Environmental Engineering and Management Journal November/December 2008, Vol.7, No.6, 851-858
http://omicron.ch.tuiasi.ro/EEMJ/

"Gh. Asachi" Technical University of Iasi, Romania

QUALITY ANALYSIS OF THE SOILS IN THE CORDUN METALLURGICAL PLATFORM AREA

Elena Doinița Cârlig[1*], Matei Macoveanu[2]

[1]*Environmental Protection Agency, Neamt County, Romania*
[2]*"Gheorghe Asachi" Technical University of Iasi, Faculty of Industrial Chemistry and Environmental Protection, Department of Environmental Engineering and Management, 71 Mangeron Blvd., 700050 Iasi, Romania*

Abstract

The present article deals with the study of the quality of the soils in the Cordun area – the waste dump. This refers to the characteristics of the analyzed location site (geomorphological, geological considerations, the pedological and agrochemical characterization of the soils in the area outside the plant), but also to the establishment of the pollution rate in the location site (experimenata data, results and debates). The conclusion of the present article is that the analyzed area presents a potentially significant pollution rate in the area outside the plant and significant in the area inside the plant's yard.

Keywords: levigation, clay iluviation, eluviation, gleization, leaching (percolation)

1. Characteristics of the analyzed site

1.1. Geomorphological considerations

Fluviatile geomorphological forms, which resulted as a consequence of the action of the active factors, but also because of the structure and the rock, form together a microregion of confluence. From the morphostructural point of view, it is part of the province of the East-European platform, where different grounds are formed such as structural plains - plateaux, structural plains and cuestas, (Andone et al., 1992). Morphogentically, the ground has taken the present configuration in the quaternary, under the influence of the negative tectonic movements and the climateric oscillations, which caused the alternation of the glaciar and interglaciar phases.

The studied area is included from the geomorphological point of view in Moldavian Plateau, more precisely in the subunity known under the name of Moldova – Siret Chute. This subunity is delimited at the West by the hill Piemountain area, and in the East by Barlad Plateau.

In the studied area, the Chute includes two different relief forms, namely the terminal Sector of the Moldova inter-river – Siret, with altitudes higher than 200 m on the balance line which links Sabaoani - Traian – Cordun villages and a flat relief of Moldova's and Siret's major streambeds.

Here and there, the steps of the cliffs situated at relative altitudes from 20 m to 115 m, can be distinguished in the area on the left side/slope. Their morphological elements are hardly perceptible, because of the areolar errosion phenomen and the coluvio– proluvial glacis. In fact, the terminal sector of Moldova– Siret inter-river is a unification of the terraces of the two rivers, their deposits being covered by an alluvial layer.

1.2. The geology of the region

The terraces in this area were formed in Quaternary as a consequence to the alluviations in the interglacier phases, in other words, these terraces correspond to some sedimentation stages, respectively glacier stages (Oncescu, 1959). A difference between the geological age and the morphological age can be made. The Roman area was formed from two morphological units (Oancea, 1959).

- the Sub-Carpathian neogenous unitaty – composed mostly of aquitanian deposits (argillaceous with salt), burdigalians (sandstones, sandstones

* Author to whom all correspondence should be addressed: phone: 0040-744869860, e-mail: edcarlig@yahoo.co.uk

alternated with marls) and tortonian (marls and sanstones).

- the Moldavian Platform unity – composed of Bessarabian subdeposits (sands interlayered by marls, limous sandstones and two-three eolitic lime levels) combined with paleozoic, mezozoic and neozoic formations. The quaternary is formed of fluviatile and slope deposits.

The territory of the Cordun village is situated in the South-Western part of the Moldavian Platform. This area is an alluvial plain of young age, being composed mostly of medium gravel interlayered with chads/shingles, subordinatedt to the argilleous and argillo-dusty sands, their thickness beyond of maximum 3-5 m.

