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MONITORING PLAN FOR THE ROSIA MONTANA PROJECT SITE AND SURROUNDING AREAS TARGETING SOIL IMPACTS DURING CONSTRUCTION, OPERATION, CLOSURE AND POST-CLOSURE

2007

Contents

1. Introduction

Implementation of Rosia Montana Project will include several stages. They will start with organising the site logistics camp, development of roadways, power and water supply lines, and spaces required for such activities. It will then continue with construction of the industrial facilities themselves, of which the more important will include: opening the pits for the extraction of ore and construction materials (sandstone and andesite), building o the process plant, of the tailings management facility dam, implementation of the whole system of installations involved in the good operation of waste transfer and disposal activities, building of landfill foundations, etc. This will be followed by the operations stage, planned to last for about 16 years, when the ore will be extracted from the pits, transported to the process plant, and the resulting tailings will be disposed of in the dedicated TMF pond. Waste rock disposal, low grade ore and soil stockpiling activities will be conducted in parallel.

Once the deposit becomes depleted, at the end of ore extraction and processing activities, c closure stage will include decommissioning of the operational equipment and installations, dismantling of waste rock and soil stockpiles for the purpose of environmental restoration of the degraded land, reconstruction of soil profiles and re-vegetation of newly formed soils. A post-closure stage will follow, during which the long-term effects of the activities conducted throughout the operating years of the Project, and of the closure stage in particular, will be monitored.

Each of the operational steps of the Project will have negative effects on the environment in general, and therefore on soil. The activities conducted on the site will largely represent sources of pollution, at first for the ambient air, and then for the soil. Pollutant materials initially released to the air in the form of solid particles or gases, after undergoing chemical transformation there, will be re-deposited on the soil and induce unwanted changes, unless special measures are adopted.

In open cast mining, the main source of air and soil pollution is dust from blasting, excavations and transport of useful and waste material. Dust contains a number of chemical elements that, once deposited onto the soil, may become pollutant once they exceed a certain concentration level. Heavy metals form an important part of these chemical elements.

Other sources of pollution include combustion gases generated from fuel burning facilities in mobile and stationary devices: Combustion gases include carbon oxides (CO, CO_2), nitrogen oxides (NO_x, N_2O), sulphur oxides (SO_2, SO_3), volatile organic compounds, volatile and condensable polycyclic aromatic hydrocarbons etc.

Once in the ambient air, they will all undergo chemical hydration and oxidation transformations then come back onto the soil in the form of acid rain, affecting the vegetation and acidifying the soil or increasing the natural acidity of acidic soils. Given the above, it follows that there is a need to protect at least the quality of non-stripped soil in the Project impact area, as well as of the soil in the areas surrounding the ore extraction and processing site area. This may not be achieved without control of the soil quality dynamics. It will also be necessary to control the soil quality dynamics in the stockpiled materials after stripping. It is necessary that the physical, chemical and microbiological characteristics of the soil should not be significantly impacted, so that it may be used in good condition for the environmental rehabilitation of areas degraded by construction works.

2. Legal Framework

This monitoring plan for the Rosia Montana project site and surrounding areas, from the point of view of soil impacts during the construction, operation, closure and post-closure stages was developed in accordance with the Order of the Minister of Waters and Environmental Protection No. 863 of 2002, Annex 2, part II on approving the Methodological Guidelines applicable to the framework environmental impact assessment procedure. This was supplemented by Law No. 444 of 8 July 2002 approving Governmental Emergency Ordinance No.38 of 2002 on the development and funding of soil and agro-chemical studies and the financing of a National Soil-Land Monitoring System for Agriculture and a Soil-Vegetation one for Forestry. The monitoring methodology is specified in Annex No. 5 of this Law. A further addition was Government Decision No. 1003 of 2003 on approving the National Soil-Forestry Vegetation Monitoring Plan for Forestry.

The following regulations have also been taken into consideration: Emergency Ordinance No.152 of 10 November 2005 on integrated pollution prevention and control, Emergency Ordinance No. 195 of 22 December 2005 on environmental protection, Government Decision No. 1403 of 19 November 2007 on the rehabilitation of areas where the soil and terrestrial ecosystems have been affected, Government Decision No.1408 of 19 November 2007 on soil and subsoil pollution investigation and assessment approaches, Mine Law No.85 o 2003, Government Decision No. 1208 of 2003 approving the Implementation Norms for the Mine Law and Order of the Ministry of Industry and Resources No. 273 of 2001 on approving a Mine Closure Manual.

In conducting the monitoring, consideration should be given to Order No.756 of 3 November 1997 of the Minister of Water, Forests, and Environmental Protection approving the Environmental Pollution Norms.

European Union regulations in this field have also been considered. Some of them include: Council Directive 96/61/EC of 24 September 1996 on integrated pollution prevention and control, EU Commission; European Commission, July 2003, Integrated Pollution Prevention and Control (IPPC), Reference document on general monitoring principles, Directive 2006/21/EC on environmental impact assessment studies, Directive 35/2004/EC on minimising environmental degradation and ecological reconstruction of degraded areas.

3. Establishment of Soil Sampling Points for Monitoring

The location of soil sampling points for monitoring (Annex No. 1) was established in relation to the locations of industrial facilities and to their development over time, so that the sampling points should nit be affected by future industrial development. This will ensure that soil quality in non-stripped areas may be monitored throughout the development of the Rosia Montana Project.

Sampling locations were also selected based on the nature of the industrial facility, so that any effect of the facility activities on soil may be recorded.

