ENVIRONMENT QUALITY MONITORING, ESSENTIAL REQUIREMENT IN THE ENVIRONMENT MANAGEMENT

Georgeta ALECU, Andreea COSAC

INCDIE ICPE-CA – National Institute for Research and Development in Electrical Engineering
313 Splaiul Unirii, 030138 Bucharest-3, Romania, alecu@icpe-ca.ro

***Abstract* - Existence of an environment protection department in each entity where an activity is evolving, it is necessary both for organization and evolution of control activity of internal measures for pollution reduction generated by this, and for achievement of a fast and efficiently connection with territorial agency for environment quality control. Existence of a minimal endowment for measuring and monitoring of the main pollutant emissions of the entity must be according with the measuring requirements of the main polluting parameters of the internal sources. The paper analyses parameters that impose periodic measurements achievement of main internal pollutant emissions in a domain in which is evolving an anthropic activity, emphasizing the preventing role, also on that corrective of these measurements. It is accentuated the significant contribution at regular time intervals of these measurements, for all types of the involved technological activities.**

Keywords: *environment, monitoring, pollution, emissions, control*

1. ISSUES RELATED TO THE MONITORING

The monitoring of environment quality is an issue that appertain both governmental agencies which are carry on of environment protection, and industrial manufacturers. Governmental agencies want a continuous monitoring of environment to prevent the ecological disasters and to establish more exactly the responsibilities in situations of major pollution, while the industrial manufacturers want a more precise evidence of pollutant emissions to know at which amends it can expect.

A valid idea especially for the countries in course of development, relate the pollution reduction of increasing of technological processes efficiency, [1]. Thus, the monitoring of pollutant emissions creates an alternative image on the consumptions reduction, being, therefore, a benefit source for industrial manufacturers.

Firstly, it must achieve the selection of substances types of which evolution will be pursue in the frame of monitoring process, also the measuring of them concentrations inside of preset time intervals which, in generally depend on the performances of detection systems. Secondly, it impose the existence of monitoring system capable to signalize, in real time, all situations that precede the exceeding of admissible limit concentrations, namely the alert and alarm situations, also the situations in which these concentrations are exceeded. The last stage refers to the capacity of monitoring system to describe the variation way of pollutants concentrations from the monitoring area.

The substances types that must be detected in the monitoring time are deduced as a result of the compromise. Thus, to achieve the overall knowledge of atmospheric pollution level for an area, it is necessary the knowledge of all minor constituents of this, H_2O, Ne, Kr, CH_4, Xe, CO, H_2, N_2O, O_3, NO + NO_2, also of all emissions from atmosphere determined by industrial activity of the region that will be monitories. This knowledge is limited by the fact that the most technological processes are not exactly described, thus to permit us to know all the emissions types.

Accordingly, in a specific application of air pollution monitoring, we will must to limit to the detection of some of substances represented for effects on short, medium and long time on the environment and for which exist sensors which can be included in a real time monitoring system:

- toxic and combustible gases (CO, CH_4, NH_3, H_2S, H_2 etc);
- nitrogen oxide and volatile organic compounds (VOC), especially phenols;
- freon, carbon dioxide.

This list can be extended, if there are other possibilities of detection.

Regarding the detection levels which must be achieve, its are always under the level of limit concentrations, due the fact that are monitoring the alarm situations (10% from limit concentration) and alert situation (3-5% from limit concentration).

Some requirements must be achieved of real time monitoring systems for air pollution. These are:

- more better coverage of the region in which it achieves the monitoring;
- more stable localization in the preset measuring points;
- more exactly measuring of the concentrations for prechosen air pollutants and of rapid variations of these;
- achievement of a rapid alert for critical situations;
- longer period of unattended operation;
- energetically independence;
- working in hard environment conditions.

