

INTRODUCTION

The Ministry of Education, Research and Youth – the National Authority for Scientific Research (MEdC – ANCS) launched **in the second term 2005** the Programme **Research of Excellence (CEEX)**, with the main aim to structure and consolidate the **Romanian Area of Research**, and thus, to ensure the preparation of the S&T community in Romania for:

- a more rapid and efficient integration in the European Research area;
- the participation to the future Seventh EU Framework Programme for Research for the period 2007-2013.

The Programme **Research of Excellence** was approved by Government Decision 368/2005 and is authorized for the period 2005 - 2008. The programme stimulates the development of collaboration between R&D institutions, universities and enterprises, for increasing the impact on the quality of research done in Romania. The programme has in view to support and accelerate the process of alignment and integration of enterprises according to the specific requirements and regulations of the European Union, as well as to increase Romania's capacity to ensure performant partners for both S&T collaboration programmes in Europe and for international technological consortia.

Accordingly, the new Programme **Research of Excellence** focuses on the objectives related to:

- increasing the capacity to align to ERA specific S&T priorities and objectives, which aim to raise the competitiveness and to support the development of the knowledge-based economy and society in the European space;
- increasing the quality, performance levels and the competitiveness of R&D activities, by:
- the formation of poles of excellence in S&T fields specific to leading and emerging technologies

The necessity for fulfilling of those requirements is clearer, if we take into consideration the perspective of future adhesion to the European Union, which impose simultaneous:

- developing a social and economic environment, dynamic and competitive, focused on the domains of high technology and capable to fulfil the demands of long term developing, in the context of globalize economy;
- framing up the Romanian Area of Research for integrating in the European Area of Research, manifested by a number of evolutions and transformations upon the Romanian research institutes and organizations, aiming the development and improving of the activity and of the existing human and material resources.

CEEX is an useful tool in order to make the link between the first National Plan for R&D and Innovation and the second National Plan, which was launched in 2007.

The CEEX projects, unrolled in the MENER (approx. 100), include 2 thematic areas: environment and energy. Those modules supported complex projects of developing the research activity, human potential and research infrastructures, with national, regional and international partners. The projects financed until now in the frame of the MENER program, could represent future projects proposals for the 7th Framework Program of Research, 2007-2013.

This booklet will represent for the near future a source of inspiration and promotion of the Romanian Energy Policy.

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ANALYSIS PEM FUEL CELL DESIGN AND MANUFACTURING WITHIN ICSI-RM. VALCEA

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Fuel cells are electrochemical devices that convert chemical energy of the fuel into electricity at high efficiency without combustion. Fuel cells are viewed as viable power sources for many applications, including ground transport, distributed power generation and portable electronics. This project presents the results obtained by the ICSI-Rm. Valcea regarding the Proton Exchange Membrane Fuel Cells (PEMFCs) development.

In the last decades of the previous century, due to global environmental problems, energy security and supply issues, many studies were conducted to investigate the uses for hydrogen energy and facilitate its penetration as an energy carrier.

Subsequently, many industries worldwide begin to develop and produce hydrogen, hydrogen-powered vehicles, hydrogen fuel cells, and other hydrogen-based technologies. In view of the substantial long-term public and private benefits arising from hydrogen and fuel cells, the European Union and national governments throughout Europe, including the Romanian one, are working towards realizing a consistent policy framework preparing the transition to a hydrogen energy economy. Based on public funds, ICIT Ramnicu Valcea developed a research program on energy conversion using fuel cells.

For a better understanding of PEMFC working principle we focused our attention on small dimensions of MEAs. The 25 cm² active area MEAs and the graphite bipolar plates are commercial available.

The fuel cell developed to our institute has following components:

- 25cm² Nafion 112 MEA;
- 2 EPDM rubber gaskets;
- 2 high density bipolar plates;
- 2 Cu current collector plates;
- 2 stainless steel end plates;
- 4 gas inlet an outlet connectors;
- fastening elements;

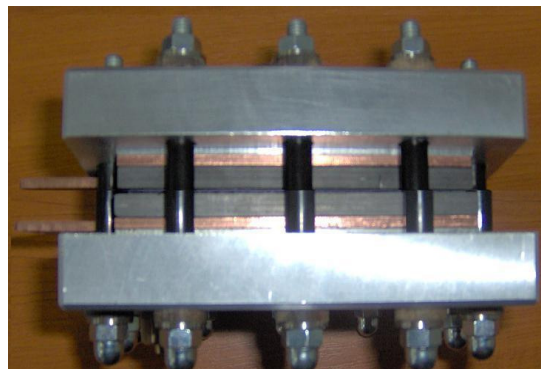


Figure 1. 25 cm² single PEM

fuel cell

All the fuel cell components are manufactured in ICIT Rm. Valcea, including milling of bipolar plates. Bipolar plate is one of the important components of a PEM fuel cell and has the role to supply the fuel and the oxidant to the reactive sites, to remove reaction products, to collect the produced current and to provide mechanical support for the cells in the stack. Bipolar plates constitute more than 60% of the weight and 30% of the total cost in a fuel cell stack. For this reason, the weight, volume and cost of the fuel cell stack can be reduced significantly by improving layout configuration of flow field and use of lightweight materials.

Different combinations of materials, flow-field layouts and fabrication techniques have been developed for these plates to achieve aforementioned functions efficiently, with the aim of obtaining high performance and economic.

To avoid low and unstable cell voltages after extended periods of operation using straight flow field with separate parallel flow channels, in ICIT Rm. Valcea we used bipolar plates with serpentine flow channel (Figure 2).

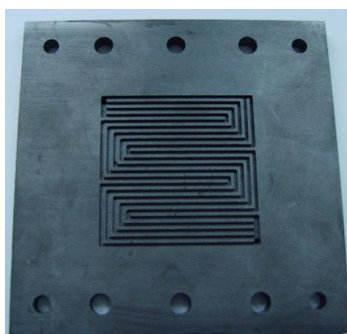


Figure 2. High density graphite bipolar plate

It is seen from the figure 2 that we used multiple serpentine channels that was preferred to one single serpentine channel. In a single serpentine flow field the reactant is forced to flow to row over the entire active area of the corresponding electrode. This fact causes the substantial pressure drop and significant concentration gradients from the flow inlet to outlet due to the removal of the stagnant flow area. Additionally, using a single channel to collect all the liquid water produced from the electrode reaction may promote flooding of the single serpentine, especially at high current densities. Hence, for higher current density operation, especially when air is used as oxidant or with very large gas flow field plates, is better to use several continuous separate flow channels. Also, this fact will limit the pressure drop, thus minimizing the parasitical power required to pressurize the air, which can be as much as over 30% of the fuel cell and fuel cell stack power output. This design ensures an adequate water removal by the gas flow through the channel, and no stagnant area formation at the cathode surface due to water accumulation.

A single cell was tested (Figure 3) in different conditions: temperature, pressure, flow rate and humidity. The following slop represents V-I for 25 cm² fuel cell operating at different values of pressure.

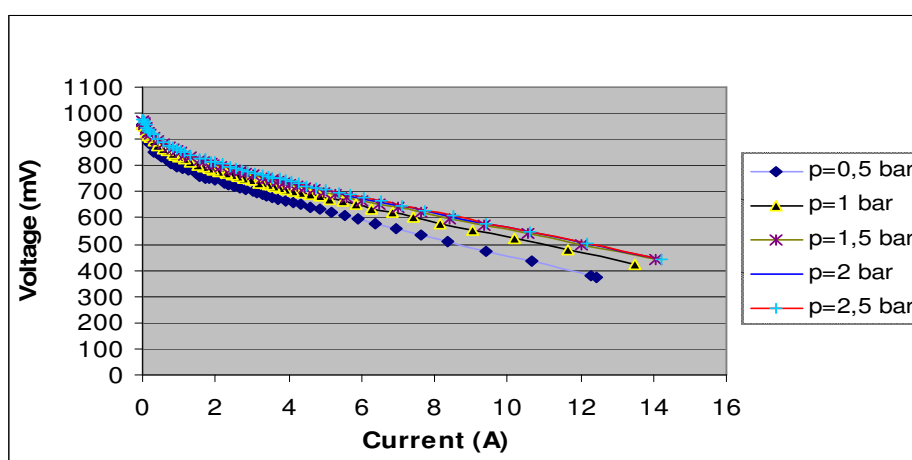


Figure 3. U – I curves for different pressure values

ADVANCED CONTROL METHODS FOR THE EFFICIENCY IMPROVEMENT IN ENERGY GENERATION AND USE

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The energy production and utilization have been in the attention of international specialists for a long time, but they become especially important after the break of the energy crisis in the beginning of the seventies. An increased number of research centres and economic companies has been involved in the solving of these issues. Governmental and intergovernmental policies have been developed, pointing out the role of the research in this field. For example, programs framework FP4, ...,FP7 include researches on energy as a priority topic. The attention is focused in two main directions: new efficient and clean energy sources, including renewable energy generation, renewables for heating, energy storage etc., and energy efficiency and savings. These directions are introduced in the thematic fields of CEEX Program and part of them is recovered in the scientific objectives of our Project [1],[2].

The researches developed in the MENER Program framework are focused on three main directions: the decrease of energy consumptions, using adequate control methods; the increase of performances, using control techniques for renewable systems of power generation (wind and solar); the improvement of energetic performances for integrated power generation and consumption systems.

Control techniques represent one important way for improvement. Although basic and applied researches based on control techniques have been reported, we consider that one can bring new and significant contributions in this area. These envisaged contributions rely on continuous developments of control engineering methods stimulated by the tremendous evolution of computation technology and power electronics.