With the start of construction activities and the development of extraction and processing activities, the soil within the industrial site will be in one of two situations: undisturbed soil and stripped and stockpiled soil. Soil sampling points have been established for both situations. Thus, the points on the mp (Annex No. 1) numbered from 1 to 17 relate to unstripped soil, while those marked in Roman numerals from I to V, each with sub-notations a and b, relate to stockpiled soil. Numbers from I to V are actually the five soil stockpiles storing stripped soil separately, as topsoil stockpiles collected from the organic upper horizon(s), and stockpiles of soil collected from lower, mineral horizons. Letters a and b denote the two specific points for each stockpile. Therefore, there will be 17 sampling points for unstripped soil and 8 sampling points for stripped and stockpiled soils.

Sampling points for unstripped soil will be operational throughout the Project lifetime, while sampling from stockpiles will become operational only during their existence, namely from the construction to the decommissioning stages, when the closure and environmental rehabilitation work start.

In order to reveal the influence of mining and ore processing activities on areas adjacent to the Rosia Montana Project site, seven soil sampling point have been established and noted on the map under numbers 18 to 25. These points will be operational throughout the project lifetime.

4. Soil Sampling Approaches and Times

Before commissioning any construction work, the undisturbed sampling points will be defined on site. The geographical coordinates will be established by GPS for each point. The points will be marked on a 1:10 000 map. 400 m^2 (20m x 20m) reference plots will be defined around each sampling point. A soil profile will de established in the centre of each plot where soil samples will be taken in the disturbed and undisturbed state.

Before sampling, once the profile is established, photographic documentation ill be taken. Disturbed soil samples will be collected from ever soil horizon, including from significant transition horizons. Each sample should weigh about 1 kg.

Undisturbed soil samples will be collected in 100 cm^3 metal cylinders, four cylinders for each horizon, only from freshly opened profiles.

In order to define the changes occurring in the upper soil horizon, due to polluting impact, two average agri-chemical samples will be collected from across the entire 400 m^2 reference area over a depth of 0-10 cm and 10-20 cm. Each agrichemical average sample will comprised of 25 individual samples collected in a relatively uniform pattern in a square grid. Each agrichemical average sample should weigh about 1 kg.

Samples will be collected from the stockpiled soil in two locations, one located in the lower third of the pile and one at the top. Samples will be collected with a soil probe every 20 cm. In the point located in the lower third of the pile soil samples will also be collected, if possible, from the first two soil horizons on which the stockpile was built. Collection may be done at an angle, starting at the stockpile base. Soil sampling depth at the top of the stockpile should be 1.5 to 2.0 m.

The first soil sampling step using the described methodology will precede the construction stage. The analytical data collected at this stage will be considered control values. They will be used to compare with values obtained in subsequent monitoring stages, conducted at annual intervals.

5. Physical, Chemical and Biological Analyses of the Collected Soil Samples

5.1. Physical Analyses of Disturbed Soil Samples

Soil samples collected from each soil horizon will be subjected to chemical analyses, but also some physical testing conducted on this type of samples. These will include:
- granulometric composition, based on the Atterberg scale, to determine the 2-0.2 mm, 0.2-0.02 mm, 0.02-0.002 mm and less than 0.002 mm fractions, with values expressed as percentages;
- content of structural hydro-stable macro-elements (% g/g);
- structural micro-element dispersion (% g/g);

The structural instability index will be calculated.

5.2. Physical Analyses of Undisturbed Soil Samples (in Cylinders)

Laboratory testing will determine:

- spot humidity (% g /g);
- apparent density ($kg.m^{-3}$);
- resistance to penetration (Mpa);
- saturated hydraulic conductivity ($mm.h^{-1}$);
- hygroscopic coefficient (% g/ g);
- humidity equivalent (% g /g)

Based on analytical data, the following will be calculated:

- total porosity (% v/ v);
- extent of consolidation;
- size distribution of pores (% v/ v);
- wilting coefficient (%);
- field capacity (%);
- aeration porosity (%).

5.3. Current Chemical Analyses for Soil Characterisation

- soil reaction (pH in aqueous suspension)
- organic matter (humus) content, %
- total nitrogen content, %
- sum of changeable bases me 100g soil
- changeable base content by chemical elements (Ca, Mg, Na, K), me/100g soil
- hydrolytic acidity me/ 100g soil
- changeable aluminium, me/ 100g soil
- saturation extent in bases, me/ 100g soil
- mobile phosphorus content, soluble in ammonium acetate-lactate solution, $mg.kg^{-1}$
- mobile potassium content, soluble in ammonium acetate-lactate solution, $mg.kg^{-1}$

5.4. Chemical Analyses Required for Establishing Pollution Intensity

- total heavy metal content (Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn), $mg.kg^{-1}$.
- mobile heavy metal content, soluble in ammonium acetate solution, - EDTA at pH 7.0, $mg.kg^{-1}$
- total and mobile sulphur content $mg.kg^{-1}$.
- total petroleum hydrocarbon content $mg.kg^{-1}$.

- total cyan ammonium content (CN) mg.kg^{-1}

5.5. Qualitative and Quantitative Microbiological Analyses

- number of bacteria, viable cells/ g of soil
- number of fungi, u.f.c./ g of soil
- soil breathing, mg CO_2/100g soil

Most methods used in soil monitoring analyses are standardised.

5.6. Analysis Quality Control

The analyses will be performed by accredited laboratories. A control program will be implemented by the Contractor under its internal analytical control system. International and internal standards will be used to this effect. A control sample will be analysed for each analytical series. The Beneficiary will conduct its own control by sending out repeat, duplicate or triplicate samples for analysis.