Water pollution degree is evaluated by oxygen quantity from the water and by presence of some extraneous, noxious and toxic products in some quantities. Industrial pollution had proportions in the same time with her increasing. The volume of industrial waste waters is, in generally, with 70% bigger than municipal domestic waters, and theirs charging and harmfulness is much bigger. Currently, the pollutants "palette" it varied enormously, as a consequence of industrial increasing from the last decades. The chemical and food industry are the most polluting. Do not need to forget neither the agricultural pollution. Urbane pollution take place by evacuation of domestic waters, either by channels, in rivers or ocean, or infiltration in the ground-water table. Purification stations represent the main way for the treating of polluted water.

The soil, like air and water is an environment factor with especially influence on the life health. Of soil quality depends the formation and protection of water sources, both surface water and especially underground water. Soil pollution is considered as a consequence of some insalubrious customs or improper practices, due to the random disposal and storage of wastes resulted from human activity, of industrial wastes or improper utilization of some chemical substances in agricultural practice.

2. LOCAL CONTROL METHODS

Anthropic pollution eventuates due to the activities developed by human (industry, agriculture, activities from human settlement). Thus, it results that the most efficiently possibility for the control of anthropic pollution is that from the source. This possibility it can use both in preventive purpose, before the pollution eventuates, and after the pollution eventuated, for this diminishing.

a) Control of anthropic pollution sources

- Knowledge of all pollution sources of the region (industrial, agricultural unity, living settlement) and theirs characteristics (the emission quantity and type, constructive characteristics of the source): it inventories all technological sequences in which it produces wastes as emissions in air, water and deposition on the soil in solid shape. It must be known the type, chemical and physical characteristics and final destination place of the pollutant (air, water, soil);
- Prediction on the dispersing of pollutant emissions in environment (diffusion models of pollutants in air, contamination models of water and soil): it estimate the dispersing area of pollutants around the pollution sources inventoried below, also local values of these pollutants concentrations;
- Blockage or reduction of emissions by installation of filters, dust collectors, pilot station of water treatment, reduction of solid wastes storage.

b) Control of technologies for products achievement

- Strict conformation of technological instructions is a safety way for pollution reduction, because is obviously that any deviation from the technological instructions has as result the increasing of consumptions of raw materials, materials and energy, and, thus, an adequate increasing of pollutant emissions. Inobservance of technological instructions can determine, also, producing of some accidents which have as result the pronounced increasing of pollution on short time;
- Maintaining, in any moment, of technological installations at initial functioning parameters by achievement of periodical examination and repairs, conducive to pollution reduction on the same ways like those described at point (a);
- Strict control of raw materials and input materials for maintaining of its characteristics at parameters required by manufacturing instructions is in condition to prevent the pollution, suppressing the access in technological flow of some substances of which processing determines appearance of some pollutants for which there was not provided control and protection methods;
- Elaboration of scenarios for technological risk and natural situations by type catastrophic is necessary even in case of technological instructions conformation to comply with pronounced increasing of pollutant emissions on very short time.

c) Control of economic efficiency

- Reduction of raw materials and materials consumption, within the limits of requirements imposed by the manufacturing instructions. A reduced consumption of raw materials and materials means not only an increasing of benefit on product unit, but also the minimum of pollution;
- Limitation of reserves at market requirements level determines not only a performed marketing activity, but also the significant decreasing of pollution from technological line.

d) Monitoring of environment quality

- Necessity for existence of an environment protection department in each entity (industrial, agricultural or living) is justified for organization and control of internal measures for pollution reduction generated by this, and for achievement of a fast and efficiently connection with territorial agency for environment quality control;
- Existence of a minimal endowment for measuring and monitoring of the main pollutant emissions of the industrial, agricultural unit or living settlement entity must be according with the measuring requirements of the main polluting parameters of the internal sources and, also must be compatible with measuring systems of regional agency for environment protection;
- Achievement of periodical measurements of the main internal pollutant emissions has both a preventive role

and corrective one. It is well that measurements to be achieved at significant time period for the implied types of technological activity;
- Continuous monitoring of emissions with high catastrophic potential is necessary for prevention of situations by catastrophic type (explosions, intoxications, fires).