The most important directions in the use of the control technique for the efficient energy consumption and generation approached in our project are presented below.

a) The decrease of energy losses in electrical drive systems, using adequate control methods : the research are focused on the optimization of steady and transient state. Also, the use of variable speed drives represents an important way for decrease of energy consumption, especially for some type of working mashines (pumps, ventilators, compresors). These are nowadays ones of the main directions of electrical drive trend [3]. The developed researchs combine these possibilities with steady state optimization. The optimal control of the transient state is useful especially in the application with frequently change of speed. Certain original methods [1],[2],[4],[5],[6],[7] were developed for this purpose. These methods have significantly advantages in implementation and allow the use of the optimal control without difficulties. Theoretical, simulation and experimental results were obtained for electrical drives and servo drive systems with different motor types, especially with d.c., brushless d.c. and induction motors. The performed tests indicate that it is possible to obtain a decrease of the energy losses up to 5 – 20%, depending on the working operation and on the weight matrices in the performance indices.

b) The increase of performances of renewable systems of power generation (wind and solar) using control techniques: The researches in the field of the wind energy systems are oriented in different directions. A first one is the modeling of such systems for different situations, e.g. the stand alone operation, the grid composed by several wind generators,

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supplying the local consumer and / or interconnected with energetic system. Another direction refers to the control strategy itself, which must take into consideration – from our opinion – the obtaining of a high efficiency and a satisfactory reliability. The later aspect is very important for wind energy systems, which are frequently built in isolated location. The reliability can be also improved by control techniques in order to limit the torque variations, or through diagnosis-type studies. The studies already developed in the Project framework refer firstly to a critical analysis of the existing solutions for modeling and control of the wind systems. The optimal control of these systems (from energetic and reliability point of view) was approached and theoretical and simulation results were obtained. For practical experiments, some types of controllers were studied and experimental stands were carried out. These laboratory installations [8] allow the simulation of the induction generators, operating with frequently change of speed. Also, a 1 kW wind turbine was installed and first experiments were performed.

The solar sources is another direction of our studies, the aim being also the improving of the efficiency via control techniques and equipment. The studies refer to the use of photovoltaic and solar thermal sources as well as combinations of these. The increase of the energetic transfer to the electrical network or to specific consumers was studied. The already obtained results refer to the increase of the obtained power from a given surface and the establishing of two methods for orientation of the solar panel in order to maximize the efficiency. A method for maximizing the power was proposed and tested.

c) The improvement of energetic performances for integrated power generation and consumption systems. The research will be focused on the study of the performance of several interconnections of sources and load, the adequate control methods in order to maximize the global efficiency. It consist of theoretical studies, numerical simulation tests, and experiments with the laboratory model. Some flexible multifunctional systems capable to allow several types of interconnections were designed. These systems implicate the energy cogeneration too.

d) Electronic power converter is a section of our research, with applications in all above mentioned directions. . The aim is to build a modular structure converter, easy to adapt to different needs. Some converter structures were analyzed and two new prototypes were designed and carried out.

Conclusions

The efficiency improving in energy generation and use is a very important and actual problem and many researches are dedicated to this question. The use of adequate modern control techniques and equipment is a solution in this direction. The performed studies show that this desideratum can be achieved.

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DESULPHURIZATION COAL WITH MICROBIOLOGICAL PROCEDURES

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Pollution from coal combustion is the largest problem in the current use of coal and the biggest constraint on the increased use of coal. When these fossil fuels are combusted, sulphur-di-oxide is released into the atmosphere causing acid rains which dissolves buildings, kills forest and poisons. The sulfur found in coal is either part of the molecular coal structure, is contained in minerals such as pyrite (FeS₂), or occurs in minor quantities in the form of sulfate and elemental sulfur.

After applying the classical procedure of coal manufacture and from the natural bacterial solubilization of the coal residual waters full of metallic ions results. The presence in the residual waters from the coal processing stations of metallic ions in higher concentrations raises an important problem about depolluting the environment.

During the past decade a special importance has been given to the microbial biodiversity, which could represent an ecological source for selecting adequate microorganisms for the environment bioremediation. The microbial communities evidenced in such sites include both groups of chemolithotrophic microorganisms involved in the metals biosolubilization processes and groups of heterotrophic microorganisms involved in the processes of bioaccumulation or biofixation of metallic ions.

The development of the biotechnological processes, based mainly on the activity of the microorganisms, demonstrated the efficiency of bioremediation the polluted environment with residuum and toxic substances.

A variety of ecological processes are affected and altered by air pollution. Such processes include community succession and retrogression, nutrient biogeochemical cycling, primary and secondary productivity, species diversity and community stability.

Biodesulphurization is a process that involves a microbial system, heterotrophic and chemolithotrophic microorganisms, that would remove sulphur from fuels without degrading the fuel value of the product.

Objective: the quantitative estimation of the physiological groups of microorganisms present in coal and drainage mine water samples analyzed

One of the purposes of this project was the quantitative determination of microorganisms from six samples of pitcoal (from Lupeni, Paroșeni, Lonea, Mintia, Vulcan, Petrila), one sample of lignite (from Turceni) and one sample of water from downstream drawn in 2006 year and from two samples of lignite (from Turceni and Halânga) taken in 2007 year.

In this project, we revealed in samples of coal and water heterotrophic microorganisms belonging to the following physiological groups: microscopic fungi, aerobe heterotrophic bacteria (neutrophilic and acidophilic), strict anaerobe heterotrophic (sulphur-reducing), nitrifying bacteria (nitrite bacteria and nitrate bacteria) and acidophilic chemolithotrophic bacteria on Fe²⁺, acidophilic chemolithotrophic bacteria on S⁰, acidophilic chemolithotrophic bacteria on S₂O₃.

The total numbers of aerobic heterotrophic neutrophilic bacteria were estimated used the decimal dilutions of these samples followed by the inoculation of dilutions in selective

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solid medium (nutritive gelose) and incubation at 28°C for 48 hours. The quantitative estimation was performed by statistical methods commonly known as MPN (“most probable number”), enriched cultures and direct numbering of the cells developed on selective medium.

The results obtained in the 2006 year concerning the aerobic heterotrophic neutrophilic bacteria shown the lower value at the sample of pitcoal drawn from Paroşeni (4×10^3 cells / g) and the highest value in the case of the lignite sample taken from Turceni (4.0×10^7 cells / g). Intermediate values were obtained in the case of pitcoal samples taken from Vulcan (3.7×10^4 cells/g), Lonea (6.0×10^4 cells/g), Lupeni (1.4×10^5 cells/g), Mintia (1.8×10^5 cells/g) and Petrila (5.8×10^5 cells/g). The aerobic heterotrophic neutrophilic bacteria not obtained from sample of water from downstream due to the very low pH value (2.5) of the water.

On the Manning medium it was revealed the existence in analysed samples of the heterotrophic acidophilic bacteria belonging to the *Acidiphilium* genus. It is obvious the influence of the increased pH value of the samples analysed on the presence and numerical density of the acidophilic heterotrophic bacteria of the *Acidiphilium* genus. The acidophilic heterotrophic bacteria were representative in numbers in all samples analyzed (6×10^1 - 1.4×10^5).

The sulphur and iron-oxidizing acidophilic bacteria of the genus *Thiobacillus* are strongly influenced by the neutral and basis pH of the analysed samples, both as number (1.1×10^1 - 1.1×10^4 bact/ml) and as dominant species. Thus, the acidophilic chemolithotrophic iron-oxidizing bacteria belonging to *Thiobacillus ferrooxidans* were present in one sample of water. To reveal the iron-oxidizing bacteria we used one specific media 9K which has as an energetic substratul sulphate iron in an optimum concentration (44.2g/l), the presence of the bacteria being revealed by the apperance of brown-reddish colour of the medium and the decrease of the pH value under 2.0.

The heterotrophic strict anaerobe, sulphur-reduction bacteria, were present in the samples of coal analyzed in a moderat number, reaching the maximum value of 4.5×10^4 bact/ml in the case of coal from Halânga. In the sample of water, these bacteria are absent.

The chemical autotrophic nitrifying bacteria, although present in all the samples analyzed, showed differences in the numerical distribution, the nitrate bacteria (7.5×10^1 - 1.1×10^5 bact/ml) being better represented than the nitrite bacteria (0.9×10^1 - 2.5×10^3 bact/ml).

It had been analyzed 7 pit coal, 2 lignite samples and one of drainage mine water from mycological point of view. Samples were inoculated into the following nutrient media: potatoes-glucose-agar; potatoes-glucose-agar- pit coal/ lignite (1%;2,5%;5% coal) and agar-pit coal/ lignite (1%;2.5%;5% coal). All analyzed samples contain fungi having no any correlation with chemical content of nutrient media. The lowest content of fungi had been registered in pit coal from Petrila (1.6×10^2 UFC/g) and the biggest in lignite from Turceni and drainage mine water (1.6×10^4 UFC/g).

Objective: Isolation of microorganisms strains as pure cultures from coal samples analyzed

From these seven samples were isolated and purified 42 strains of aerobic heterotrophic neutrophilic bacteria which were grown in tubes with selective solid medium.

The results obtained in the 2007 year regarding the aerobic heterotrophic neutrophilic bacteria shown values of 1.8×10^6 cells/ g in the case of lignite taken from Turceni and of 1.1×10^4 for the lignite samples drawn from Halânga. From these two samples were isolated and purified 35 strains of aerobic heterotrophic neutrophilic bacteria which were grown in tubes with selective solid medium.

The strains and populations of acidophilic heterotrophic bacteria were analyzed having in view the growth of the bacterial cultures in the specific culture media. The growth was represented through the difference between the initial value of the optical density and the one determined at two days growth intervals. The growth of *Acidiphilium* cultures has been

quantified by measuring the optical density (OD) at the wavelength of 660nm (spectrophotometer UV), while the activity has been appreciated through the decrease of the pH (pH meter type PHM 26) of the culture solutions every 4 days.

In order to obtain populations of *Thiobacillus ferrooxidans* from these samples were used selective liquid culture medium 9K (mineral medium with a pH of 2.5), in which the energetic substratum was represented by the ferrous sulphate in the optimum concentration of 43.22g/l, which corresponds to 8.6g/lFe²⁺. To isolate strains it was used the medium 9K agared. Isolated colonies obtained are coloured brownish red. Using this technique at 10 strains, 8 populations of *Thiobacillus ferrooxidans* were isolated.

All fungi have heterotrophic nutrition and were able to grow into all nutrition media specific for these microorganisms. The main criteria for isolation of pure culture was rate of growth into specific nutrient media having in addition pit coal/ lignite (1%;2.5%;5% coal). At the present time there are 20 fungal pure cultures in Mycological Collection from Institute of Biology. They are belong to the following genera/species *Aspergillus niger*, *Trichoderma viride*, *Cladosporium sp*, *Penicillium sp*.

Objective: Phenotypical characterization of microorganisms strains

From the morphological point of view, the microscopic analysis revealed that most isolated strains were represented by Gram-negative, non-spore or spore forming, straight rods of different dimensions, isolated or grouped in chains or in clusters. Some of the strains were represented by Gram-negative coccus, isolated or grouped in clusters. All of tested strains proved to be oxidase-positive, catalase-positive, excepting one of them that was oxidase-positive and catalase-negative.