1.3. Pedological and agrochemical characterization of the soils from the area outside the metallurgical platform

The geographical disposition of the village of Cordun plays an essential role in what concerns the general physical geographical setting of formation of zonal soils; the presence of Moldova and Siret rivers, some of the most important hydrographic drainages in the Eastern part of Romania, have conditioned the formation of intrazonal soils.

Pedogentic processes through which soils in the area were formed are levigation, clay iluviation, eluviaion, gleization, psudogleization (Lupascu et al., 1998):

- levigation as a pedogentic process represents the shifting on the profile of the soil or out of it, through the infiltration water, of some soil constituents;
- clay iluviation is the pedogentic process characterized by the mechanical translocation of clay from a superior horizon to an inferior horizon; thus such a clay iluvial or argilic horizon, rich in clay thanks to the above horizon, is formed;
- eluviation is represented the shifting on the profile by water , in suspension or in sollution, of some components of the soil material, usually from a superior horizon to an inferior one;
- gleization as a process of pedogenesis or alteration means the reduction of the ferric iron with the marbling of the material mass in a mainly anaerobe environment, temporary or permanent, in a weak draining determined by the presence of water;
- pseudogleization means the marbling process of the soil material as a consequence of the oxidation and reduction process in the soil in aerobiosis and anaerobiosis conditions, due to storage and stagnation of water from precipitations in the soil profile on to an impermeable or low-impermeable horizon;

In the area, the following soil types can be found:

- Cambic chernozem (no humus cumulation)
- Clay iluvial chernozem (profound distribution of the humus according to the profile)
- Brown luvic soil (reduced distribution of the humus)
- Brown eumezobasic soil (reduced distribution of the humus)
- Alluvial protosoil
- Alluvial soil
- Anthropic protosoil is a type of soil formed on the materials deposited through human activities; the deposited materials have different chemical and physical characters.

The soils situated in the Moldavian alluvial plain have been permanently under the influence of flooding and lateral erosion processes exercised on the banks. Nowadays, through the embanking of the bank of Moldova, important areals covered with alluvial soils and anthropic protosoils have been drawn from under the influence of these processes.

Out of the analysis of the types of soil regarding the reserve of humus in the studied area – we can observe a low weight of soils with a high content of humus and thus it result for this territory the soils' lower capacity to retain pollutant elements.

Soils permeability is a characteristic of soils dependent on soils' texture on the control section and the total porosity. The data presented in the surveys made for the analyzed area demonstrates the fact that 24.25 % of the territory has an accelerated permeability, insureing an intense percolation of the soils and thus a levigation possibility of the pollutant products towards depth (OSPA Neamt, 1996).

Percolation as a process means the depth penetration of the descendent water current obtained from precipitations or other sources. In the analyzed area, 49.21 % of the territory has a low or very low permeability and on these surfaces percolation is produced more slowly, thus producing a bigger stagnation of the pollutant elements on the soil area (OSPA Neamt, 1996).

Quality soil classes of the studied area (the waste dump) shows the following situation:

- low quality areas : they include areas or soils affected by limitations or strong degradation processes (gleization, flooding and edaphic volume), which represents the 4th soil class;
- very low quality areas : not advisable to use for arable land; non-improving limitations, or improving limitations (gleization, pollution, flooding rate, surface humidity excess), which represent the 5th soil class;

2. Soil pollution evaluation in the metallurgical platform area

2.1. The analysis of the health status of the soil in the platform area – global pollution index method

This method assumes the implementation of several stages of synthetic appreciations based on quality indicators that may reflect the general status of one of the analyzed environmental factors and then indicate them through a graphical method.

Soil quality framing at a given time is done with a a bonity scale, by giving some grades to express the nearness or the remoteness from the ideal status (Table1). The bonity scale uses grades from 1 to 10. The natural status unaffected by human activity is represented by 10, and 1 is the grade representing an irreversible status and extremely serious of deterioration of the analyzed environmental factor.