3. REGIONAL CONTROL METHODS

To have a common framework for developing of measuring and control activities of environment quality it is necessary that at regional level (state or continental area) to function the same system of regulations and laws, also, as much as is possible, the same logistic and managerial organization. Thus, it must take measures on the following directions:

Regulations and laws for environment protection

- Elaboration of regulations and laws which have impose the control measures at local level, also of principles and methods for solving of environment pollution situations (the pollutant pays);
- Elaboration of standards which have predict the limit concentrations admissible for pollutant emissions of the air, water and soil;
- Elaboration of the organizing and functioning laws for regional institutions of monitoring and control for environment quality.

Organization of control and monitoring infrastructure of environment quality

- Organization of territorial and national agencies for monitoring and control of environment quality;
- Adjustment of real procurations of monitoring and control for environment quality to the specialists of these agencies;
- Technical and logistic endowment of governmental agencies for measuring and characterization of every type of pollutant emission from monitored territory.

Organization of the space

- Establishment of a specialists teams which have refer any new investment from the point of view of the impact on the environment;
- Periodical referring for function of agricultural, industrial unities and living settlement from the point of view of these impacts on the environment.

Monitoring of environment quality

- Achievement of national networks for monitoring and control of environment quality and monitoring of these parameters in a sampling regime which has included the achievement possibility of ecological risk situations, is favorable both for knowledge in real time of environment status from a limited geographical area (state or continental area), and for integration process of the regional networks in a global network of environment monitoring.

Scientific research

- Encouragement and stimulation of a research projects which have develop measuring and characterization systems of environment quality parameters.

4. GLOBAL CONTROL METHODS

At global level, the control of environment quality it achieves by creation of some global satellites networks which are monitoring the environment especially regarding the global pollution phenomena (greenhouse effect, depletion of ozone layer etc). Also, imposing of some restrictions on the products quality, for environment protection, represents one of most efficiently ways of pollution diminishing. Action directions are the following:

Creation of global infrastructure for monitoring and control of environment quality

- Creation of the international organisms for monitoring and control of environment quality;
- Encouragement and stimulation for creation and development of profile nongovernmental organizations, is a very efficient measure from the point of view of bureaucracy avoiding by governmental type. Also, nongovernmental organizations have the possibility to attract more financing sources, unlike the governmental organizations which are limited by the budget requirements and by the lack of an efficient control of the way in which are developing the financing programs.
- Encouragement and stimulation of the international cooperation in the field of scientific research programs and resolving of the ecological risk situations.

Extension of market restrictions

- Assessment of restrictions regarding the pollution minimization as a performance criterion in marketing is one by the most safety method for the reduction of local and global pollution because its inobservance determines immediate decreasing of the benefit on entire trajectory of the product, that is not convenient for nobody.

The new global political order

- Encouragement and stimulation for creation of global politic frame for a efficient protection of environment (sustainable development).

Monitoring of environment quality (planetary networks)

- Development of new and performance programmes of measuring and characterization of the pollution from distance (remote sensing);
- Achievement of some alert networks in real time of the situations with ecological risk and pollution;
- Enlargement of access to data provided by the satellites network, especially by conversion of military programs in civil applications.

5. EDUCATION AND TRAINING

- Development of some educational programs, from elementary level of education until high school level inclusive, which has formalize a new attitude regarding the environment;
- Reorientation and redimension of specializations from academic education to sciences study about planet and environment;
- Development of an efficient system of post academic education which has as result the training improvement of all specialists already formed in any domain which is related to environment protection.

6. THE ECOSANOGENETIC ANALYSIS

The ecosanogenetic analysis is the first step of pollution reduction in industrial areas.

This analysis has the following objectives:

(1) Geoecological configuration of industrial areas;
(2) Identification and assessment of pollution sources of area;
(3) Assessment of dispersal effects;
(4) Analysis of thermodynamic stability and evolution trends;
(5) Establishment of solutions for pollution reduction in area;
(6) Achievement of ecosanogenetic feasibility study for each industrial unity and overall area.