On the basis: of these phenotypical features, of the development and the production of pigments on specific media (King's A and King's B) some of the isolates were preliminary characterized that belonging to *Pseudomonas* (probable *Ps. aeruginosa* or *Ps. fluorescens*), *Sarcina / Micrococcus* and *Bacillus* genera.

In investigating the influence of acidity on the metabolical activity of the chemolithotrophic bacteria the following aspects were pursued: (1) the concentration of the Fe²⁺ biologically oxidated; (2) the concentration of Fe³⁺ resulted after the biological oxidation; (3) the acidity (determining the pH value of the culture liquids). The oxidative activity of the cultures of chemolithotrophic iron-oxidating bacteria *Thiobacillus ferrooxidans* was evidenced by the oxidation of the Fe²⁺ to Fe³⁺.

Studying the physicochemical parameters (pH, temperature, airing) over the oxidative activity of the bacterial populations of *Thiobacillus ferrooxidans* it was observed that they presented a maximum activity of the cultures at pH values close to the acidity of the habitats from which they were taken.

For identification of fungal strains they had been inoculated into potatoes-glucose-agar. It had been into consideration the following features: morphology of colonies, rate of growth, morphology and size of microscopically structures involved in sporulation, rate of sporulation, potential of growth into nutrient medium containing different concentration of coal. The most representative structures and colonies had been included in photographic database.

INTELLIGENT APPARATUS AND SWITCHING IN POWER SYSTEMS

Florin MUNTEANU¹, Constantin DÂRZAN²,

The main objective of the project was to design, to realise and to test an improved intelligent device allowing for an intelligent switching of high voltage circuit-breakers.

The corresponding specific tasks were to solve the problems related to short-circuit case, including the situations where the “zero crossing missing” or “current displacement” of the fault current could appear.

The concept of using controlled switching for fault current interruption has considerable appeal. The control objective is to control contact parting time so as to cause a current zero to occur at the beginning of the extinguishing window, such that arcing time and hence the energy generated during arcing is minimized. This could prolong the electrical life of the switching device, possibly increase the interrupting capacity of the switching device, and minimize the thermal requirements for the interrupting chamber and the mechanical requirements for the operating mechanism.

The very important results of this project are:

- the fault type detecting method as fast and accurate as necessary;
- an algorithm and a hybrid structured relay to anticipate the first zero passing of the fault current in every phase;
- a certified intelligent device for controlled switching of high voltage circuit-breakers.

The third improved version of the device was tested in 220 kV line circuits and the results confirmed its normal operation including the environment temperature, breaker switching time interval, voltage/pressure values of the mechanism components.

The method for type fault detection in three phase circuits was established. The result is the relay in fig.1 where:

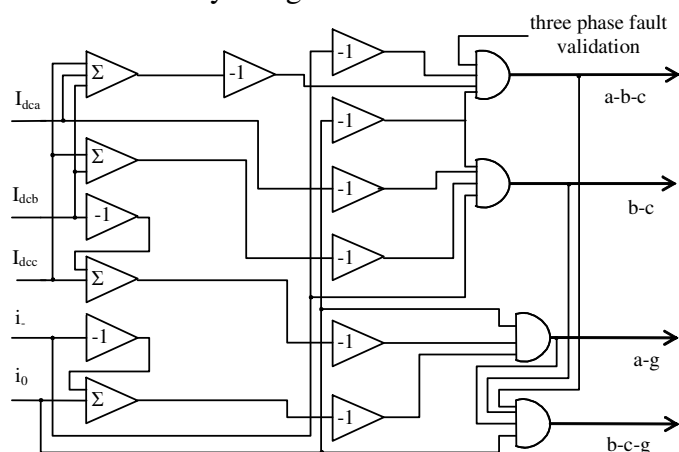


Fig.1 The block diagram of a hybrid structure relay for fault type detection

- i_{dca} , i_{dcb} and i_{dcc} are the initial d.c. components of the fault currents on the corresponding phases;
- i_+ , i_- and i_0 are the sequence fault currents components.

The above mentioned situation, when the **current displacement phenomenon**, or zero crossing missing, can appear is depicted in fig.2 as well the key variables in detecting the first

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zero crossing of fault currents. A simplified analysis of the phenomenon related to a successful intelligent opening of the circuit breaker is based on:

- Δt_d , mechanical opening time of the breaker contacts;
- t_n , the data acquisition time relative to the d.c. component characteristics of the fault current; this component is essential one in influencing the first zero crossing of the total (a.c. + d.c.), asymmetrical, fault current;
- t_r , the estimated real time for the first zero crossing of the fault current.

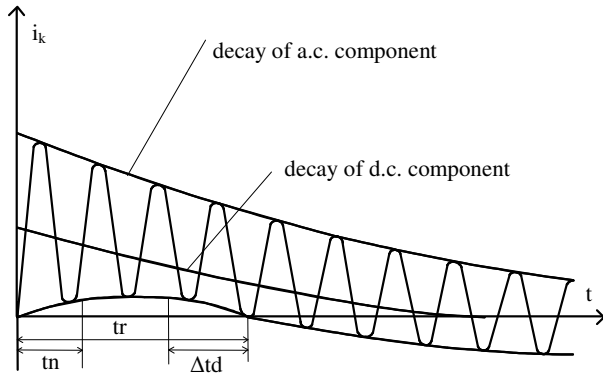
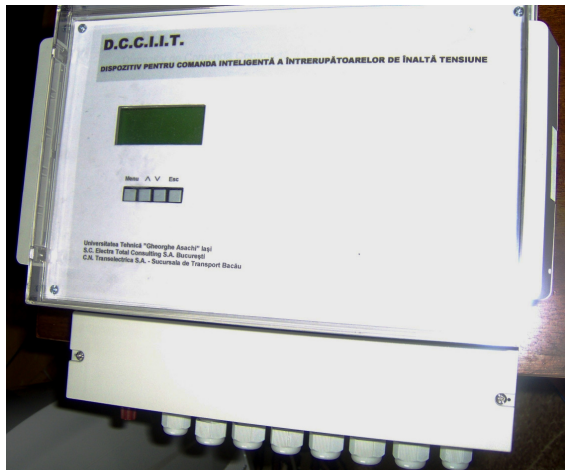
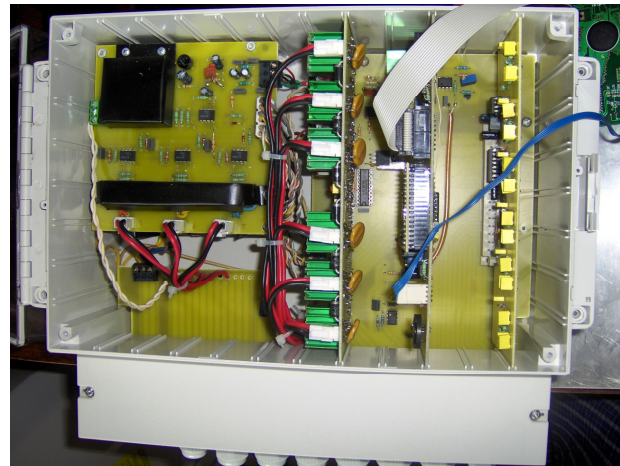


Fig.2 Typical situation of the short-circuit current displacement

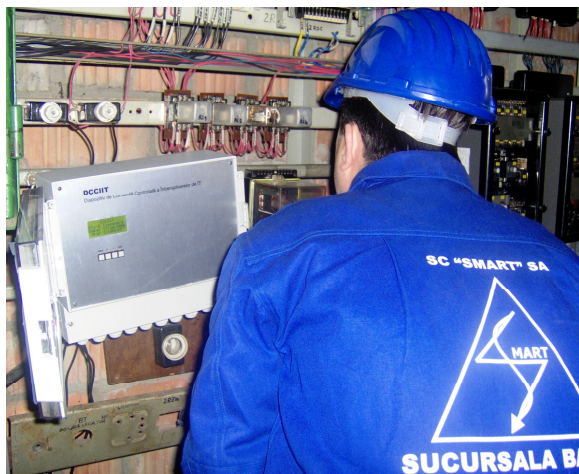
The device for intelligent switching is presented in fig. 3 (a,b,c).



a)



b)



c)

Fig. 3 The device for intelligent switching: a) front view; b) inside view; c) during on-site tests

CREFEN – AN INFORMATIC SYSTEM FOR ENERGY EFFICIENCY IN RESIDENTIAL SECTOR

Adriana ALEXANDRU¹

The project presents, at the current level of the European researches in the field, an integrated software system for assessing, prognosis and training the specialist and consumers for the efficient use of the electricity in houses. The system integrates the economical, and environment impact, as well. A special issue is to develop, the necessary databases of equipment and endowments from residential sector using the market surveys and questionnaires.

The **objectives of the project** deal with energy efficiency and saving energy field:

- drawing up of scenarios and prognosis of electricity consumption in residential sector
- achievement of an advanced modeling and simulation software system-tool of electricity consumption in residential sector and of economical and environmental effects,
- using a tool for defining the potential of energy saving, prognosis and scenarios of consumption evolution, improvement of the degree of taking into consideration by the consumers, decision factors and specialists of the opportunities,
- promoting new technologies in electricity consumption in residential sector, in the framework of a sustainable development integrated at the European level,
- design and implementation of a web application with databases for domestic and lighting appliances available on the Romanian market,
- design and implementation of an interactive system and an electronic book.

The **current results** of the project are:

1. Analysis of the energy consumption in the residential sector. The energy consumption in the residential sector was analysed in Romania through a people survey. An European study signaled that promoting energy efficient appliances may lead in Romania to 0.4 TWh/year savings in the electricity consumption. The statistic data for the period 2000 – 2004 allow us to determine the variation of total household consumption, total number of household consumers, average consumption per household consumer. A preliminary study has been realized on the CREFEN project using feed-back reply forms concerning the usage degree of different household appliances, during November 2005. We were also interested in the GSL and CFLs use in households in Western Romania. We received 295 replies, namely 220 apartments and 75 houses. The analysis of the presented data allows us to estimate a few characteristics of electric energy consumption of households. The annual electric lighting household consumption in Romania in 2004 was about 6.71 kWh/m²/year (based on the average consumption of 1003 kWh/household/year, the average household surface of 37.39 m² and the average contribution of the consumption on the lighting circuits.

