.

## 1 INTRODUCTION

In the central part of Romania there is Hunedoara area, a hilly region very developed and populated.

Hunedoara hills are developed between Strei Valley and Poiana Ruscă Mountain looking like a step between these relief units. These hills show in a form of levelled hills associated in a piemountain surface at 400-450 m altitude, that pass outlying to a terrace level at 140 - 160 m and 350 - 360 m, more developed than younger terrace. Entire hilly relief has a great number of large source valley, favourable for village development, and decrease gradually to north-eastern and to eastern up to Mures and Strei passage.

Strei passage represent an ensemble compound by a 3 km large river meadow and a terrace system very well developed in the left side of the valley. The more developed terrace has 18 - 20 m. The river meadow is subjected to flooding that need land protection working.

The relief aspect allow to practice agriculture. Cereals is extended on 2/3 surface and the rest is occupied with vegetable, especially in Mures meadow.

At Sântuhalm, close to Deva there is a great complex of greenhouses provided with thermal energy by Hunedoara Siderurgical Plant.

Hunedoara hills supplies optimal condition for human communities development.

In sixties and seventies years this are had a highly development rate regarding industrial and social aspects. In this area, at Hunedoara and Călan were developed steel factories and coke

plants. Today this area supply 1/5 from Romanian steel. This development based on local iron ores reserves from Poiana Ruscă Mountain, coke coal from Jiu Valley and an over one hundred years tradition.

In eighties years the industrial development based on diversification including building materials industry, food industry and light industry. At Hunedoara was built a 12 MW power station based on coke oven gas and a similar one at Călan.

Building materials industry is based on local resources and siderurgical waste. Building materials plants are to Chiscădava close to Deva and to Bârcea Mică close to Hunedoara. Marble is manufactured also to Simeria and talc powder, dolomite and lime to Hunedoara.

Light industry and food industry is based on a great number of small capacities. At Hunedoara was built a shoes factory and a woollen knitted factory and at Deva a silk factory. Preserved meat and milk processing factories are developed at Deva, Hunedoara and Simeria.

Since 1980 Deva became an industrial city, approaching with Hunedoara and Călan specific industry, very strong developed and very pollutant.

Industrial development affected environment and its equilibrium state mainly by air and water pollution especially in developed cities area. The most polluted area is represented by Hunedoara where the industrial zone have a large number of polluting sources (16).

The inherited relation between industrial area and residential area that expose the whole communities to a high pollution exposure process, increase in the last years. In comparison with the initial report the urbanisation rate increase continuously. The vicinity report between industrial and residential area cannot assure the required protection spaces between high polluted industrial area and residential area.

## 2. METEOROLOGICAL CONDITIONS.

Deva -Hunedoara area has a very different climate in comparison with surrounding areas.

Because of relief range in tiers the annual average temperature in Mures meadow, that is +10°C is very differently from annual average temperature from surrounding mountains, that is minus 2°C. The monthly temperature evolution at Deva is presented in figure 1.

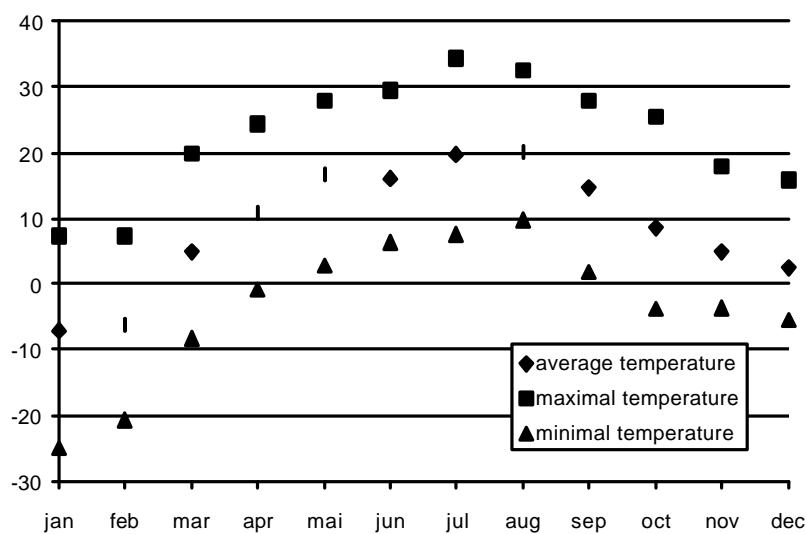


Figure nr 1. Deva monthly temperature.

Annual average rainfall is 540 mm at Deva in comparison with 1400 mm on surrounding mountains. Monthly average rainfall evolution during a year is presented in figure 2.