2.2. Experimental data

2.2.1. Samples

In order to determine soil characteristics at the surface and in depth (5 and 30 cm), a manual sampling device was used, which has been cleaned after every assay. Soil logs have been performed on the basis of influencial areas analysis and they may have been influenced by the activity in the area.

For the site surface characterization it has been gathered a number of (15x2) samples from the site [S_1 – East T sect., S_2 – M (N) sect.– billet store, S_3 – residue oils separator, S_4 – Combustible bank, S_5 – FMT sect.– in the back, the water tower, S_6 – etching – T sect. , S_7 – neutralization station – etching, S_8 – North HTS, S_9 – the oxygen plant (in the front), S_{10} – CHP – dam, S_{11} – main gate 1, S_{12} –hammer shop (in the front) – cooling tower, S_{13} – 30 m South from the exist hammer shop, S_{14} –S shop– turboblowers pump, S_{15} – brisk shop], (2x2) samples outside the sitei [S_{16} – in front of the unit – near the eating-hall, S_{17} – arable land at 100 m behind the unit], but in the near vecinity (neighbouring) and a sample considered as etalon (at the same depth) on the Roman–Iasi highway 5 km from the analyzed unit.

2.2.2. Analytical techniques for soil

As a result of the current activities there was a need for some determinations concerning: waste of heat, pH, the total amount of extractable substances, organic carbon, gas and vapours, iron, chrome, lead, nickel and cadmium ions content.

a. Substances extractable in petroleum ether

Tapped soil samples were analyzed from the point of view of the total content of substances extractable in ether, using the petrolium ether extraction method according to STAS 7587 -96.

Soil samples were dried, pestle milled and passed through a 2 mm coarse sieve. Approximately 10 g of sieved soil, weighed analytically, were contacted under agitsation with 50 ml of petrolium ehter. After approximately 20 minute of extraction the suspension is being filtered on to 1g of anhydrous sodium sulphate. The extract is collected in a tared crucible, and then introduced in the drying system for the evaporation of the solvent (40◦C maximum). When the evaporation residue gets to a constant point, the extract quantity is determined.

b. Organic carbon

The establishment of the content of the soil analyzed in organic matter, absorbed gas and vapours was made through the treating of the samples with potasium dichromate, at heat in the presnce of sulphuric acid, the dichromate excess being titrated in Mohr salt sollution in the presence of ferronine as an indicator (yellow –red green turn).

c. Contents of chrome, lead, zinc, nickel si cadmium ions

2 g of soil dried in air and pestle milled are introduced in a Berzelius glass on to which we add approx. 5 ml concentrated azotic acid and it's coverred with a watch glass. It is mineralized on sand bath, at the blockout, until the residue turns completely white.

If the residue is not completily mineralized after the vaporization of the nitric acid, we should add 2 cm^3 of perchloric acid and the mineralization continues (according also to SR ISO 11047/1999). The distruction of the organic component of the soil occurs. The residue is being re-treated with nitric acid 4% sollution, easily heated to facilitate solving. After cooling it is filtrred on low prorosity filter paper in a graded bottle at 25 cm^3. The bottle is properly washed in distilled water and it is filled in at the sign. The content of chrome, lead, nickel and cadmium ions is determined using atomic absorption spectrophotometriy according to the graduation curves for each and every studied ion (a Perkin Elmer atomic absorption spectrophotometer and for calibration it has been preferred the use of salts of nitric or sulphate studied ions).