2. Evaluation and prognosis of the electricity consumption. After analysis of *different models for electricity consumption evaluation and prognosis* (econometric, time series), it is suggested a bottom-up approach, starting from the consumption of appliances and lighting in dwellings. The primary data are to be obtained by questionnaires, acquiring information as: ownership rate for each appliance, rated power, average operation period and others (efficiency, resources consumption). The households distribution is made according criteria as: geographic site, rural or urban environment, family income, dwelling size.

A *Questionnaire Summer 2006 campaign* was achieved. A total of 204 questionnaires were obtained from a large geographical area. The first obtained data regards the attitude of

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the questioned people to the energy efficient domestic appliances topic - more than 70% agree that the decision to buy an appliance should be based on energy efficiency class as well.

3. CREFEN web-based application is designed and will be implemented with the goal of enabling European citizens to access, via the Internet, energy and performance information for 12 household appliances sold in Romania. The system is based on information contained within the Energy Label and its associated Sheet.

The database includes white goods appliances currently stocked by the manufacturers or by the retailers, energy efficient models manufactured by the suppliers of Romania, consumer electronics and office equipment and appliance groups which have recently been labelled such as ovens, lamps and room air conditioners.

The main functions of the web-based application are:

- *the Web-Interface for Data Acquisition* using specific forms can be accessed for the data acquisition of white goods, air conditioner, oven, and luminaire (lamp). The validation of the data included in the web form is made function of the type of the fields.
- *Selecting energy efficient appliances:* The EU label and fiche allows one to select a model in terms of its characteristics such as size or volume, performance, energy and water usage. The search mechanism in the database can use one or more criteria: appliance selection criteria in terms of type, size, performance and price range manufacturer (useful when searching for the whole group of an appliance of one manufacturer), and product name (used when searching for a specific appliance).
- *Database outputs:* Based on the searching parameters, the search mechanism generates a list of matching appliances along with all the data set that is stored in the database. The search output is listed in tabular form containing groups of 5 products plus the typical 10 years old model. For each appliance the following general information is provided: manufacturer/model, size, energy efficiency class, energy consumption and some specific information characterizing a group of appliances. The models are listed in order of lowest to highest energy consumption.
- *Lifetime cost:* The lifetime cost is calculated based on usage of electricity, water and detergent (where applicable) and compared with the operating cost of a typical 10 year old appliance. This indicates how much energy and money you can save with a new appliance and what contribution this will reduce greenhouse gas emissions. The comparison is made not only between the 5 products presented on the screen, but also with a typical 10 years old model. The user can then obtain detailed information about a specific model.

4. Educational resources for schools. Suitable on-line resources have been developed for use in educating both students (both for primary and secondary schools) and their families. Internet based resources for teachers and students have been developed which discuss the reasons for saving energy and also how energy can be saved through a series of practical activities. Practical activities have been developed to explain and illustrate one or more of the key themes of energy usage and savings in the home. These activities can be trailed using an eBook. For families, additional information is required: an appliance energy survey in the form of a spreadsheet downloadable from the CREFEN website which can be used to quantify the potential savings due to appliance use, and information on how to reduce domestic electricity bills.

The **perspectives** of CREFEN include: experimental exploitation of the system (Loading of the database with an initial volume of information), elaboration of the final format of web application and demonstration of its functionality, evaluation applications and scenarios of consumption evolution, and organization of an Workshop for training of the consumers concerning the energy efficiency in the residential sector.

COMPLEX ECOLOGICAL METHOD FOR THE EVALUATION AND BIOMONITORING OF THE QUALITY OF THE SOMES HYDROGRAPHIC BASIN, MONISOM

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The project presents an ecological and complex methodology for evaluation and biomonitoring of the quality of the Somes River hydrographical basin, under anthropogenic influences. The developed methodology will facilitate the elaboration of restoration methodology and strategies for the conservation of the aquatic ecosystems, diminish/stop the transboundary pollution, and all the economic and juridical implementation of it for the sustainable development of the region.

The objective of this project are ▲ Study, analyses and documentation for elaboration the strategies and methodologies for biodiversity monitoring of the damaged sectors of the river. ▲ Evaluation of the present quality of the hydrographical basin Somes: preparing and analyze the samples, interpretation of the results. ▲ Elaboration of a database in GIS format: (ecological and chemical database and map processing of ► characteristic habitats from the investigated river ► identification of the disturbed surfaces. ▲ Evaluation and biomonitoring of the hydrographical basin quality ▲ Spreading the information: scientific articles, presentations, web-site, workshops.

Up till now the quality of the Somes hydrographical basin was evaluated by study of the most important communities of living organisms, with major role in the Somes River ecosystems (microorganisms, as bacteria from the benthos and water, unicellular algae, macrophytes, organisms from the macrozoobenthos and fishes). Also, the heavy metal concentration from the water and sediment was analyzed both by traditional (aqua regia digestion) and new analytical method (*situ*, speciation of the heavy metals through the technique of diffusion gradients in thin film layers-DGT).

The results were integrate in to the Geographical Information System (GIS), which will help to create a complementary and complex database, make correlations between chemical and biological parameters. The realized maps containing: ● localization of the polluted sources, ● results came from the studies of the living communities ● the level of the pollution of the water and sediments from each sampling site could be a basis of finding fast methods of de-pollution and reconstruction in order to re-establish the parameters suggested by the national and international standards for running waters.

This project is a premier at the national level in what concerns the biomonitoring method of the Somes River catchment's area and the correlation of different results (water, sediment and biological data) with the chemical analysis of white stork and sand martin chick feathers breeding in this area. In addition, the chemical methods applied *in situ* to analyse heavy metal concentration by DGT and the analysis of heavy metal concentration from bird plumage are applied for the first time in Romania.

The results from this study will create the premises for elaboration and implementation of a national level biomonitoring system concerning the aquatic ecosystem's quality in the major river in Romania, from restoration and conservation perspectives, in condition where the water of the rivers Lapus, Somes and Tisa must secure an important part of the water for domestic use, agriculture and industry. Spreading our results at large scale (scientific

presentations, papers, webTG1 -site) will lead to a better appreciation of the real situation by the local authorities and interested persons.

The proposed methodology could be a starting point to elaborate other methodologies in environment protection, biomonitoring of other catchment areas stipulated by the environmental law 13/1995 and the EU Directive *Framework for Community Action of Water Policy*, OJ L327/22.12.2000

INTEGRATED SYSTEM FOR THE EVALUATION OF THE PROPAGATION OF POLLUTANT AGENTS IN RIVER WATER AND ESTIMATION OF THE IMPACT ON POPULATION HEALTH IN THE ZONE

Z. Moldovan¹, I. Arpad², Maria Mircea³, Monica Popa⁴

In applying measures to improve water quality an important role is assumed by the existence of precise methods for the control of quality and quantity of pollutants in surface and underground water. Quantitative and qualitative determination of priority compounds implies the use of up to date analytical techniques satisfying sensitivity and selectivity conditions, as:

- 1) Coupled systems of the type gas chromatography - mass spectrometry (GC/MS);
- 2) High performance liquid chromatography (HPLC). Based on measurements performed at selected sites and having as parameters processes of the biodegradation, adsorption and dilution type, an evaluation of the pollution degree with individual compounds in a large dimension hydrologic basin will be performed.

The target compounds were mainly among the priority compounds contained in European Regulation Documents. The results obtained will be the starting point for the evaluation of the hazards for the population health.

The target problems proposed to be solved:

- Detailed investigation of molecular structures in natural systems;
- Integration of mass spectrometry and chromatography techniques to environmental investigations;
- Development of informational systems for the high capacity acquisition and processing of data obtained by direct measurements and by evaluation of processes taking place in different environment matrices;
- Utilisation of output data to evaluate hazards upon human health;
- Integration of Romanian research and monitoring to the circuit of EU research;
- Creation of scientific support to elucidate, fundament and increase scientific knowledge on the transport of pollutants in the natural environment;
- Opening the possibility to participate in European programs for the institutions involved.
- Dissemination of results in the field of national environment quality.

Measurable objectives

Expected results:

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⁴ (UMF), University of Medicine and Pharmacy, Cluj-Napoca

- Identification of polluting compounds in trace quantities (ng/l) in samples collected at regional level (Somes - Tisa hydrographic basin);
- Databases containing structure, quantity and location of compounds having impact upon life;
- Identification of the origin of pollutants in the aquatic media at regional level;
- New scientific information connected to natural processes of degradation, dissociation, adsorption and dilution for organic pollutants from the aquatic media;
- Complex software systems for the quantitative evaluation of particular compounds as well as hazard evaluation upon human health;

The main obtained results:

The main obtained result was an innovative sensible and selective method based on coupled Gas-Chromatography/Mass Spectrometry System for determination of micropollutants in water samples.

The following families of compounds were detected:

1) Steroidal compounds of type 5β -stanols C27 (*coprostanol*) C28 and C29 (*stigmastanol*) and their precursors, 5Δ -stenols as C27 (*cholesterol*), and C29 (*Sitosterol*). They have a high chemical stability and are used as molecular biomarkers of human activity.

2) *Phthalate acid esters (PAEs)*. They are widely used in different industrial activities having main application as plasticizers for PVC resins, adhesives and cellulose film coating. Analytical data about presence and relative levels of PAEs in surface water can be used to identification of contamination sources.

3) *Polyetoxylate* compounds (currently used as surfactants) with diagnostic ions m/z 89, 133, 177 (generally) were identified as Alcohol Ethoxylates (AEs) (High branched). The molecular distribution for a family of AEs with n in range 3-10 is shown in the Fig. 1.

4) High-branched chains compounds identified as *antioxidants* used in the food industry.

5) *Long chain amides and acids* with the number of carbon atoms in the range 16-22.

6) *Pharmaceutical compound* included in few therapeutic groups as analgesics, antiepileptics, psychiatric, stimulants, anticoagulants, antineoplastic and disinfectants were also detected.

7) Products used as *Personal Care Products* were detected in significant quantities. Galaxolide (HHCB) and Tonalide (AHTN) were detected around of 300ng/l. The unchanged quantity detected in different places along of the river are according with stability of the these compounds as was reported. Due to the environmental stability, Galaxolide and Tonalide were selected as suitable tracers for musk fragrance.

