

# Studies Regarding the Soil Level Pollution with Metals in Limitrophe Zone of Tg.-Jiu Industrial Area

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**Abstract:** The paper presents studies regarding the soil pollution with metals in limitrophe zone of industrial area. Soil samples were taken from 18 points, at different distance from Tg.-Jiu industrial area. All metals concentrations from analysed soil samples are approximately around normal values, under alert and emergency level, corresponding for the soils less sensitive.

**Keywords:** metals, soil pollution, industrial area

## 1. Introduction

The soil is a dynamic system where short-term fluctuations occur, such as variations in humidity and pH levels, in redox conditions; it is also the place where the organic matter gradually decomposes as a consequence of changes in nature. These changes alter the shape and availability of metal ions and therefore they must be taken into account when making a decision on soil pollution or waste storage. [1]

Metals accumulation in soils represents a process with toxic effects for human, animals and plants. Exposed to heavy metals accumulation in soils can be chronic (during time) and appear by transfers made in food chains. Exposure to a high concentration with immediate effects is rare but can appear. [2]

Metals are presented in polluted soils in different forms: dissolved, colloidal, and particulate. Soil pollution with heavy metals are due to soluble forms and potential soluble, like ionic exchangeable, adsorbed onto surfaces, or soluble organometallic compounds, especially complexes of fulvic acids. Metals solubility in soil and ground water is dependent on pH, redox potential, soil texture, biocenosis composition, and plants grown in polluted areas [1, 2, 3]. Metals mobility in soil is influenced by their releasing and retaining, from soil matrix into soil solution. [3]

Pollution of large soil areas and of ground waters are due to wastes from mining exploitations, chemical industry, municipal wastes, etc. Soil is polluted with heavy metals like Cu, Cd, Pb, Ni, Zn and Cr. The widespreading of mining wastes onto large areas represents risks both for human health and environment. [4]

The aim of this paper was to evaluate the soil pollution level with metals in limitrophe zone of Tg.-Jiu industrial area.

## 2. Experimental

Soil samples were taken from 18 points, at different distance from Tg.-Jiu industrial area (50 m, 100 m, 150 m, 500 m and 1000 m).

Soil samples were taken according to the general procedure. Soil samples were taken from first 20 cm from the surface using an agrochemical device. The quantity of prelevated soil was between 200-300 g.

Soil and plant samples were dried at room temperature pestle milled and passed through a 2 mm coarse sieve. After dried, the non-decomposed vegetal remains, foreign materials and gravel was removed from the samples.

The following parameters was analysed: pH, concentration of zinc, cadmium, cobalt, nickel, copper, manganese, lead and total chromium.

For soil pH determinations was prepared a 1:2.5 soil:water suspension. After 2 hours (time necessary for establish a equilibrium with CO<sub>2</sub> from atmosphere) suspensions was analysed using a digital pH-meter. [5]

Samples of soil were mineralized with "aqua regia", brought into solution and analyzed in order to determine the content of metals [5]. The concentrations of metals were determined using an atomic absorption spectrophotometer VARIAN SpectrAA 110.

The values obtained for analysed soil parameters were compared with the values admitted by the current legislation of Romania for the soils less sensitive.

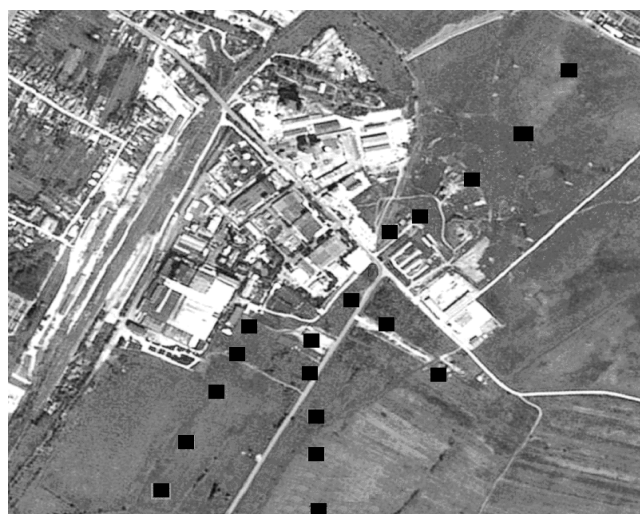


Figure 1. Prelevation point of soil samples in limitrophe zone of Tg.-Jiu industrial area

### 3. Results and Discussion

Figure 2 shows comparatively the pH values of soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area. pH of the samples is in the range 3,7 – 4,3.