Table 1. Evaluation scale for environmental component soil (Robu et al., 2005)

Evaluation grades	*Cu (mg/kg)*	*Zn (mg/kg)*	*Pb (mg/kg)*	*Ni (mg/kg)*	*Cd (mg/kg)*	*Cr^{total} (mg/kg)*	*TOC (%)*	*Extractable compounds (mg/kg)*
10	0-100	0-100	0-100	0-50	0-1	0-30	<3	<100
9	100-150	100-250	100-250	50-200	1-5	30-150	3 -3.2	100-500
8	150-250	250-550	250-550	200-350	5-7	150-300	3.2 -3.4	500-1000
7	250-500	550-750	550-750	350-500	7-10	300-600	3.4 -3.6	1000-2000
6	500-550	750-800	750-800	500-750	10-15	600-750	3.6-3.8	2000-3750
5	550-600	800-850	800-850	750-800	15-20	750-800	3.8-4.0	3750-5000
4	600-650	850-900	850-900	800-850	20-25	800-850	4.0-4.5	5000-6250
3	650-700	900-950	900-950	850-900	25-40	850-900	4.5-7	6250-7500
2	700-800	950-1000	950-1000	900-1000	40-50	900-1000	7-10	7500-10000
1	>800	>1000	>1000	>1000	>50	>1000	>10	>10000

2.3. Results and discussions

The results of the analyses are presented in Tables 2-9.

Note: The determining of the substances extractable in petrolium ether may cumulate other organic substances besides petrolium hydrocarbons.

According to MAPPM Order no. 756/1997 (MO, 1997), the analyzed site is characterized as being a soil:

- with less sensible usage (for intra-plant soil);
- with sensitive usage (for outside plant area usage).

From the examining of the experimental data, the following items resulted:

- in many of the points inside the the unity (6 points) the intervention point is outlevelled for the substances extractable in petrolium ether; the same thing can be told about the alert values (it is outlevelled at 42.86% of the number of the soil samples).

Table 2. The results of the physical-chemical analyses of the soil samples (5 cm depth of sampling)

Soil sample	***The depth sampling 5 cm***				
	Organic carbon (%)	Extractable compounds (mg/kg)			
		Normal values	Alert values	MAC*	Measured values
S_1	4.31	<100	1000	2000	3720
S_2	3.58	<100	1000	2000	940
S_3	3.45	<100	1000	2000	3380
S_4	4.28	<100	1000	2000	27480
S_5	4.10	<100	1000	2000	2880
S_6	3.82	<100	1000	2000	9330
S_7	4.54	<100	1000	2000	670
S_8	4.45	<100	1000	2000	720
S_9	3.58	<100	1000	2000	110
S_{10}	4.26	<100	1000	2000	840
S_{11}	6.40	<100	1000	2000	250
S_{12}	3.76	<100	1000	2000	100
S_{13}	4.52	<100	1000	2000	140
S_{14}	4.69	<100	1000	2000	660
S_{15}	7.59	<100	1000	2000	700
S_{16}	4.29	<100	200	500	2080
S_{17}	2.62	<100	200	500	140
Etalon	2.44	<100	200	500	180

* MAC – Maximal allowed concentration

Table 3. The results of the physical-chemical analyses of the soil samples (30 cm depth of sampling)

Soil sample	***The depth of sampling 30 cm***				
	Organic carbon (%)	Extractable compounds (mg/kg)			
		Normal values	Alert values	MAC	Measured values
S_1	2.82	<100	1000	2000	2830
S_2	3.52	<100	1000	2000	600
S_3	3.60	<100	1000	2000	11730
S_4	2.87	<100	1000	2000	15090
S_5	3.08	<100	1000	2000	3140
S_6	3.28	<100	1000	2000	5012
S_7	4.00	<100	1000	2000	1870
S_8	3.95	<100	1000	2000	950
S_9	4.32	<100	1000	2000	280
S_{10}	4.50	<100	1000	2000	330
S_{11}	5.96	<100	1000	2000	380
S_{12}	3.71	<100	1000	2000	2540
S_{13}	4.52	<100	1000	2000	440
S_{14}	3.52	<100	1000	2000	780
S_{15}	7.47	<100	1000	2000	337
S_{16}	3.86	<100	200	500	1050
S_{17}	3.00	<100	200	500	160
Etalon	2.38	<100	200	500	195