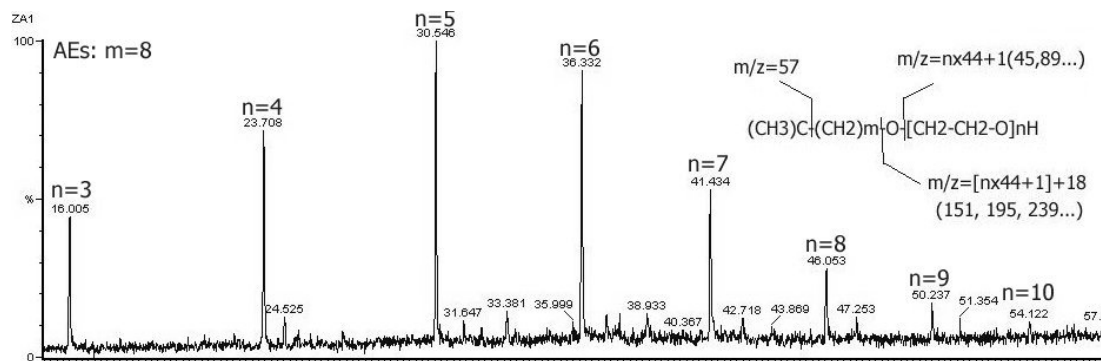


Fig. 1. Characteristic ion chromatogram (m/z 89) for alcohol ethoxylates (AEs) on water sample from river (Somes place 1).

**INTEGRATED PLATFORM FOR THE USE OF ENVIRONMENT
ISOTOPIC TECHNIQUES FOR THE MANAGEMENT OF MINERAL
WATER RESOURCES – CASE STUDY IN THE AREAL OF ORIENTAL
CARPATHIANS MOUNTAINS**

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For Romania, the present project represents the first systematic and long-term integrated approach of the mineral water deposits through isotopic analyses, on a wide areal and using a great number of investigation methods. The main objective of the project is scientific administration of mineral water resources from the areal of the Oriental Carpathians, using stable and radioactive isotope techniques and GC-MS technique.

The research solves the following problems correlated with the main objective: 1. The estimation of the mixing degree with other types of water; 2. Pointing the location and proportion of the recharge; 3. Calculation of the flow speed of underground waters; 4. Elaboration of a hydrologic concept called underground water system; 5. Performing isotopic ratio measurements on environmental isotopes in order to establish the isotopic stamp and the origin of the waters; 6. Identifying the mineral water spring types by measurements of natural concentrations of tritium and ¹⁴C; 7. Identifying of traces of pollutants by measurements of isotopic ratio ¹⁵N/¹⁴N and ³⁴S/³²S; 8. Corroborating these last measurements with trace analyses by GC-MS. Till now we are in progress with the 1, 2, 5 and 6 objectives and we have obtained the very good results in the field.

Deuterium analyses from water are carried out with the SMAD or Thomson mass spectrometer existing in the Mass Spectrometry Laboratory of NIRDIMT Cluj Napoca. The isotopic analyses of the other light elements C, N, O, S are performed with a mass spectrometer ATLAS upgraded. Depending of the desired precision these measurements are carried out on single or multiple ion collection.

The determination of the origin of mineral waters with hydrogen and oxygen isotopes was achieved by systematic measurement of D and ¹⁸O isotopes, graphic representation in a plot ($\delta D; \delta^{18}O$) and the comparison of the positions of the points towards the straight line of global precipitation, GMWL. The positioning of the points on a straight line parallel with the oxygen axis show the presence of an isotopic exchange of the water oxygen with the rocks in contact, confirming the water origin.

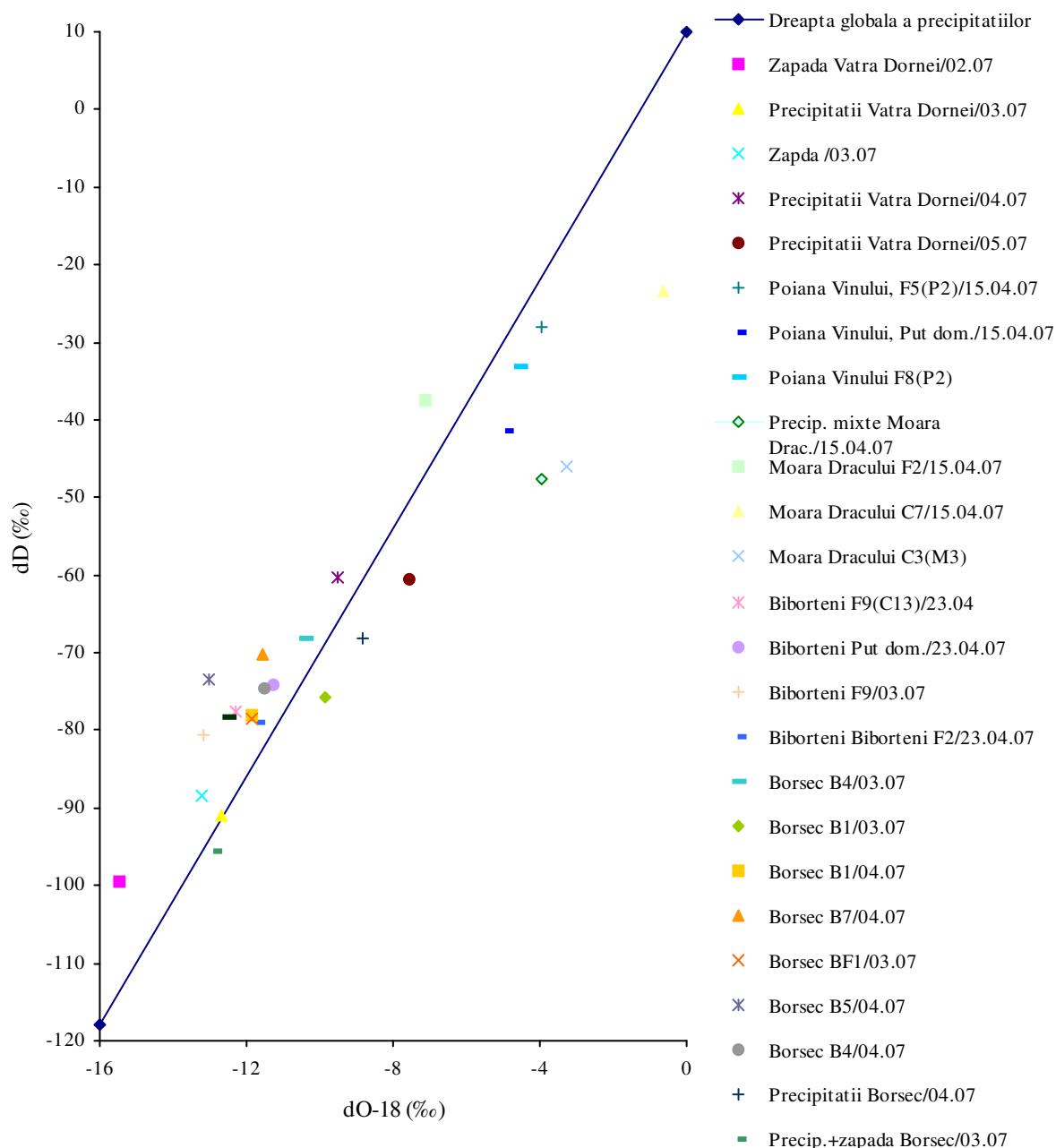
The origin of the waters was determined as follows:

-meteoric origin – straight line parallel with the global precipitation straight line (GMWL)

-geothermal origin – straight line parallel with $\delta^{18}O$ axis

-evaporation or mixing origin – a sloap between the two previous mentioned

In the below figure is shown the origine of some of the mineral water sources that were studied together with the precipitation for each areas.



The ^{13}C carbon is an excellent tracer of the carbonates evolution in the underground waters, due to the large variations noticeable at different carbon pools level. The ^{13}C content in the underground waters depend of the ^{13}C concentration in the feeding water, the geological nature of the infiltration areal, the mineral composition of the aquifer, the presence of CO_2 manifestations in depth, the temperature and the pH of the water, etc. The nature and the quantity of CO_2 solved in water and the equilibrium reactions of water with carbonate minerals from the crossed rocks, determines preponderantly the water contend of ^{13}C .

The most important results of the of the project obtained until now is connected with determination of the origin of the mineral waters from the springs of Oriental Carpathians areal, elaboration of a data base regarding the temporal evolution of the phisico-chemical and

isotopic characteristics of mineral waters and the improvement of the protocols for authorizing of the mineral water springs.

ULTRASENSITIVE MONITORING OF POLLUTANTS BASED ON TANDEM SYSTEMS USING NON-CONVENTIONAL DETECTORS.

Cornel CUNA¹, Adrian BOT¹, Martin KAUCSAR¹ and Daniel URSU¹

In this project some non-conventional methods for accurate and ultrasensitive determination of some pollutant substances classes are being proposed, methods based on tandem coupling of chromatographic separators with specific, non-conventional detectors. The element of novelty of the proposed research relies in utilizing some originally designed and produced detectors and in the coupling manner of these detectors with chromatographic-type separators.

Using ion mobility spectrometry coupled with gas or liquid chromatography and with mass spectrometry to detect pollutant organic substances (VOCs, POPs), chemical warfare agents, drugs or explosives, established successfully proven applications in the last decade.

Due to the fact that separation processes based on differences of mobility are based on physical and chemical processes totally different than those involved in chromatography, it is obvious that using as detector a ion mobility cell (IMS cell) will add a new qualitative dimension of acquired data. Correlation between the ion mobility spectra (obtained with the IMS detector) and the retention time of gas chromatograph (GC) provides us with a high performance analytical method that can be used in trace detection of the chemical compounds and solves many problems concerning environmental monitoring and prevention of its contamination. The development of this hyphenated method requires a coordinated action of experts from different fields: physicians, chemists, electronic and mechanical engineers, mathematicians and programmers. The following detectors are to be used in these coupling procedures: a) high-resolution electrolytic detector - for halogenated derivatives, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), pesticides, insecticides, and oil products, b) thermoconductive detector based on polymeric filaments, for small molecules (inorganic gaseous pollutants SO₂, NO, NO₂, H₂S, CO, CO₂), and c) detector based on ion mobility, especially for organic toxic substances (POPs: Aldrin, Dieldrin, Endrin, Chlordane, DDT, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene, PCBs, Dioxins and Furans). It is taken into consideration the automation of the process of data acquisition and processing, and data remote transmission.