6. Phase and Final Reporting on Monitoring

Analytical data delivered by the specialist laboratory will be interpreted by the soil science specialist accredited for this purpose. He will compare the results obtained in every sampling step with the results of soil samples and analyses conducted before the inception of construction works (control samples) and with the analytical results obtained during the soil study of the soil cover in the area where the mine and process plant have been planned. The specialist will refer to the relevant regulations regarding pollutant level values, if any, and pollution intensity. In his report, the specialist will outline the areas with contamination or pollution problems, establish the intensity of the phenomena, and propose remedial measures. On completing the monitoring, when the morphological, physical, chemical and biological characteristics of the investigated soils are close to the control sample values, from the pr-construction phase, the final report will be developed. This report will include not only soil-related, but also vegetation considerations.

7. Soil Monitoring in the Project Inception Stage

During the pre-construction phase, soil samples will be collected from both the profile developed in the centre of the reference plots, and as agrichemical average samples collected over depths of 0-10 cm and 10-20 cm. Agrichemical average samples will comprise the sum of individual samples collected across the entire 400 m^2 area. Sampling will include all the selected points, both inside the future industrial site, and outside it.

The collected samples will be processed and analysed in authorised laboratories for all the indicators specified under Section 5. The results of these determinations will be considered reference values, characterising the soil at time 0 of the Project. They will represent the soil features in the natural regime, and some of them, specific to the samples collected from areas already influenced to some extent by mining activities, will also cumulate such effects.

Interpretation of the analytical data will also take into consideration the analytical results for soils obtained by the National Research and Development Institute for Soils, Agri-Chemistry and Environmental Protection (ICPA) in 2003, during the soil cover study for the area defined for the Rosia Montana Project activities. Many of the profiles developed at that time will no longer be significant for the monitoring stage, as the respective soils will have disappeared by stripping, pit development, coverage with waste rock, low grade ore and topsoil stockpiles. Many of those profiles were taken from the area designated for the construction of the TMF system facilities. The soil impact assessment study reviewing the impacts of silver and gold bearing ore extraction and processing activities, a study developed by the same institute in 2006 must also be taken into consideration.

8. Soil Monitoring during the Construction Stage

With the inception of construction works, the soil will suffer a major impact in the stripping of significant areas of land for the development of roads and buildings. The stripped soil will be transported and stored in separate stockpiles, depending on its origin, from upper, organic, humus-rich horizons and from lower, mineral horizons. Also, the soil beneath the stockpiles will be removed from its natural cycles and undergo significant physical, chemical and microbiological changes when it is covered and the horizontal transfer of air and water stops. A total area of 1,061.61 ha will be affected overall.

During the construction stage, accidental pollution with petroleum products may occur due to tank leaks or during repairs of equipment in places not specifically designated for this purpose.

In the process plant development area, the soil may become polluted by dust and fumes from vehicles, dust from the concrete preparation plant, or from construction waste.

Given that at this stage dust will be the major pollutant of the ambient air and ultimately of the soil, during the construction stage, care should be taken to determine whether the dust induces any physical, chemical and microbiological changes in the upper soil horizon.

Therefore, during the construction stage, average agrichemical samples will be collected for the two depths as indicated (0-10 cm and 10-20 cm), according to the methodology described in section 4, from all the 25 reference areas, located both within and outside the industrial site.

These disturbed soil samples will be analyzed for only some of the physical, chemical and microbiological parameters as indicated in section 5. These will include: granulometric analysis, pH in aqueous suspension, organic matter content, carbonate content, total nitrogen content, sum of exchangeable bases, hydrolytic acidity, base saturation extent, mobile phosphorus and mobile potassium content. In order to determine the nature and intensity of pollution, the total heavy metal content, the total and mobile sulphur content and residual petroleum hydrocarbon content will also be determined. Microbiological changes may be established by determining soil breathing intensity, and if it has changed significantly from the control values, as established in the preliminary monitoring stage, the number or bacteria and fungi may also be determined.

The analyses indicated to be performed during this stage may reveal whether the soil material, especially in the top ten cm, has undergone any change of granulometric composition, due to dust depositions, and if the dust has changed the levels of any chemical indicators, such as: pH, the sum of exchangeable base, organic matter content, total nitrogen and mobile forms of phosphorus and potassium.

If the intensity of such changes is strongly negative, buffering measures may be required. ?

9. Soil Monitoring during the Ore extraction and Processing Stage

The pollution sources mentioned for the construction stage will persist during operations. Moreover, new sources will occur, including the waste rock, low-grade ore and topsoil stockpiles. The latter will emerge after the stripping of soil from the areas of land used for the construction on industrial facilities or roadways.

During ore extraction and processing operations, the soil may become contaminated following accidental fuel (petrol, diesel)or lubricant spills. Accidental spills of chemical reagents used in the process (sodium cyanide, activates carbon, slaked lime, copper sulphate, sodium meta-bisulphate, and hydrochloric acid) are also possible. Accidents may also occur from the break of tailings delivery pipelines between the process plant and the TMF reclaim pond. Significant pollution may also occur due to breaks in the pipelines transporting acid wastewaters to the neutralisation and treatment plant.

During this stage, that will last or about 16 ears, the full set of analyses indicated in section 5 will be required at 4 year intervals. Analyses will be conducted on samples collected from both the genetic profile horizons and from the two sets of agrichemical average samples, collected from the reference areas.

All the physical, chemical and microbiological tests will have to be performed, as it is necessary that the soil should be fully investigated every four years, a period of high probability of contamination or pollution. With the help of the analytical results, the intensity of this phenomenon can be assessed and environmental rehabilitation measures can be decided.