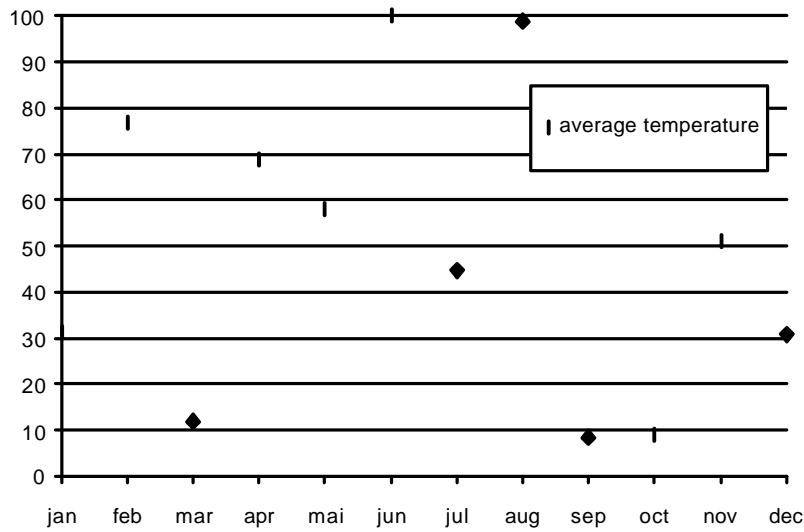


Figure 2. Monthly average rainfall evolution during a year at Deva.

The same differences because of different altitude appears to the wind distribution. Generally air circulation is mainly from east to west. Local mountain breezes are present in all these cities.

### 3. AIR POLLUTION AT DEVA

Deva is the residence of Hunedoara county. This city is placed on Mures river at the beginning of Mures canion. Deva surface is 59.9 km<sup>2</sup>. Deva was developed in time like a strategically, political and economical town. Now Deva has 80,000 inhabitants.

Industrial activity on Deva is represented by 12 great companies distributed on its surface. The most important industrial objective is Mintia power station placed close to roman castrum. This power station of 1000 MW based on coal from Jiu Valley, a coke coal with high content of volatile mater (38-40%) and ash (40-50%). Sulphur content is also great (2.3-3%).

Near Mintia power station is Deva Mine and Deva Processing Plant that produce cooper, lead and zinc concentrates.

Another important industrial objective is Chiscădava building materials plant. This plant produced 3,000,000 metric tones of cement per year, bricks, mineral wadding, etc.

Another industrial units are chicken farms, preserved meat factory, bakery, etc. The industrial structure of Deva's companies are presented in figure 3. The size of circles depend of industrial production value.

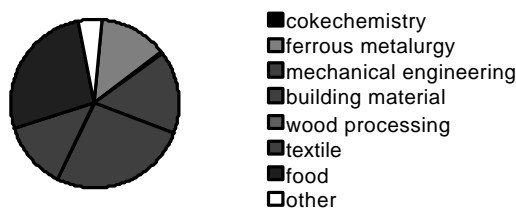


Figure 3. Deva industrial structure.

Because of these industrial companies, especially power station, building materials and mining activity air in Deva is very polluted. The air pollutants content in Deva's air is shown figure 4.

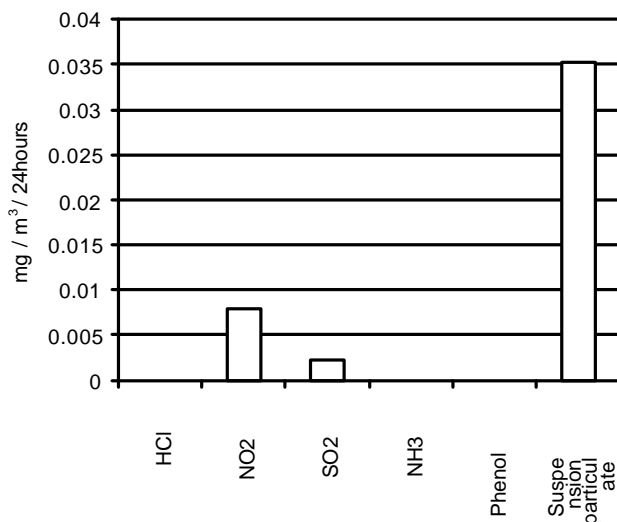


Figure 4. Air pollution in Deva.

#### 4. AIR POLLUTION TO HUNEDOARA

Hunedoara is the greatest city in the studied area. City's surface is 184 km<sup>2</sup>. Hunedoara is placed to 18 km south from Deva, on Cerna river valley. Hunedoara has 90,000 inhabitants. Placed at 240-280 m altitude Hunedoara is surrounded by hills with 350-410 m altitude. New residential areas were developed in the last years on this hills. In the older part of city there is the mainly industrial unit, Siderurgical Plant, that produced 1/5 from Romanian steel. This plant is developed along Cerna valley on some kilometres. The plant is provided with old furnaces, electrical steel works, Siemens-Martin steel works, rolling mills, coke plants, iron ores processing plant, dolomite and lime plant, two power station, oxygen plant and phenol plant.

Close to siderurgical plant is mechanical engineering plant that produced 6.5 % from Romanian equipment's for metallurgical industry.

Hunedoara has also textile industry, clothes industry and food industry.

The industrial structure of Hunedoara's companies are presented in figure 5.