Objectives:

- Realization of several specific, non-conventional detectors: the electrolytic detector, the thermalconductivity detector, and the ion mobility detector.
- Realization of the coupling systems of these above-mentioned detectors with gas-chromatographic systems.
- Elaboration of software packages.
- Elaboration of the working methods using the tandems gas chromatograph - non/conventional detectors and procedures' establishment.

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Results:

1. The measurement configuration for the thermalconductivity microdetector with polypyrrole filaments.
2. The analytic module of the electrolytic cell detector.
3. The experimental model of the ion mobility detector.
4. The testing of the detectors on different classes of organic compounds.

Expectations:

Until to the end of the year we propose us:

1. The experimentation of the gas chromatograph analysis installation ,realized with thermalconductivity microdetector.
2. To test the experimental model gas chromatograph-ion mobility spectrometer.
3. To test the experimental model gas chromatograph-electrolytic cell detector.

TOOLS, GUIDELINES AND INDICATORS INTEGRATING THE ENVIRONMENTAL CONCERNS INTO AGRICULTURE, FORESTRY AND RURAL WATER POLICY

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The TOGI project objective is to design and test a single, integrated, national-wide and operational set of measurable criteria and indicators as a basis for a harmonised comprehensive information system used for integrating the environmental concerns into agriculture, forestry and rural water policy. The choice of criteria and indicators within TOGI is build on previous outputs from national and European projects (e.g. IRENA, PAIS). Formal protocols, procedures, tools and implementation recommendations has been developed for the collection, collation and reporting of harmonised country-wide information. The indicators are useful in reporting and monitoring the application of various codes of good practice in agriculture and water. The use of selected indicators for catching the response of local communities (stakeholders) to the action of the main driving forces in the rural area (agriculture policy, global changes) has been demonstrated through the use of Decision Support Systems developed for integrated land and water management.

The TOGI project developed an indicator based framework for monitoring and evaluating agriculture and rural water policy based actions on the basis of DPSIR (Driving Force-Pressures-State-Impact-Responses) approach relating complex socio-economic and environment systems. This objective is designated to develop and define robust, relevant and scientifically-sound criteria and indicators for the harmonised (over the country and in an EU perspective) characterisation of the threats to environment derived from agriculture, forestry and rural water policies. For each indicator rationales for the definition of baseline and

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threshold values corresponding to boundary conditions for “good environment status” has been identified. There was elaborated thus a well-defined official agreed list of criteria, indicators and thresholds integrating the environment issues into agriculture, forestry and rural water policies, using the DPSIR framework developed by the European Environment Agency. IRENA project was dedicated to evaluate the indicators for defining the cross-compliance between European agriculture and forestry policy and environment concerns. TOGI has identified the existing gaps regarding concepts, indicators and data, elaborating a manual, a fully-documented publishable consistent set of definitions, procedures and protocols for the harmonised characterisation and assessment of environment for monitoring from the perspective of agriculture and forestry activities. The manual is available on the project web-site for comment from end-users and stakeholders during the project.

The outputs of the project have been for reporting and monitoring the codes of good practice in agriculture, and the problems of sustainable agriculture production and management of biological resources.

The proposed indicators and procedures have been tested over a comprehensive set of pilot area (NUTS4 level) chosen to represent the diversity of natural and socio-economic conditions over the country (distributed considering euroregions, landscape, socio-economic development, vulnerability to various agriculture activities).

The project integrated statistical and administrative data with existing geographical cover information (soil, water bodies, land cover, land use) for the indicator calculation. A database strategy has been developed taking into account the structure and content of existing database coverages (soil, CORINE and LCCS land use, river basins – Catchment information system, digital elevation models, land productivity, socio-economic parameters at NUTS4 level). A database design enabling connectivity with other data layers will be specified. Therefore, TOGI is answering to the needs of Commission Directorates-Geneals and the European Environment Agency (EEA) to have well defined databases and protocols interchangeable at EU level for the evaluation of agri-environmental indicators.

Guidelines for using indicators in monitoring and reporting the application of various codes for good practice (Code for Good Agriculture Practice, Good Agriculture and Environment Condition Code, Code for Good Farming Practice, Code for Good Water Practice) and agri-environment measures have been elaborated. Using the indicators for reporting and monitoring the codes of good practice in agriculture TOGI is answering to the problems of sustainable agriculture production and management of biological resources.

The end-users and stakeholders have been involved for the integration of indicators in existing Decision Support Systems for Integrated land and water resource management. The indicators and their evaluation on a territorial base have been used for evaluating various options for local implementation of integrated land and water management. The ability of indicators to structure and transmit the stakeholder’s response to pressures on environment due to agriculture and rural water policies will be documented. Publishable “Best Practice guidelines” for the development of multi-sectorial and multidisciplinary DSS in support of integrating environment concerns into agriculture and rural water policies.

The indicators have been integrated into decision support systems to contribute to the application of information technology for solving societal challenges in support of environment and sustainable development. The use of indicator based guidelines and decision support systems integrating the local communities answers to the challenges induced by global changes will contribute to an in-depth understanding of complex and interrelated socio-economic challenges in Romania confronted with the integration in EU.

The indicator framework has been used for the elaboration of agri-environment tasks in the country reports to the international commitments such as Kyoto protocol, the UN Convention on Biological Diversity, the UN Convention on Desertification and Land

Degradation. Links with standard reporting forms has been created in order to use the scientific-based indicator framework developed in TOGI for fulfilling the country commitments. Therefore, TOGI is answering to the rationale of the Thematic area 6 on the research needed for the implementation of international commitments.

A site for communicating of project achievements and integration of the reactions from end-users and stakeholders through the project web-site and by networking with interested institutions and organisations have been done.

The proposed objectives have been achieved until this phase. The indicator set and the manual have been elaborated; the thresholds and base value for each indicator have been calculated; the risk assessment and the communication with local stakeholders were evaluated.

The objectives for the last phase are to elaborate Best Practice Guidelines for the development of multi-sectoral and multidisciplinary DSS in support of integration environment concerns into agriculture and rural water policy and to organise a training workshop.

The project could be developed in the future by achieving a set for soil specific indicators, considering the further Soil Directive that the European Committee intends to elaborate.

THE EVALUATION AND REMEDIATION OF HISTORICAL POLLUTION OF ACQUIFERS THROUGH NON-CONVENTIONAL METHODS

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The general objective of the project is the optimization of the methodology and technical evaluation and characterization solutions for the level of historical pollution of the degraded aquifer strata and to fundament technological solutions for their control and remediation. The specific objectives of the project foresee the creation of a general evaluation, surveillance and remediation program for groundwater which reflects the main tendencies and orientations in the area of aquifer protection both in Europe and worldwide.

The project has five stages which target the creation of the informatic and technological support for the functionality of the research and development network, the presentation of the main methods for characterization of polluted aquifers, the decision upon a strategy for sampling and the realization of analytical determinations, research regarding the potential for remediation of the polluted medium by employing in-situ remediation methods (bio-remediation), and finally, developing a technological network in the area of biotechnologies for the aquifer remediation and the transference of the results towards the potential users.

The application, on various levels, of this project's targets will bring economical benefits – the optimization of investigations for defining the pollution, the optimizations of measures for remedies by establishing de-pollution limits based upon realistic and feasible

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criteria, the reduction of exploitation costs of the remediation solutions by optimizing their functionality – and it will lead to the efficient remediation of the quality of the environmental factors – soil and groundwater.

During the period of October 2005 up to June 2007, the bases for the research network have been established (<http://erpisa.utcb.ro>), research and surveys have been conducted regarding the characterization models of the aquifer strata, the creation of a database associated to the polluted aquifers, the evaluation of the current stage in the area of decontamination processes/procedures of the aquifer strata, the decision upon the sampling strategy and the realization of analytical determinations as well as field surveys in several locations (Pod Ovidiu, CFR Calatori București Basarab), the realization of a pilot bio-remediation amplified aerobic station and the start of experiments regarding the de-pollution of the aquifer strata.

The database regarding the pollution of aquifer strata was created for the Ialomița hydrographical basin and it contains: the identification of the income from diffuse and point pollution sources, the global evaluation of the ratio of point pollution sources from the estimation of the effluents and the global quality of the groundwater.

At the same time, field surveys were conducted regarding the degree of soil and subsoil pollution with oil products. A strategy was established regarding the sampling and the realization of analytical determinations and the database was configured (fig. 1) regarding the representative parameters (physical, chemical and bacteriological contaminants) regarding the selection of remediation sites. For this were defined the parameters that govern the transport and behavior of pollutants in the groundwater; laboratory tests were conducted upon samples for the determination of contaminant and micro-biota types for the location of Pod Ovidiu – CONPET S.A. Ploiești and CFR Calatori București Basarab (Figure 2).

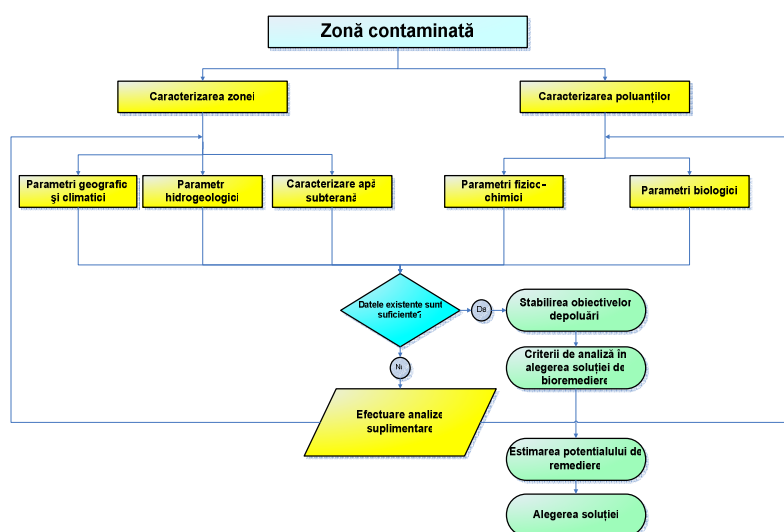


Figure 1. The scheme for the database design

Also, an analysis of the spatial-temporal evolution of the quality of the groundwater was conducted and a mathematical model was calibrated for the determination/prognosis of the extent of the groundwater pollution regarding the choice of an optimal solution for decontamination.