However, for a timely prevention of such phenomena, it is recommended that an average agrichemical sample should be collected on an annual basis from every reference area, from the two specified depths.

The range of analyses to be performed on these samples will be similar to the one indicated for the agrochemical average samples during the construction stage.

Stripped soil stockpiles will be sampled down to a depth of 1.0 m or 1.5 m, every 20 cm, at four year intervals, while average agrichemical samples will be collected annually from the surface of the pile, again at two depths (0-10 cm and 10-20 cm). There will be two sampling points, one in the lower third of the pile, and one at the top. The samples will be collected across an area of 400 m^2, located around the point where deep soil samples are collected.

The analytical range for the samples collected from stockpiles is similar to the one indicated previously for agrichemical average samples collected at previous stages.

10. Soil Monitoring during the Closure and Post-Closure Phases

Dust will continue to be the major pollutant during the closure stage. It will be generated from the transport of waste rock from stockpiles to the pits and other locations that need to be rehabilitated. The same may occur during the transport of soil from the stockpiles to the areas where the soil profile needs to be restored or during the transport of various materials from the decommissioning of industrial facilities.

On the process plant site, soil pollution sources may emerge during closure, due to incidental leaks or spills of reagents during the decommissioning of process installations. Incidental spills may also take place from decommissioned vehicles. In this case, fuel and lubricant spills may be generated.

Due to the above, during closure, soil samples will also be collected from the decommissioned sites o former industrial facilities, such as the process plant and its ancillary installations. In addition, soil samples will also be collected from the vehicle fleet sites, and fuel storage sites.

The location of soil sampling points will be done in principle base on the methodology described in the first part of this paper, but new options may be selected, based on the situations that the soil science specialist finds on site.

The range of analyses for these soil samples collected from the decommissioned areas will be similar to the one specified in section 3, plus special analyses, if required by specific situations.

Once the closure sage has concluded, soil samples will be collected on a full scale from all the profiles investigated over the years, and agrichemical average samples for two depths (0-10 cm and 10-20 cm) from all the reference areas.

The post-closure stage begins once the environmental rehabilitation has been concluded in all the impacted areas, after the re-vegetation of areas suitable for such operations, i.e. areas used for stockpiling, for the process plant, and the TMF dam and pond.

During this stage, all the physical, chemical and biological processes occurring in the reconstructed soil areas will be monitored, as well as the areas previously monitored during other stages of mining and processing operations.

As a rule, soil samples will be collected from the decommissioned sites every ear in the first three years and then, depending on the evolution of soil development phenomena, at 3-4 year intervals, up to a period of 20 years after mine closure. Te samples collected annually during the first three years will be agrichemical average samples, while in the first and third year profile samples will also be collected.

Depending on the development of physical, chemical and biological phenomena during the post-closure stage, the time interval required for profile sample collection will be determined. Also depending on the development of soil chemistry phenomena in the areas no impacted by stripping, the time interval required for soil sample collection and the necessary range of analyses will be determined.

11. Special Considerations on Soil Monitoring

All soil-related operations, from stripping through to the ecological reconstruction of the soil profiles, including trend monitoring during the post-closure stage, need to be conducted under the guidance of a soil specialist. The latter will indicate the areas where stripping is to be undertaken, the stripping depth of both topsoil and lower horizons.

The soil science specialist will lead all the soil monitoring activities, ever since the pre-construction and through to the post-closure stages. He will also supervise the building of stripped soil stockpiles, insisting on separation of the organic horizon from the mineral horizons. And, again, he will supervise the opposite activities of soil stockpile decommissioning, soil transport to the areas where soil profiles need to be restored and, implicitly, the restoration of soil profiles. He/she will ensure that the base horizons are built with an adequate texture. If not, he/she will indicate the texture mix to be achieved. He/she will supervise the installation of the fertile horizon. The soil science specialist will also supervise the acid soil neutralisation and the organic and/or mineral fertilisation operations. Calculation of chalky soil additives and organic or mineral fertiliser doses will be based on the usual methods in force, in accordance with the agrichemical characteristics of the soils.

12. Soil Pollution Prevention Measures

The Project provides a number of measures aiming to prevent accidental soil pollution or reduce the intensity of potential pollution. These include:

- development o concrete paved and bermed platforms in the areas provided for chemical and fuel unloading and in the areas used for fuel filling installations and vehicle bases;
- building a spill collection structure for potentially polluting materials;
- providing drainage of potentially pollutant liquid materials and runoff from the process plant site into specific collection systems, suitably equipped;
- absorbent material used in cleanup operations and wastewaters from occasional spill control operations will be treated as hazardous waste;
- the stockpiles will be typically built on concrete-covered areas, provided with a perimeter bund to prevent water erosion and loss of humus and nutrients.

Soil Monitoring in the Rosia Montana Project Area

Introduction

In September 2010, 27 soil samples were collected from profiles within the Rosia Montana Project footprint (the same areas where soil was sampled in 2003-2006), with the aim of capturing any potential major changes from the data obtained during the preparation of the environmental impact assessment study.

The locations of the soil sampling points are shown on plate no. 1. Sampling was done by the Soil and Agrichemical Study Office in Alba (OSPA Alba) and the analyses were performed in cooperation with the National Research and Development Institute for Soils, Agri-Chemistry and Environmental Protection in Bucharest.

Tables 1 – 12 show the results obtained in the laboratory analyses and the interpretation of this data.