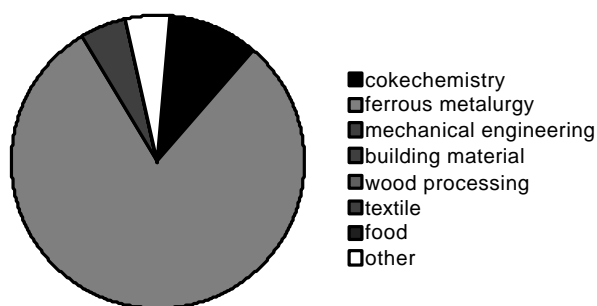


Figure 5. Hunedoara industrial structure.

Because of these siderurgical plant, coke plant and mechanical plant Hunedoara is the most polluted city in the area. The air pollutants content in Hunedoara's air is shown figure 6.

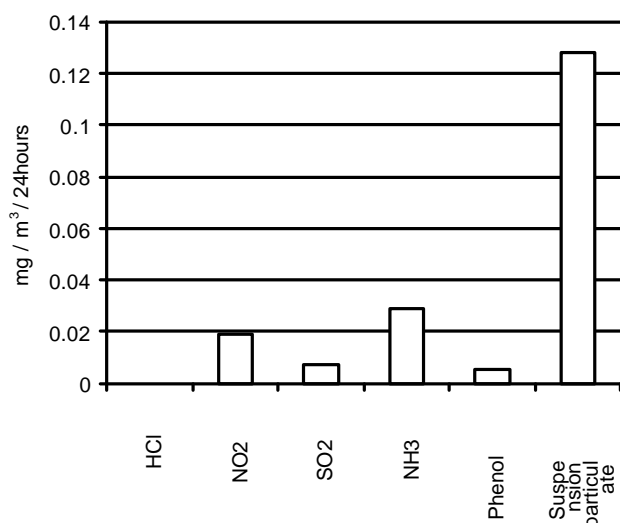


Figure 6. Air pollution in Hunedoara.

## 5. AIR POLLUTION AT CĂLAN.

Călan is a small city placed on Strei valley at 26 km south - west from Deva. Călan surface is about 101 km<sup>2</sup> but just 3.6 km<sup>2</sup> constitutes the residential area. Călan has 15,000 inhabitants.

The most important industrial unit is also metallurgical plant provided with four great capacity furnaces ( 1000 m<sup>3</sup>), coke plant (650,000t/yr.) and iron ore agglomeration plant (1,650,000 t/yr.).

The industrial structure of Călan's companies are presented in figure 7.

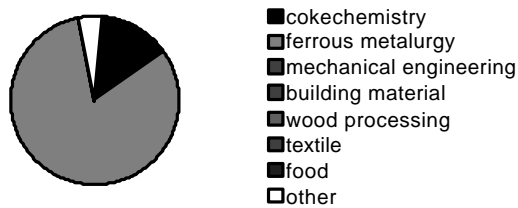


Figure 7. Călan industrial structure.

Because of these metallurgical companies, especially coke plant air in Călan is very polluted. In the last years the pollution level decrease due to coke plant closing. The air pollutants content in Călan is shown figure 8.

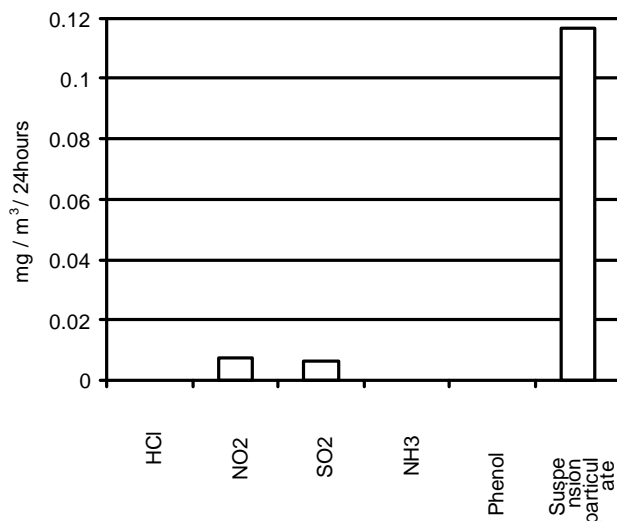


Figure 8. Air pollution in Călan.

## 6. AIR POLLUTION AT SIMERIA.

Is a small town placed at 11 km east from Deva. It has 15,000 inhabitants. This town is not very developed. In Simeria there are a marble processing plant, a milk processing plant and rail ways work shop.

The industrial structure of Simeria's companies are presented in figure 9.

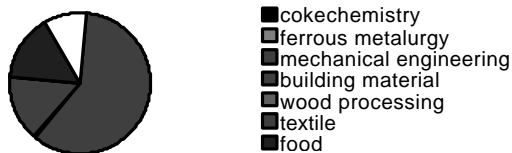


Figure 9. Simeria industrial structure.

Air in Simeria is low polluted. Just sedimentable particulates has some great values.

## 7. CONCLUSION

Hunedoara - Deva area is a very developed region.

Main cities are placed on rivers valleys separated by hills.

Main wind direction is from east to west. This fact protects urban area.

In this area is just a high local pollution because relief protects different places by pollutants transportation.

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