The results of the analysis regarding the copper concentration in soil samples prelevated presented in figure 3 shows that these concentrations are much smaller than the values for alert level.

Figure 4 present comparatively the values of nickel concentration for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area. The nickel concentrations in all analysed samples are between normal values and alert level.

The results of the analysis regarding the lead concentration in prelevated samples presented in figure 5, shows that the lead concentrations in soil are around normal values and smaller than alert level.

The cobalt concentrations for soil samples prelevated are presented comparatively in figure 6. It can be seen that in all cases the samples present cobalt concentrations reduced than alert level.

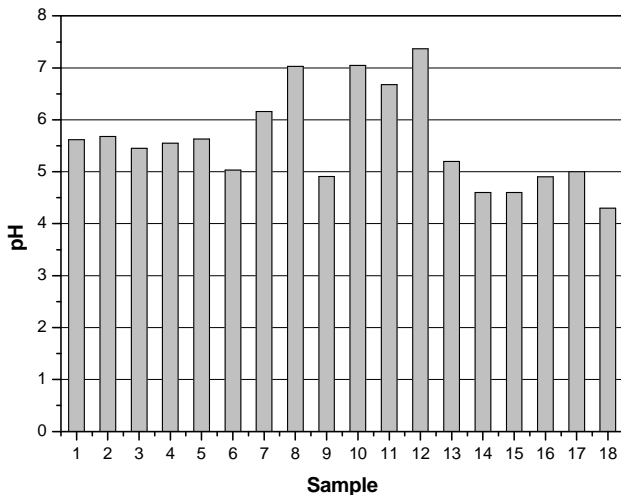


Figure 2. pH values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