Establishment of Soil Sampling Points for Monitoring

Locations of the soil monitoring sampling points were selected in accordance with the provisions of the Monitoring Plan developed in 2007-2008, with the location of the industrial facilities and their development over time, so that the sampling points may not be affected by the development of industrial facilities over time. This will ensure that soil quality in non-stripped areas may be monitored throughout the development of the Rosia Montana Project.

Sampling locations were also selected based on the nature of the industrial facility, so that any effect of the facility activities on soil may be recorded.

With the start of construction activities and the development of extraction and processing activities, the soil within the industrial site will be in one of two situations: undisturbed soil and stripped and stockpiled soil. Soil sampling points have been established for both situations.

Sampling points for unstripped soil will be operational throughout the Project lifetime, while sampling from stockpiles will become operational only during their existence, namely from the construction to the decommissioning stages, when the closure and environmental rehabilitation work start.

In order to reveal the influence of mining and ore processing activities on areas adjacent to the Rosia Montana Project site, seven soil sampling point have been established. These points will be operational throughout the project lifetime.

Conclusions

The area investigated under the soil impact study in the case of the gold bearing ore extraction and processing activities at Rosia Montana covers 1,785 ha. It is bordered in the north by the Rosia and Vartop inter-river; in the east by the inter-river separating the headwaters of the Vartop, Rosia and Corna streams from the catchment of the north-east flowing streams, toward the Aries, or to the east; in he south the area is bordered by the inter-river of the Corna and Abruzel Valleys; and in the west by a conventional north– south line connecting the north of Iacobesti Village to the south through Saliste Hill, Saliste Valley, Baiesilor Hill, and the Corna Valley.

The soil cover consists of eu-mesobasic brown soils of the typical and lithic sub-types (BMti, BMls) and acid brown soils of the typical, andic, lithic, andic-lithic sub-types (BOti, BOan, BOls, BOan-ls), with both types belonging to the cambisol class, and typical regosols (RSti), typical colluvisols (COti) and typical lithosols (LSti), all three belonging to the non-evolved, truncated or disturbed soil class. The predominant soils are brown acid and brown eu-mesobasic soils.

The dominant soil reaction is acid-strongly acidic, on 52% of the area, and slightly acidic on 40% of the area. Supply of raw organic matter is medium-high on 99% of the area, but the humus content itself is low.

Nitrogen supply is predominantly medium , mobile phosphorus is low and very low, on 96% of the area, and mobile potassium medium and well provided on 92% of the area.

The soils are predominantly skeletal, with low to moderate skeleton content in the A horizon, over 57% of the area, and slight-excessive over 14% of the area. The predominant texture of the A horizon is loamy, over 57% of the area, and loamy-sandy over 38% of the area.

Topsoil depth is generally low. On 26% of the area less than 10 cm, on 26% between 10-20 cm, on 27% between 10 and 30 cm and on 17% between 20 and30 cm. Overall, 70% of the area of monitored soils have a topsoil cover of up to 30 cm.

The soil cover of Rosia Montana area is sparsely or medium populated with fungal or bacterial micro-fauna, has a relatively moderate diversity (2-4 species) of fungi and (1-9 species) of bacteria and relatively well balanced taxonomic communities. Global physiological activities of the edaphic micro-flora displays a medium intensity, with soil breathing values mostly ranging between 20 and 80level mg CO_2/100 g soil.