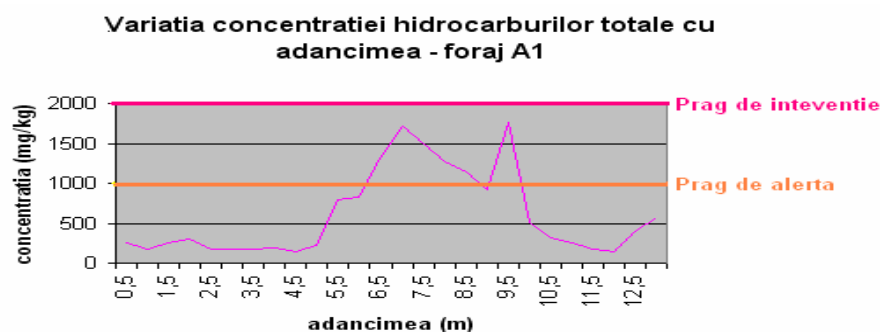


Figure 2. Results of the in-situ determinations

Regarding the potential for remediation of the polluted medium by applying several biotechnologies, certain criteria systems were defined and analysis indicators for the characterization of groundwater strata within polluted soils and conditions and application limits for the bio-remediation technologies were set through the study of laboratory/pilot scale models. The documentary survey regarding the biotechnologies for aquifer remediation was comprised of: the general principles of the bio-remediation process, the factors which influence the micro-biota within the aquifer and the bio-remediation mechanisms, the factors which influence the micro-biota within the aquifer, the feasibility of the bio-remediation technologies.

The project is focused on the optimization of protection and remediation measures of the environmental factors, with special regard to the groundwater. Through its connections and results, the project will have positive indirect effects upon the other environmental factors, soil, air. The associated hazards of polluted groundwater – ecological risk, aquatic biota risk, health risk – will be evaluated and control and minimization measures will be proposed. The results of the project will most certainly have an impact on the environment in the sense of a major reduction in historical pollution.

ROMANIAN FOREST GENETIC RESOURCES CONSERVATION AND SUSTAINABLE MANAGEMENT (COREGE-FOREST)

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The scope of FGR conservation in Romania is the assurance of populations and species adaptability in a changing environment by maintaining a good level of the genetic variability.

The objectives of the proposal are: **A. *In situ* conservation of forest genetic resources (FGR) in their ecosystemic** (for all the representatives ecosystems) **and specific diversity** (for all autochthonous and introduced exotic broadleaved and resinous species important and relevant for the forest field); **B. *Ex situ* conservation of FGR** of autochthonous and introduced exotic broadleaved and resinous species in some arboretums, proveniences field tests, half-sib tests, full-sib tests, clones and families orchards, interspecific hybrid tests, poplar and willows autochthonous clones proper collections, hybrid black poplar collections and genitors collections; **C. Some broadleaved and resinous valuable genotypes *ex situ* conservation using biotechnologies methods** (somatic embriogenesis, tissues cultures etc.); **D. Genetic diversity evaluation on izoenzimatic marker bases for resinous FGR;** **E.**

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Database and geographical information creation for FGR and digital maps (GIS) at national level draw up; F. Elaboration of FGR National Catalogue and technical guidelines for their sustainable management.

The main results obtained through the activities realized within the specific objectives of the project, are:

Objective A – Actualization / Creation of the databases regarding the forest genetic resources (FGR) conserved *in situ* in the south and south-eastern regions of Romania, in 17 counties. There were identified, described and constituted 132 conservation centers of genetic resources gathering 2778,1 hectares in surface for all the forest species from the research zones and the database was created.

Objective B1 – Actualization / Creation of the database regarding the FGR conserved *ex situ* in the arboretums Simeria, Doftana, Hemeiuși, Mihăești and Bazoș. In this 5 arboretums there are conserved *ex situ* 4731 taxonomic units, 636 resinous and 4095 broad-leaved.

Ex situ conservation of FRG in arboretums: Evaluation of adaptation and acclimatization of species and elaboration of the management plans for five arboretums, including the organization of a conference and realization of informative material (booklets, folders, CDs, creation of databases regarding the FGR conserved *ex situ* in half-sib and full sib trials and spruce genitors collections) .

Objective B2 – Actualization / Creation of databases concerning the FGR conserved *ex situ* in Clones and families orchards where are conserved the vegetative copies and/or the plus trees (selected trees) open pollinated families for the principal resinous and broad-leaves species. There were analyzed 118 seed orchards gathering 700,9 hectares where are conserved *ex situ* more than 5000 selected trees, from the most valuable trees from the national forest fund.

Objective B3 – *Ex situ* conservation of the FGR in provenances field tests. – Creation of databases regarding the FGR conserved *ex situ* in experimental trials with spruce provenances (15 trials), fir (6 trials), larch (6 trials), black pine (4 trials), Scots pine (6 trials), Swiss stone pine (2 trials), oak (11 trials), sessile oak (3 trials) and ash (5 trials).

Objective B6 – Actualization / Creation of databases regarding the FGR of poplar and willow clones and hybrids conserved *ex situ* in experimental trials, clones collections, stool beds. The forest genetic resources of willow and poplar conserved *ex situ* are the most valuable from the national and international genetic fund and they represent the selected biological material used for experiments and production works.

Objective C – *Ex situ* conservation of the FGR using biotechnologies methods – The establishment of the working method for the conservation of valuable genotypes of white and grey poplar using *in vitro* cultures.

Objective D – The evaluation of genetic diversity using izoenzymatic markers for some FGR of resinous and broad-leaved species with valuable wood.

- Determination of the genetic parameters intra-population diversity for the Banat black pine for 21 locus analyzed using 10 enzymatic systems.
- Determination of the genetic diversity intra- and inter-populations for alpine stone pine from 7 provenances, analyzing 24 genetic locus using 10 enzymatic systems.

Researches will have an important technical impact promoting to capitalization on long term breeding experiments and to put bases to some new research for fundamentation of sustainable forest management, in condition of climate change. For environment, this major action of *in situ* and *ex situ* conservation have role to ensure species and population adaptedness in condition of climate change through maintained of high level of genetic variability. Also, impact on economical and social environment is positive, because using

superior and adapted forest reproductive material, economical, ecological, protection and social function of forest will be increased.

INTEGRATED SUPPORT FOR SUSTAINABLE DEVELOPMENT OF CHEMICAL INDUSTRY COMPANIES, THROUGH IMPLEMENTATION OF ECO-EFFICIENCY CONCEPTS – INTEGR-IT

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Mihaela OPRESCU³

The main scope of the project consists in the development and appliance of an integrated support for sustainable development of the companies from chemical industry, through rapid implementation of eco-efficiency principles. Even if sustainable development and pollution prevention are included in the principles on which the national environmental protection strategy is based, there is a lack of awareness, from the vast majority of the industrial units, of economic, social and environmental benefits resulting from implementation of eco-efficiency tools.

Main objectives:

- Development and implementation of the integrated support system for sustainable economic growth of Romanian companies, simultaneously with the improvement of environmental performance, in the spirit of sustainable development
- Building a network of excellence dedicated to promotion and implementation of eco-efficiency tools – e-Eco-efficiency

Results:

Stage 1 – Development of working methodologies for implementation of eco-efficiency tools.
Objective 1: Development / extension of working methodologies for sustainable development of the company

- Strategic model of sustainable development. The proposed strategic model is comprising as core elements: diagnosis of the unit, vision, mission, fundamental values, strategic objectives structured on four perspectives (financial, partners, internal processes, development and growth) and three dimensions (social, economic, environment), strategy metrics;
- Methodology for "cleaner production" assessment, technical, economic, environmental and CSR assessment of generated options. The proposed methodology is structured on six main steps: start-up, analyses of process phases, generation of cleaner production opportunities, assessment and selection of opportunities, implementation of selected solutions and support for cleaner production solutions;
- Methodology for environmental management accounting system. The following main steps are needed to be performed: identification of "environmental costs", development of company's material and monetary flows, allocation of "environmental costs" to cost carriers and setting-up a set of monitoring indicators.
- SWOT analyse for chemical industry. The general framework and particularities of SWOT analyse dedicated to diagnosis of Romanian chemical industry were presented. Data that illustrates the SWOT capabilities, which are containing all the factors

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influencing the technological, environmental, financial, social performance of the organizations were centralised.

Stage 2 – Preliminary audit and selection of pilot areas for demonstration of methodologies' applicability. Objective 2: Selection of representative pilot areas for demonstration of developed methodologies:

- Questionnaires regarding unit's production profile, present capacities and technologies. The questionnaire was developed taking into account the complexity and variety of raw materials, processes, technologies, products, emissions from chemical industry. All possible common aspects of industrial chemistry were included, in order to allow the comparison, assessment and selections of units from various areas of chemical industry, without neglecting the important specific aspects;
- Questionnaires dispatch to potentially beneficiary units and collection of diagnose data. A number of 127 units were contacted from which 116 confirmed the receiving of the questionnaire;
- Data base with representative units from chemical industry. A number of nine short-listed representative units were included in the data base developed using MS Access environment;
- List of selection criteria. Multi-criteria evaluation of the units. List of selected pilot areas. Nineteen individual criteria were developed and the units were assessed using a multi-criteria evaluation approach. Units selected as pilot areas are SC CHIMCOMPLEX SA, UPS Fagaras, SC KEMWATER CRISTAL SRL and SC GA-PRO-CO SRL.

Stage 3 (on-going) – Implementation within the selected pilot areas. Demonstration of proposed methodologies. Objective 3: Demonstration of methodology's applicability / efficiency, through implementation within representative pilot areas from chemical industry

- Trained personnel (from pilot areas) in "cleaner production", technical, economic, environmental and CSR assessment of generated options, environmental management accounting, sustainable development strategy. A number of 33 members of unit's teams were trained. Presentations are also available on the project's web-site.
- WEB site for audit, training and implementation of eco-efficiency procedures. The www.ecoeficienta.ro site is on continuous improvement. The interim results and presentations of methodologies used are free available to all interested persons.
- "Cleaner production" assessment. Technical, economic, environmental and CSR assessment of generated options performed within the pilot areas. At this moment the middle stage of the assessment is performing – evaluation of cleaner production options.
- Environmental management accounting system implemented within the pilot areas. Environmental costs were already identified and material and monetary flows developed. At his moment, the cost allocation on cost carriers is under work.
- Model of sustainable development of the company implemented. The diagnosis of company (the most important step) is in the final stage.