The algorithm of ecosanogenetic analysis is presented in fig. 1, [1, 3].

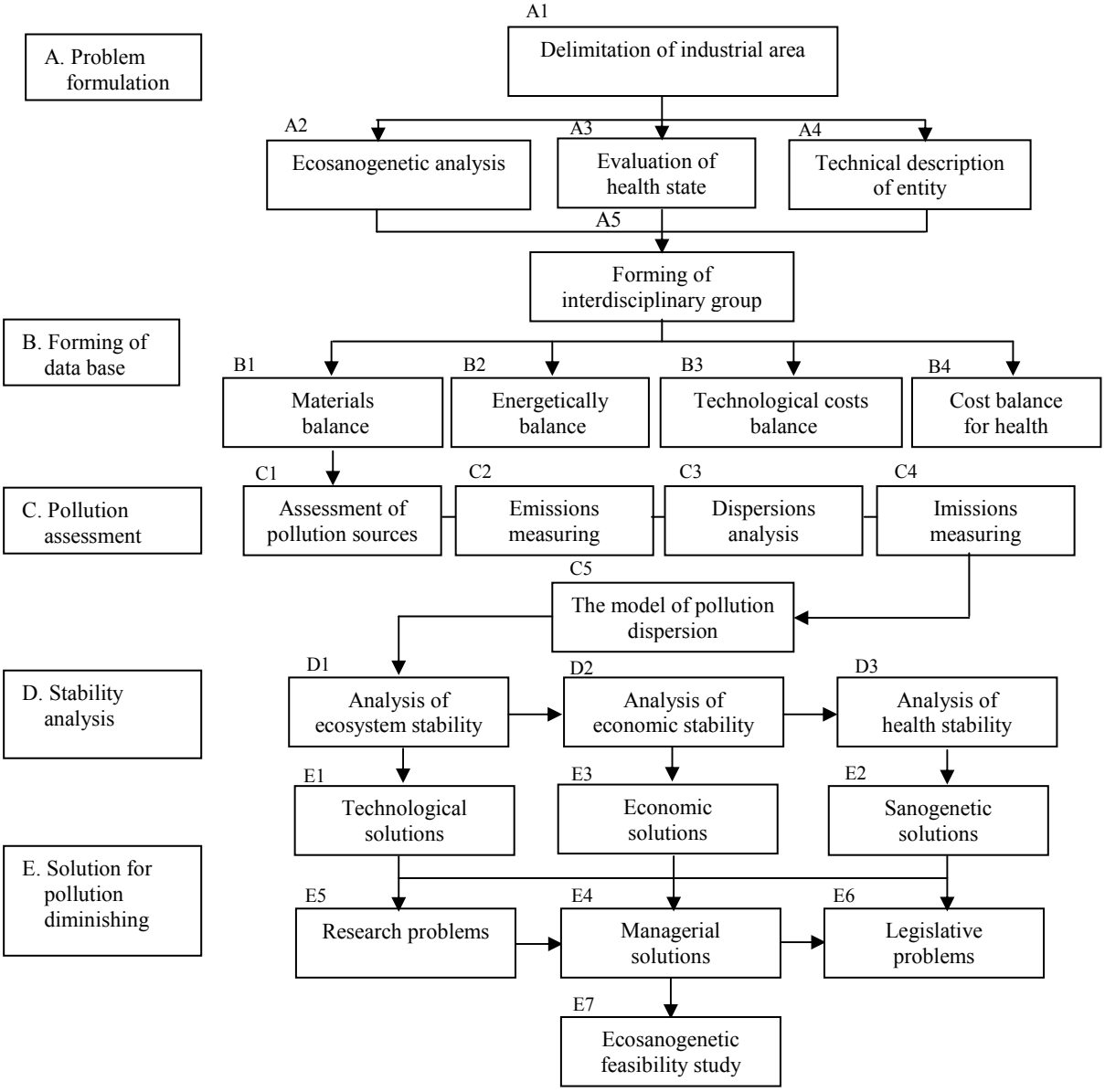
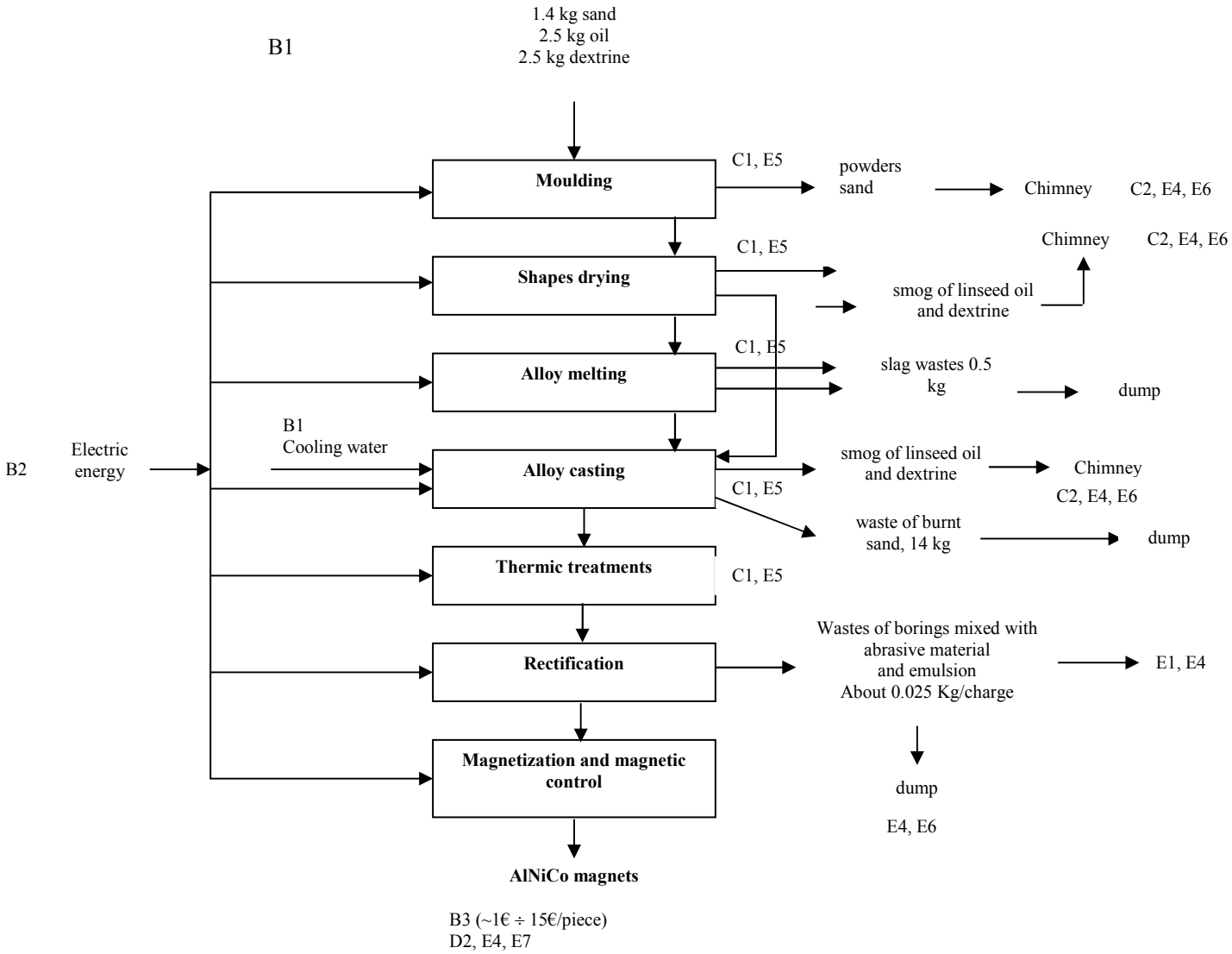


Figure 1: The algorithm of ecosanogenetic analysis for an industrial area

In A chart is presented the sequential algorithm, underlining in A5 sequence the interdisciplinary dimension of the specialists group. In B chart, the usual consumption balance is complete, because it includes the pollutant substances and residues (quantities and final destination). The C chart includes the usual impact studies. The D chart refers to global stability of area affected by pollution. The stability type that will be determined will impose the reorganization type of each entity. In E chart, the E1, E2 and E3 sequence presents the computation mode of benefits on short term of the pollution decreasing. The next sequences present the benefits of pollution decreasing on long term (including the costs for health improvement).