Figure 1 – Locations of soil sampling points

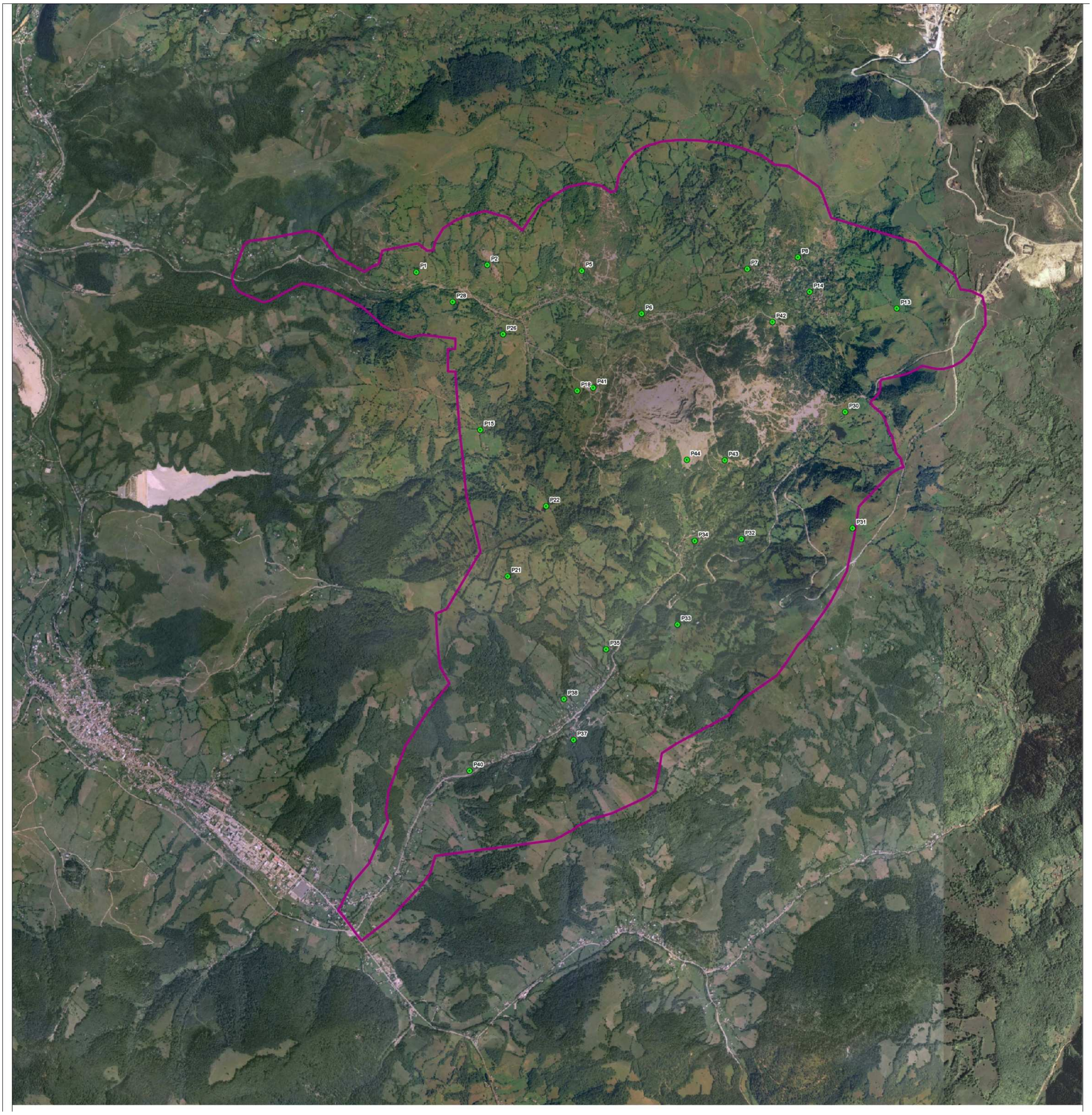

Table 1 - Chemical Analyses for Soil Characterisation

Sample No.	ID	pH H_2O	M.O. %	HUMUS %	I.N.	Ah	SB	V %	N total %	P-AL ppm	K-AL ppm
0	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
1	**P1**	5.82	8.09	4.02	2.57	6.5	11.6	64.0	0.192	11.7	122
2	**P2**	5.28	8.45	3.72	1.57	7.6	5.6	42.4	0.179	11.0	130
3	**P5**	6.62	8.38	4.74	4.64	-	-	-	0.228	12.0	100
4	**P6**	6.65	9.79	6.42	6.29	-	-	-	0.300	266.0	318
5	**P7**	5.54	8.08	3.90	2.59	6.9	13.8	66.6	0.185	10.5	100
6	**P8**	6.70	9.08	4.14	4.05	-	-	-	0.202	40	166
7	**P13**	6.53	7.73	4.28	4.19	-	-	-	0.206	40	166
8	**P14**	8.32	7.83	4.04	3.95	-	-	-	0.192	250	334
9	**P15**	5.38	11.43	4.14	2.46	7.3	10.8	59.6	0.202	11.7	96
10	**P18**	7.50	9.31	3.12	3.05	-	-	-	0.154	14.0	100
11	**P21**	5.00	12.08	6.42	2.63	11.2	7.8	41.0	0.300	14.6	108
12	**P22**	5.45	8.47	2.40	1.50	5.9	10.2	63.3	0.120	20.5	96
13	**P26**	7.72	10.76	5.22	5.11	-	-	-	0.245	11.5	150
14	**P28**	5.53	5.97	4.92	3.46	5.8	13.8	70.4	0.232	14.0	184
15	**P30**	6.00	9.56	4.14	3.35	4.4	19.0	81.1	0.202	18.1	176
16	**P31**	5.81	10.81	5.34	3.41	6.9	12.2	63.9	0.251	14.6	106
17	**P32**	6.44	6.60	3.90	3.82	-	-	-	0.185	14.0	294
18	**P33**	4.73	7.79	3.72	1.51	11.4	7.8	40.6	0.179	14.5	266
19	**P34**	5.79	9.13	5.10	3.67	5.4	14.0	72.0	0.236	63.5	162
20	**P35**	6.19	10.31	5.40	5.29	-	-	-	0.254	20.5	196
21	**P37**	4.84	9.65	5.00	2.13	11.9	8.9	42.7	0.235	14.3	132
22	**P38**	5.52	9.70	5.10	3.50	6.8	15.0	68.8	0.236	10.8	138
23	**P40**	7.79	11.88	5.78	5.66	-	-	-	0.270	29.5	142
24	**P41**	3.61	4.11	0.90	0.22	12.3	4.2	25.5	0.056	18.5	130
25	**P42**	3.45	4.48	2.18	0.50	12.6	3.8	23.1	0.112	15.2	130
26	**P43**	7.44	5.10	3.00	2.94	-	-	-	0.147	38.0	154
27	**P44**	3.12	4.21	0.84	0.16	13.0	3.2	19.8	0.053	10.0	116

Result interpretation:

Table 2 - Acidity

pH H_2O	STRONGLY ACIDIC	MODERATELY ACIDIC	SLIGHTLY ACIDIC	NEUTRAL	SLIGHTLY ALKALINE	MODERATELY-STRONGLY ALKALINE
SAMPLE	P21;P33;P37; P41;P42;P44	P2;P7;P15; P22;P28; P34;P38	P1;P5;P6;P8;P13;P30; P31;P32;P35;	-	P14;P18;P26;P40; P43.	-

Table 3 – Organic matter (M.O.) – Organic-mineral material with humus content

	Very high	Extremely high	Excessively high	ABOVE THE INTERVENTION THRESHOLD
SAMPLE	P1;P2;P5;P6;P7;P8;P13;P14;P15;P18;P22;P26;P28;P30; P31;P32;P33;P34;P35;P37;P38;P40;P41;P42;P43;P44.	P21.	-	-

Table 4 – Saturation classes

	OLYGOBASIC	OLYGOMESOBASIC	MODERATELY MESOBASIC	SUBMESOBAZIC - EUBASIC
SAMPLE	P41;P42;44.	P1;P2;P7;P15;P21;P22;P31;P33;P37;P38.	P28;P30;P34.	P5;P6;P8;P13;P14;P18;P26;P32;P35;P40;P43.