Table 4. The content of total chromium from soil samples

Soil sample	***Total Cr (mg/kg)***				
	Normal values	Alert values	MAC	Masured values at 5 cm	Masured values at 30 cm
S_1	30	300	600	28.12	23.18
S_2	30	300	600	181.01	49.12
S_3	30	300	600	30.10	27.12
S_4	30	300	600	56.78	86.10
S_5	30	300	600	79.92	58.42
S_6	30	300	600	26.10	23.16
S_7	30	300	600	61.66	58.12
S_8	30	300	600	21.28	20.12
S_9	30	300	600	75.01	76.25
S_{10}	30	300	600	69.12	51.05
S_{11}	30	300	600	20.13	20.08
S_{12}	30	300	600	18.71	17.02
S_{13}	30	300	600	21.08	21.00
S_{14}	30	300	600	42.61	31.11
S_{15}	30	300	600	27.11	23.42
S_{16}	30	100	300	21.13	15.08
S_{17}	30	100	300	17.92	16.12
Etalon	30	100	300	17.89	17.51

Table 5. The content of lead from soil samples

Soil sample	***Total Pb (mg/kg)***				
	Normal values	Alert values	MAC	Masured values at 5 cm	Masured values at 30 cm
S_1	20	250	1000	14.11	10.50
S_2	20	250	1000	49.15	47.20
S_3	20	250	1000	16.21	20.12
S_4	20	250	1000	53.81	68.12
S_5	20	250	1000	41.75	90.05
S_6	20	250	1000	18.11	17.65
S_7	20	250	1000	32.12	30.08
S_8	20	250	1000	18.61	20.40
S_9	20	250	1000	22.62	30.76
S_{10}	20	250	1000	13.08	14.11
S_{11}	20	250	1000	10.62	11.14
S_{12}	20	250	1000	13.10	14.44
S_{13}	20	250	1000	5.86	6.03
S_{14}	20	250	1000	8.33	9.12
S_{15}	20	250	1000	5.56	5.58
S_{16}	20	50	100	4.81	4.86
S_{17}	20	50	100	5.12	6.14
Etalon	20	50	100	1.36	1.88

- the organic carbon content is an indicator which allows the apreciation of the pollution level of a soil. The organic carbon percentage found indicates a soil between easily (1-3 % Corganic) and strongly polluted (>4 % Corganic) (Manescu, et al., 1994). We can observe the presence in eleven prelevation points of some values of the organic carbon content bigger than 4 %, which indicates the presence in these areas of a strongly polluted soil (42.85 %).
- the alert values for the chrome ions of 300 mg/kg dry soil (MAC 600 mg/kg) is not outlevelled, the maximum value found being that of 181,01 mg/kg (S_2) at 5 cm and , respectively, 86,10 mg/kg at 30 cm (S_4) – these values outlevel the normal values of 30 mg/kg.
- for the zinc ions, the alert values of 700 mg/kg dry soil (MAC : 1500 mg/kg) is not outlevelled; three of the values (5cm) outlevel the normal value of 100 mg/kg.
- lead ions outlevel the normal value of 20 mg/kg in seven prelevation points (at 30 cm) – S_2, S_3, S_4, S_5 si S_7, S_8, S_9, but without attaining the alert and MAC.
- copper ions outlevel the normal value of 20 mg/kg in seven prelevation points (at 5 cm) – S_1, S_2, S_3, S_4, S_5, S_6 si S_9, but without attaining the alert and MAC.