The algorithm presented above was applied sequential for activity developed in the frame of research institute in materials field, in pilot plant of magnetic materials. It was achieved a detailed ecosanogenetic analysis for B and C diagrams, fractionally for other presented diagrams. The main identified pollution sources are inobservance of technological rules and using of some ancient equipment. The computations show that the wastes are recycled in quantities under 80% for magnets by Alnico type and 100% for magnets from rare earths. Remanent wastes are deposited in an adequate place and are delivered regularly at REMAT.

The fig. 2 presents, qualitative and quantitative, a technological flow for obtaining of casting metallic magnets by type AlNiCo in a magnetic materials pilot station, emphasizing the raw materials types entered in process, the energy types used, the emission/wastes types generated and product types resulted from the process.



TOTAL:
Water consumption: about 1 m^3/charge
Electric energy consumption: about 50 kW/charge

Figure 2: Technological flow for obtaining of casting metallic magnets by type AlNiCo with specific consumptions for a charge of 13.5 kg alloy

The proposed methodology establishes the action at technologic level, where the algorithms are known and is possible the direct and precise intervention.

Generally, the practical level of the action for pollution reduction in an industrial area has the following stages:

(1) Continuous measuring in real time of the pollution to each technological source;

(2) Reduction until complete elimination of emissions in water and air, using ventilation, filtration of air and water;

(3) Reduction of pollutant emissions and solid wastes, by optimization of primary resources, materials and energy on product unit, in a real time process;

(4) Increasing of the recondition and reintegration degree of the solid wastes resulted in phases (1) and (2).

Sequences (1) – (3) are obligatorily, because is obtaining, simultaneously, pollution decreasing and benefit increasing.

Sequence (4) is today a research problem, implying a physical-chemical model and technological process, also an economic model, of financial resources and costs.

7. CONCLUSIONS

- The control and modeling of industrial processes can be achieved only on the product trajectory, because the pollution of anthropic ecosystems are the source in the technological flow of the product;
- Complete disposal of emissions directly in air and water is a necessary condition, but not enough, for diminishing of industrial pollution, because the unpolluting processes of the water and air produce wastes which include the all pollutant quantity, which contrary, would be emitted directly;
- Unpolluting processes of the wastes resulted from industrial activity not represent a solution for diminishing of industrial pollution; these processes are very expensive and generate by them itself, a high pollution level, which can be more higher than that resulted from the technological flow, by direct pollution.

References

[1] B. Cotigaru, V. Petrescu, F. Caldararu, I. Ianos, C. Ochinciuc, V. Bratulescu, I. Zamfir, G. Zamfir, *Product evolution as measure of anthropic process stability*, Workshop "Problemes actuels dans la conservation des composants viables de l'environement, Bucharest, March 1995"

[2] M. J. McEwan, L. F.Philips, *Chemistry of the Atmosphere*, John Wiley&Sons, New York, 1975

[3] Laurentiu Scopelitis, *"Products quality in the evolution of anthropic ecosystems on electronic products example"*, ISBN-13/EAN:TD-Scope, ISBN-10

[4] L. Badea, FI. Caldararu, O. Bogdan, Ghe. Niculescu, Georgeta Alecu, *"Towards a model of ecogeographic analysis of a space modified anthropic by productive activity from the perspective of human – nature reports"*, International Conference "The marketing in the process of economic and social development 1971 – 2001: 30 years of marketing in Romania", 107, 22 -23 November 2001, Bucharest