Table 5 – Total nitrogen supply state

	Very low	Low	Moderate	High
SAMPLE	P41;P44.	P22; P35;P40;P42.	P1;P2;P5;P7;P8;P13;P14;P15;P18; P26;P28;P30;P31;P32;P33;P34; P37;P38;P43.	P6;P21;

Table 6 – Humified organic matter (humus) supply state

	VERY POOR	Poor	AVERAGE	GOOD AND VERY GOOD
SAMPLE	P41;LP44.	-	P2;P7;P18;P22;P32;P33;P42;P43.	P1;P5;P6;P8;P13;P14;P15;P21;P26;P28;P30;P31;P34;P35;P37;P38;P40.

Table 7 – Potential nitrogen supply according to the nitrogen index In

	Poor	AVERAGE	GOOD	VERY GOOD
SAMPLE	P2;P22;P33;P41;P42;P44.	P1;P7;P14;P15;P18;P21;P28;P30;P31;P32;P34;P37;P38;P43.	P5;P8;P13;P26;P35;P40.	P6

Table 8 – Mobile phosphorus supply (In Al)

	VERY POOR	Poor	AVERAGE	GOOD	Very good
SAMPLE	**-**	**P1;P2;P5;P7;P15;P18;P22;P26;P28;P31;P32;P33;P37;P38;P42;P44.**	**P22;P30;P35;P40;P41.**	**P8;P13;P34;P43.**	**P6;P14.**

Table 9 – Mobile potassium supply (In Al)

	Poor	AVERAGE	GOOD	Very good
SAMPLE	**-**	**P1;P2;P5;P7;P15;P18;P21;P22;P31;P37;P41;P42;P44.**	**P8;P13;P28;P30;P34;P35;P38;P40;P43.**	**P6;P14;P32;P33.**

Table 10 - Heavy metal content

ICPA No.	*No.*	*ID*	*Requested tests*								
			Pb *mg/kg*	**Cu** *mg/kg*	**Zn** *mg/kg*	**Cd** *mg/kg*	**Mn** *mg/kg*	**Fe** *%*	**Ni** *mg/kg*	**Co** *mg/kg*	**Cr** *mg/kg*
1590P	1	P5	56.2	62.5	271	0.28	2437	3.21	42.3	11.0	20.3
1591P	2	P7	21.4	42.3	78	0.29	520	2.10	19.9	5.3	26.6
1592P	3	P15	12.3	24.4	66	0.31	585	2.58	40.4	7.9	62.8
1593P	4	P18	11.1	23.6	64	0.21	1488	2.07	5.3	1.5	17.2
1594P	5	P21	6.7	20	86	0.29	406	2.45	23.3	4.8	30.4
1995P	6	P22	16.1	23.7	50	0.68	857	1.71	22.0	7.3	12.4
1596P	7	P26	22.0	27	71	0.69	445	2.27	34.1	6.6	31.9
1597P	8	P28	14.9	29.5	76	0.62	456	2.22	49.8	6.3	56.7
1598P	9	P30	10.6	13.4	43	0.66	221	0.91	9.5	1.5	11.3
1599P	10	P31	16.6	27.6	61	0.85	653	1.49	11.9	3.4	14.7
1600P	11	P1	16.8	48.4	98	0.90	674	3.11	90.3	12.5	53.1
1601P	12	P2	15.7	43.9	100	0.46	515	2.91	66.3	11.3	47.8
1602P	13	P6	48.0	52.7	395	1.10	1024	2.20	17.4	1.4	17.6
1603P	14	P14	36.0	42.8	110	0.63	341	1.61	7.8	2.0	12.5
1604P	15	P8	25.5	36.9	96	1.54	889	2.54	26.7	9.8	24.8
1605P	16	P13	6.9	27.5	47	0.56	671	1.83	6.2	4.9	5.9
1606P	17	P34	21.1	34.3	92	1.32	724	2.51	21.7	5.7	22.6
1607P	18	P32	19.7	27.8	85	1.08	591	2.43	18.3	7.6	26.9
1608P	19	P33	14.0	38.7	90	0.44	381	2.96	30.9	10.7	27.7
1609P	20	P38	40.7	39.1	106	0.45	581	3.16	43.9	8.8	38.0
1610P	21	P37	19.5	33.3	93	0.96	370	2.99	28.8	5.7	28.8
1611P	22	P40	45.6	300	137	0.89	812	2.35	23.6	6.5	21.0
1612P	23	P35	27.7	49.7	89	0.62	721	2.62	22.3	6.3	25.0
1613P	24	P41	23.2	26.8	54	0.90	242	2.84	4.6	nd	8.7
1614P	25	P42	43.4	16.5	35	0.97	155	2.12	4.6	nd	6.5
1615P	26	P43	30.9	42.0	109	1.34	1342	2.17	11.8	4.7	12.8
1616P	27	P44	24.4	36.3	57	0.52	1316	4.06	15.7	3.6	6.8

Notes: (*) Determinations using extracts obtained by OSPA Alba after wet disaggregating the soil samples under the ICPA Methodology.

(**) The values in the Table show the heavy metal contents in the soil.