Table 6. The content of zinc from soil samples

Soil sample	***Zn (mg/kg)***				
	Normal values	Alert values	MAC	Masured values at 5 cm	Masured values at 30 cm
S_1	100	700	1500	47.52	41.26
S_2	100	700	1500	71.10	68.12
S_3	100	700	1500	49.81	44.15
S_4	100	700	1500	131.07	126.12
S_5	100	700	1500	110.32	91.16
S_6	100	700	1500	44.10	44.07
S_7	100	700	1500	88.10	56.08
S_8	100	700	1500	113.54	99.55
S_9	100	700	1500	98.44	56.71
S_{10}	100	700	1500	43.21	25.61
S_{11}	100	700	1500	49.33	38.77
S_{12}	100	700	1500	35.14	30.19
S_{13}	100	700	1500	29.44	28.77
S_{14}	100	700	1500	98.66	65.87
S_{15}	100	700	1500	22.13	21.88
S_{16}	100	300	600	17.65	16.57
S_{17}	100	300	600	12.66	12.22
Etalon	100	300	600	7.21	6.54

Table 7. The content of copper from soil samples

Soil sample	***Cu (mg/kg)***				
	Normal values	Alert values	MAC	Masured values at 5 cm	Masured values at 30 cm
S_1	20	250	500	22.51	16.52
S_2	20	250	500	82.13	36.12
S_3	20	250	500	24.10	18.12
S_4	20	250	500	91.12	65.10
S_5	20	250	500	69.65	77.10
S_6	20	250	500	21.95	20.55
S_7	20	250	500	10.61	9.12
S_8	20	250	500	15.64	15.36
S_9	20	250	500	38.60	21.12
S_{10}	20	250	500	11.56	5.62
S_{11}	20	250	500	8.12	5.61
S_{12}	20	250	500	15.11	13.20
S_{13}	20	250	500	7.12	7.08
S_{14}	20	250	500	18.99	12.11
S_{15}	20	250	500	5.65	5.91
S_{16}	20	100	200	11.82	13.65
S_{17}	20	100	200	10.10	8.30
Etalon	20	100	200	8.12	8.31

- nickel ions outlevel the normal value (20 mg/kg) in fourteen prelevation points (both at a depth of 5 cm and 30 cm) : S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}, S_{11}, S_{12}, S_{13} si S_{14} ; none of the values doesn't attain the intervention or alert values.
- regarding the cadmium content : all the seventeen determined values outlevel the normal value (1 mg/kg s.u.), and three of the values outlevel the alert values level (S_3 – at 30 cm, S_{10} – at 5 cm and at 30 cm, S_{14} - at 5 cm); moreover, in the outside plant area the cadmium content is close to the alert values.
- the evaluation level for the soil has been calculated in basis of the measured values in total organic carbon, substances extractable in petrolium ether and heavy metals (Cu, Zn, Pb, Cr^{total}, Ni, Cd).

Thus the following values have been obtained:

◦ total organic carbon– plant area: 5.15; outside plant area: 7

◦ substances extractable in petroleum ether - plant area: 6.85; outside plant area: 7.75

◦ Cr^{total} – plant area: 8.93; outside plant area: 10

◦ Pb – plant area: 10; outside plant area: 10

◦ Zn – plant area: 9.85; outside plant area: 10

◦ Cu – plant area: 10; outside plant area: 10

◦ Ni – plant area: 9.75; outside plant area: 10

◦ Cd – plant area: 8.49; outside plant area: 9

Table 8. The content of nickel from soil samples

Soil sample	***Ni (mg/kg)***				
	Normal values	Alert values	MAC	Measured values at 5 cm	Measured values at 30 cm
S_1	20	200	500	23.77	24.86
S_2	20	200	500	146.23	53.13
S_3	20	200	500	26.41	29.89
S_4	20	200	500	58.11	56.09
S_5	20	200	500	51.81	45.72
S_6	20	200	500	30.54	27.12
S_7	20	200	500	25.16	22.36
S_8	20	200	500	41.13	63.33
S_9	20	200	500	30.12	41.12
S_{10}	20	200	500	31.41	71.45
S_{11}	20	200	500	37.33	31.22
S_{12}	20	200	500	36.11	28.71
S_{13}	20	200	500	25.33	21.33
S_{14}	20	200	500	22.12	22.08
S_{15}	20	200	500	19.87	16.45
S_{16}	20	75	150	17.55	15.44
S_{17}	20	75	150	16.32	15.11
Etalon	20	75	150	14.33	13.45