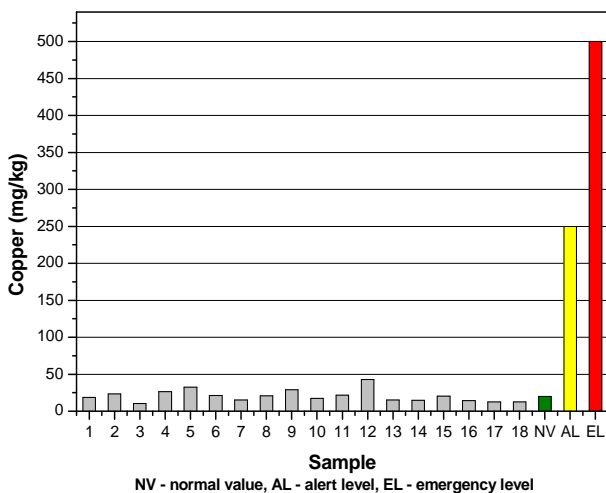


Figure 3. Copper concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

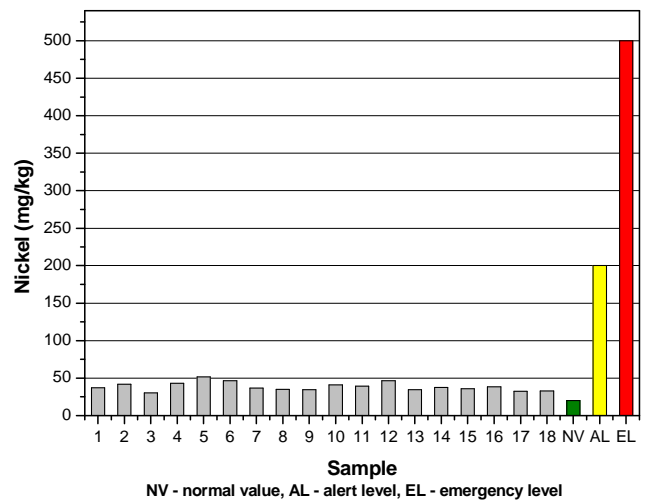


Figure 4. Nickel concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

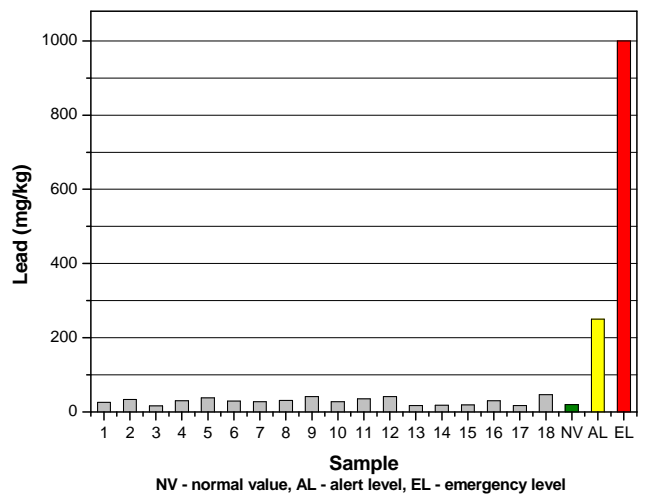


Figure 5. Lead concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

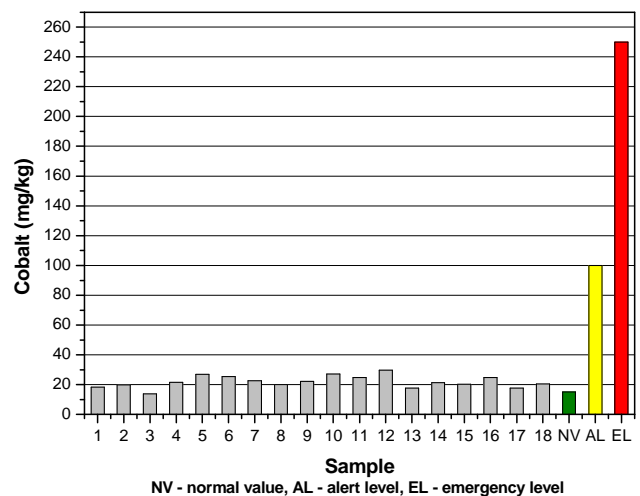


Figure 6. Lead concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

The manganese concentrations for soil samples prelevated from limitrophe industrial area of Tg-Jiu are presented comparatively in figure 7. The experimental data shows that for all the samples have been registered manganese concentration between normal values limits.

The results of the analysis regarding the total chromium concentration in the soil samples prelevated presented in figure 8, prove that all the samples have concentration values of total chromium between normal values and alert level.