The results were obtained after applying the correction based on the soil quantity processes and the final extract volume (for 1 g soil/ 50 ml final volume – the correction factor was 50).

nd - undetectable by the analytical method.

Order no. 756 of 1997, approving the Environmental Pollution Assessment Norms sets alert and intervention thresholds for soil concentrations of pollutants.

Under Article 8, the soil pollution regulations refer to both sensitive and less sensitive uses of land, identified as follows:

- sensitive land use is use for residential and recreational purposes, for agriculture, for protected areas or health protection areas where restrictions apply; and for land provided for such uses in the future
- less sensitive land uses includes all the existing industrial and commercial uses, as well as areas of land provided for such uses in the future.
- where there is uncertainty regarding the classification of a land use, the alert and intervention thresholds concentrations for sensitive land uses will be considered.

Table 11 – Interpretation of results for sensitive land uses

Article 8 MWFEP Order 756/03.11.1997

Parameter	Pb	Cu	Zn	Cd	Mn	Fe	Ni	Co	Cr
U.M.	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**%**	**mg/kg**	**mg/kg**	**mg/kg**
Normal values	**20**	**20**	**100**	**1**	**900**	**3,00**	**20**	**15**	**30**
	P15; P18; P21; P22; P28; P30; P31; P1; P2; P13; P32; P33; P37;	P30; P42	P7; P15; P18; P21; P22; P26; P28; P30; P31; P1; P8; P13; P34; P32; P33; P37; P35; P41; P42; P44	P5; P7; P15; P18; P21; P22; P26; P28; P30; P31; P1; P2; P14; P13; P33; P38; P37; P40; P35; P41; P42; P44	P7; P15; P21; P22; P26; P28; P30; P31; P1; P2; P14; P8; P13; P34; P32; P33; P38; P37; P40; P35; P41; P42;	P7; P15; P18; P21; P22; P26; P28; P30; P31; P2; P6; P14; P8; P13; P34; P32; P33; P37; P40; P35; P41; P42; P43;	P7; P18; P30; P31; P6; P14; P13; P32; P41; P42; P43; P44	Toate probele in limite normale	P5; P7; P18; P22; P30; P31; P6; P14; P8; P13; P34; P32; P33; P37; P40; P35; P41; P42; P43; P44
Below the Alert Threshold	P7; P26; P6; P14; P8; P34; P38; P40 P35; P41; P42; P43; P44	P5; P7; P15; P18; P21; P22; P26; P28; P31; P1; P2; P6; P14; P8; P13; P34; P32; P33; P38; P37; P35; P41; P43; P44	P5; P2; P14; P38; P40; P43;	P6; P8; P34; P32; P43;	P18; P6; P43; P44	P5; P1; P38; P44	P5; P15; P21; P22; P26; P28; P2; P8; P34; P33; P38; P37; P40; P35;		P15; P21; P26; P28; P1; P2; P38;
Alert Threshold	**50**	**100**	**300**	**3**	**1500**	**-**	**75**	**30**	**100**
Between the Alert and the Intervention Value	P5;		P6;		P5;		P1;		
Intervention Threshold	**100**	**200**	**600**	**5**	**2500**	**-**	**150**	**50**	**300**
Above the Intervention Threshold		P40							

Table 12 – Interpretation of results for less sensitive land uses

Article 8 MWFEP Order 756/03.11.1997

Parameter	Pb	Cu	Zn	Cd	Mn	Fe	Ni	Co	Cr
U.M.	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**%**	**mg/kg**	**mg/kg**	**mg/kg**
Normal values	**20**	**20**	**100**	**1**	**900**	**3,00**	**20**	**15**	**30**
	P1; P2; P13; P15; P18; P21; P22; P28; P30; P31; P32; P33; P37	P30; P42	P7; P15; P18; P21; P22; P26; P28; P30; P31; P1; P2; P8; P13; P34; P32; P33; P37; P35; P41; P42; P44	P5; P7; P15; P18; P21; P22; P26; P28; P30; P31; P1; P2; P14; P13; P33; P38; P37; P40; P35; P41; P42; P44	P7; P15; P21; P22; P26; P28; P30; P31; P1; P2; P14; P8; P13; P34; P32; P33; P38; P37; P40; P35; P41; P42	P7; P15; P18; P21; P22; P26; P28; P30; P31; P2; P6; P14; P8; P13; P34; P32; P33; P37; P40; P35; P41; P42; P43	P7; P18; P30; P31; P6; P14; P13; P32; P41; P42; P43; P44	Toate prpbele in limite normale	P5; P7; P18; P22; P30; P31; P6; P8; P14; P13; P34; P32; P33; P37; P40; P35; P41; P42; P43; P44
Below the Alert Threshold	P5; P7; P26; P6; P14; P8; P34; P38; P40; P35; P41; P42; P43; P44	P5; P7; P15; P18; P21; P22; P26; P28; P31; P1; P2; P6; P14; P8; P13; P34; P32; P33; P38; P37; P35; P41; P43; P44	P5; P6; P14; P38; P40; P43	P6; P8; P34; P32; P43	P18; P6; P43; P44	P5; P1; P38; P44	P5; P15; P21; P22; P26; P28; P1; P2; P8; P34; P33; P38; P37; P40; P35		P15; P21; P26; P28; P1; P2;P38
Alert Threshold	**250**	**250**	**700**	**5**	**2000**	**-**	**200**	**100**	**300**
Between the Alert and the Intervention Value		P40			P5				
Intervention Threshold	**1000**	**500**	**1500**	**10**	**4000**	**-**	**500**	**250**	**600**
Above the Intervention Threshold									