Table 9. The content of cadmium from soil samples

Soil sample	***Cd (mg/kg)***				
	Normal values	Alert values	MAC	Measured values at 5 cm	Measured values at 30 cm
S_1	1	5	10	1.56	1.28
S_2	1	5	10	9.71	2.68
S_3	1	5	10	11.12	5.69
S_4	1	5	10	10.11	14.12
S_5	1	5	10	1.96	1.41
S_6	1	5	10	1.99	1.54
S_7	1	5	10	1.65	1.42
S_8	1	5	10	3.77	3.12
S_9	1	5	10	4.12	3.71
S_{10}	1	5	10	5.82	5.11
S_{11}	1	5	10	1.91	1.20
S_{12}	1	5	10	2.71	2.50
S_{13}	1	5	10	4.32	4.20
S_{14}	1	5	10	5.12	4.32
S_{15}	1	5	10	3.75	3.01
S_{16}	1	3	5	2.89	2.56
S_{17}	1	3	5	2.75	2.50
Etalon	1	3	5	0.98	0.96

▪ Soil evaluation level is of 8.91 (plant area: 8.62; in outside plant area: 9.21)

In order to connect the points resulted from the attachment of the values expressing the real status, a geometrical figure - a circle results (Fig. 1), with a surface smaller, included in the regular geometrical figure of the initial status.

The indicator of the global pollution status of the environment, *Ipg* results from the ratio between the surface representing the ideal status *Si* and the surface representing the real status *Sr* (Fig. 1).

$$S_{ideal} = \Pi \cdot r^2 = \Pi \cdot 10^2 = 314$$

$$S_{real} = \Pi \cdot 8.91^2 = 249.27$$

$$Ipg = \frac{314}{249.27} = 1.25$$

When there are no modifications of the environmental factors, thus no pollution, this indicator is equal to 1. Graphically speaking, the geometrical figure, illustrating the environmental real status is superposed on the figure illustrating the ideal status. When there are modifications in the quality of the environmental factors, *Ipg* is bigger and bigger supra-unitary values as the surface of the real circle are reduced.

In order to analize the values obtained for the global pollution indicator, a scale from 1 to 6 has been proposed, as follows:

I = 1 – natural environment unaffected by hyman activity;

1<I<2 – environment affected by human activity in admissible limits;

2<I<3 – environment affected by human activity, causing discomfort status to life forms;

3<I<4 – environment affected by human activity, causing troubles to life forms

4<I<6 – environment greatly affected by human activity, dangerous to life forms;

I above 6 – degraded environment, improper to life forms

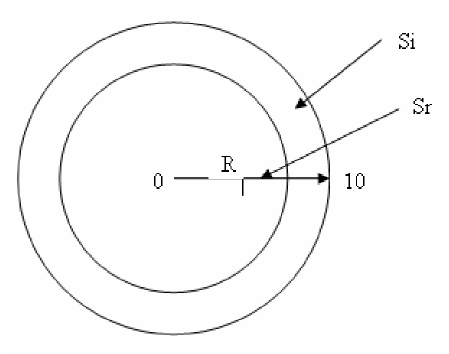

Fig. 1. Graphic representation for *Ipg* evaluation

For the studied case the following results were obtained:

1<1.25<2 *– environment affected by human activity, causing discomfort to all life forms;*

4. Conclusions

Plant area soil may be considered in some areas as significantly polluted. The main contaminats of the plant area soil are the organic carbon content (considering the substances extractable in petroleum ether) and the cadmium content.

Outside the plant area soil presents a pollution rate potentially significant: mostly polluted is the area in front of gate 1, in front of the eating-hall (S_{16}), the reduction measures of the pollution and degradation tendence of the area soil must mainly regard the waste management, water discharges from the site and the fall-out and solid particles emission through the dispersion funnels or chimneys of the unity.

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