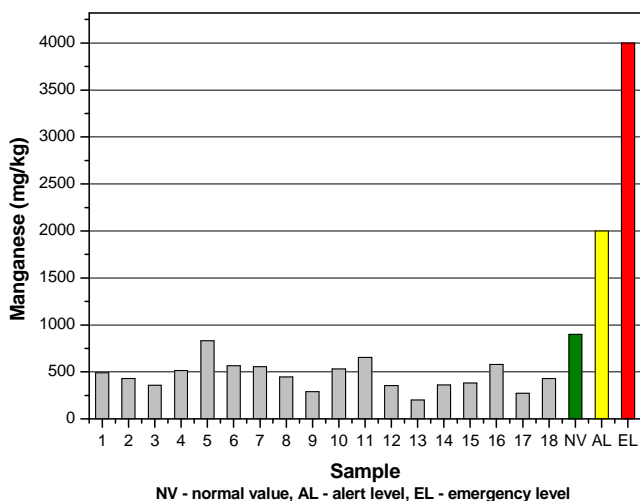


Figure 7. Lead concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

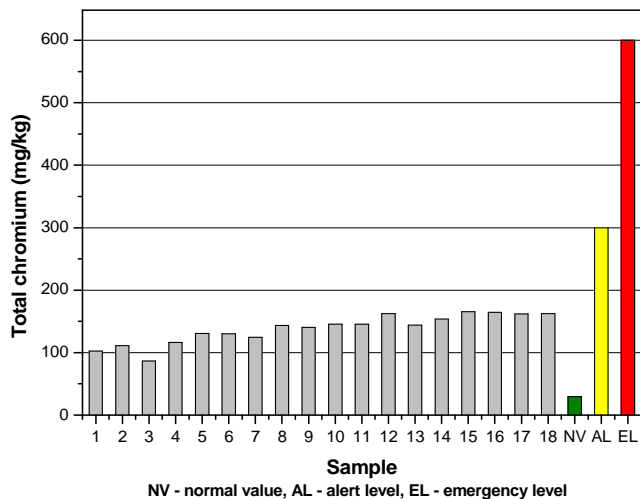


Figure 8. Total chromium concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

The zinc concentrations values for soil samples prelevated from limitrophe area of Tg-Jiu are presented comparatively in figure 9. According to the experimental data for the majority of the samples have been registered zinc concentrations around normal value. Three samples present zinc concentration values much higher than the normal value, but under alert level.

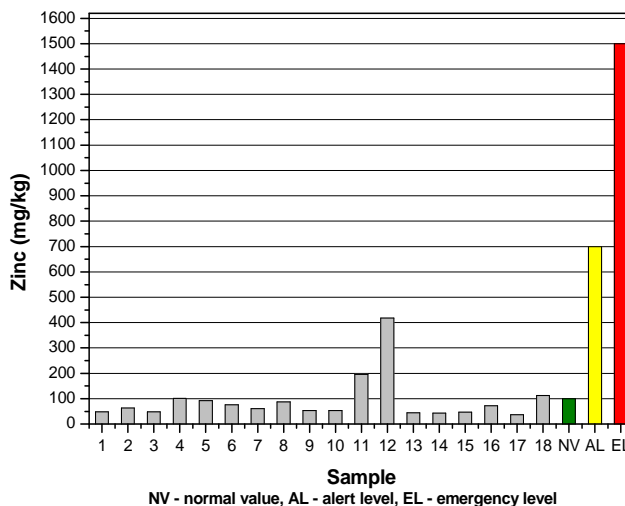


Figure 9. Zinc concentrations values for soil samples prelevated from limitrophe zone of Tg.-Jiu industrial area

The cadmium concentration for the soil samples prelevated from limitrophe areas of Tg-Jiu are presented comparatively in table 1.

The cadmium concentration values in all analyzed samples are under 0.01 mg/kg, value smaller than the alert level.

### 4. Conclusions

The aim of this paper was to evaluate the soil pollution level with metals in limitrophe zone of Tg.-Jiu industrial area.

Soil samples were taken from 18 points, at different distance from Tg.-Jiu industrial area (50 m, 100 m, 150 m, 500 m and 1000 m).

The samples pH values were in the range 3.7 – 4.3.

All metals concentrations from analysed soil samples are approximately around normal values, under alert and emergency level, corresponding for the soils less sensitive.

Following the evaluation of soil samples parameters can conclude that the soil from limitrophe zone of Tg-Jiu industrial area in not polluted with metals.

TABLE 1. The cadmium concentrations values for soil samples prelevated from limitrophe Tg-Jiu industrial area

Sample	1	2	3	4	5	6	N.V.	A.L.	E.L.
Cadmium (mg/kg)	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	1	5	10
Sample	7	8	9	10	11	12	V.N.	P.A.	P.I.
Cadmium (mg/kg)	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	1	5	10
Sample	13	14	15	16	17	18	V.N.	P.A.	P.I.
Cadmium (mg/kg)	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	1	5	10

N.V. – normal value, A.L. – alert level, E.L. – emergency level

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