Three paper works were presented at scientific events: The 7th International Conference of Technology and Quality for Sustained Development, The XXIXth Romanian Chemistry Conference and EcoAkademia (2nd place for the paper "Balanced scorecard and enterprise's sustainable development strategy).

Perspectives:

- The work will be completed with research on the alignment to BAT references and recommendations for the sustainable development of chemical industry sector. A technical – economic study on the IPPC requirements of selected pilot areas is needed in order to develop a set of recommendations for the sustainable development model of chemical sector;

- Setting up an integrated technological network of excellence in specific fields. The project's web-site will be used as a base for a e-Eco-efficiency centre that will allow the transfer of knowledge, information, technical solutions, on-line technical assistance, possibility to replicate at the level of industrial units and integration within the corresponding European technological platform.

ECOLOGICAL PROCEDURES AND SOLUTIONS FOR REMEDICATION OF CONTAMINATED SOILS AND WATERS WITH RADIONUCLIDES AND HEAVY METALS AND DUMP RENATURATION FROM URANIUM INDUSTRY (ECOINDUR)

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The project presents the researches in order to obtain environmental technologies for mitigation and restoration of the natural and man-made environmental factors. The project also is proposing to inventory the heavy metals and radioactive contaminated areas related to uranium mining industry and to completely characterize the selected contaminated situs. During the project will be performed biotechnologies and procedures in order to decontaminate the soils, effluents, waters (surface and underground waters) and dumps from radioactive industrial perimeters. Nuclear activities are involving the discharge in the environment of great volumes of waste waters which contain small uranium amounts. Moreover, the closing uranium mining activities could determine the underground radioactive waters to reach the above ground, representing a real danger to environment and population. The general objective of the project consists in the elaboration of a new soil bioremediation technology for radionuclides and heavy metals removal, dump revegetalization and for the effluents and the underground waters decontamination in order to prevent the environment damage.

The scientific objectives of the project submits the achievement of the following:

- the assessment of the heavy metals and radionuclides contaminated areas and risk assessment;
- the analyses of soil, waters and plants samples preserved from the contaminated areas;
- the plants use in order to determine the influence of the radioactivity to soil and vegetation;
- plants test under the green house conditions;
- the elaboration of technological solutions regarding the degraded areas reconstruction.

The process of experimentation is still ongoing. The first experimental field is organized at Baita Plai, Apuseni Mounts, on radioactive sterile deposit, with 3-5% slope consist in: A) soil cover with 4 graduations: 0, 10, 20 and 30 cm thickness; B) fertilization system with 3 graduations: un-fertilized, mineral fertilization with N₂₀₀P₁₅₀K₁₀₀ and organic fertilization with 100 t/ha laystall; C) planted with three species: ash, honey locust, pine, and sowing with five perennial grasses: *Lotus corniculatus*, *Dactylis glomerata*, *Festuca pratensis*, *Lolium perene* and *Bromus spp.*

The soil characteristics for radioactive sterile covering are:

- the soil pH is acid (5.62);
- the organic carbon content is low, 0.87%;

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- the total azote content is low, 0.131%;
 - the small phosphorous mobile content (3.12 mg/kg) and an small content (54 mg/kg) for mobile potassium;
 - chemically, the variation coefficient is low, only the organic carbon have higher values, but the soil never lay the alert state;
 - the heavy metals contents are normally for unpolluted soils; chemically, the soil is suitable.
- The dump talus have the debit gamma doses between 0,7 – 2,0 $\mu\text{Sv/h}$ and the medium contents of $U=300$ ppm and $Ra=8\text{Bq/g}$. The water sampling nearly dump from Baita area have the following contents in radioactive elements: $U=0,17$ mg/l and $Ra=2,3$ Bq/l.
- The result of analysis affected on dumped material is presents in table no.1

Table 1 Radionuclide and heavy metals content

Name Sample		U %	Th %	Mo %	Cd %	Zn %	Pb %	Cu %
Baita Dump	Plai	0.00116	0.00134	0.00089	0.0001	0.0165	0.0022	0.023
Baita Dumpberma	-	0.0069	0.00158	0.0008	0.0002	0.021	0.007	0.111
Baita base Perimeter	Dump-	0.00001	0.00248	SLD	0.0008	0.0455	0.02	0.031

The decontamination process mechanism of uraniferous affluents is based on two procedures: the generation of compounds due to U(IV) reduces and also the directly enzymatic reducing by the bacteria using the U(IV) as electron acceptors. The microbial anaerobic activity increase the uranium solubility by organic acids producing.

Uranium contaminated soils can be amendable by phytoremediation using the capacity of such plants to develop uranium accumulation mechanism. The best uranium forms accumulated by plants are uranyl cations (UO_2) formed in soil at $\text{pH}=5$, towards uranium hydroxyl or uranium carbonate, formed in soil at $\text{pH}=6$.

Expected results: The elaborated solutions and technologies for the contaminated areas reconstruction could allow the exploitation of the degraded soils and the optimal use of their limitary areas.

After technology application, will be performed radioactive measurements and physical, chemical, biological analyses of the soil, waters and plants samples preserved from the studied area. The results will prove the success of the decontamination technology which determines the contaminants levels to be in the standard limits. The results and benefits expected to obtain using the proposed technology are as follows:

- biotechnologies for heavy metals and radionuclids removal from the contaminated soils and waters;
- diminish of the waters pollution rate to the permissible levels;
- decreasing of the radioactive emissions of the dumps and waste deposits from the uranium mining areas;
- using the microorganisms cultures as radioactive ions and heavy metals adsorbants;
- using the hyperaccumulating plants for contaminants removal;
- recovery of the heavy and radioactive metals, especially U, Mo, Pb, Cu, Ni, by simple and less expensive operations;
- stabilization and renaturation of uranium sterile dumps;
- achievement of the European Community aquis regarding the environmental protection in the purpose of the Romania adhesion to EU.

MTBE (Methyl Tertiary Butyl Ether) DEGRADATION TECHNOLOGIES FROM THE HUMAN CONSUMPTION WATER.

Gabriel Racoviteanu¹; Marin Sandu²; Ion Udrea³; Elena Vulpasu⁴; Eduard Dinet⁵; Corina Bradu⁶; Marian Neata⁷

Methyl tertiary butyl ether (MTBE) is obtained through chemical synthesis from methanol and isobutylene and is used for raising the octanic number of the gas without lead. At the normal temperature MTBE is volatile, colourless and very soluble in water. It is detectable through specific smell and taste at concentrations between 20 and 40 ppb. MTBE can pollute the ground waters and also surface waters through fuel leakage from underground reservoirs and the pipes of the gas stations and refineries. An essential characteristic of this compounds is the high degree of persistency and resistance at biodegradation which constitute a major problem in ground water pollution which are sources for the human consumption waters.

Objectives

The major objective of the project it represents identification of the best degradation technologies of MTBE, corroborated with the analyse of some water sources used for human consumption preparation which presents high risk of compound presence.

From the general scientific and technical objectives of the project it is mentioned:

- realization of scientific researches at laboratory level and pilot scale for establish the main modalities of existent technologies adaptation for conformation;
- elaboration of modern solutions concerning the water treatment technologies;
- promoting and testing of new technologies and solutions, not-conventional for water treatment;
- establishing of advanced design methods and methodologies in the water treatment technologies domain;
- harmonization of the internal standards and regulations with the European and international ones;
- concretization of the directions and strategies according with the European domain policies referring to the conformation;
- increasing of the quality of the water for human consumption, corroborated with lowering the risk on public health determined by diseases generated by water;
- the realization of a practical method for quantitative analyse of MTBE from water;

Results

In the first 3 stages of the project was made experimental research about the MTBE degradation possibilities. There were used three methods: membrane bioreactors, catalytic oxidation and reduction of MTBE concentration by granular activated carbon adsorbtion.

The experimens revealed the following:

- MTBE is possible to be removed through biologic processes if adapted microorganisms are used;

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- the start of the biologic processes was unexpected fast;
- the biomass development is dependent to the environment conditions (temperature, pH);
- the efficiency of MTBE degradation is very high if additional carbon source is added;
- the efficiency of MTBE degradation depend on the raw water MTBE concentration; for the raw water MTBE concentration was about 1 mg/l, the effluent MTBE concentration was 10 µg/l. The U.S. EPA has recommended an MTBE concentration in drinking water of 10 to 20 µg/l or below. In case of high MTBE concentration in the raw water, though MTBE degradation efficiencies are over 95%, the effluent MTBE concentration is over the recommended limit.
- MTBE can be degraded through advanced oxidation processes, with efficiencies until 100%; the efficiency of the degradation is depending by the process conditions;
- the oxidation with ozone and oxygenated water shown the efficiencies until 75% for ozone doses respectively oxygenated water doses of 2.58 mg/mg MTBE and the reaction time of 8 minutes;
- the optimum ratio O₃/H₂O₂ for MTBE degradation was 1;
- the decrease of the efficiency of the MTBE degradation and increase of the concentration of degradation byproducts (TBA) was recorded when the doses of the ozone and oxygenated water was decreased;
- the time of the oxidation is an major factor which affect the efficiency of the process of the degradation of the MTBE with ozone and oxygenated water;
- as a result of the influence of the dose of the oxidant agent and the concentration of the catalyst for the process, in the presence of the FeSO₄, was established the optimum molar ratio MTBE : FeSO₄ : H₂O₂ at least 1 : 5 : 150;
- whatsoever of the nature of the catalytic system was identified as partial oxidation products TBA and acetone;
- in the presence of the ferrous sulphate and/or ferric chloride, function of the dose of the H₂O₂ and temperature, the degradation of the MTBE and of the partial oxidation products is complete after 22-24 hours.

It is appreciated that the biological processes in the membrane bioreactors can determine high efficiencies, if these processes are coupled with the chemical processes (advanced oxidation).

BIOCLIMATIC RESOURCES AND RESTRICTIONS IN ROMANIA

Nicoleta IONAC¹, Sterie CIULACHE²

This project actually makes, by means of an effective cooperation among more specialists in climatology, a thorough analysis of the bioclimatic resources and restrictions of the entire Romanian territory, but also lays the basis and develops a national laboratory of biometeorology and bioclimatology (BIOCLIMALAB) at the University of Bucharest, supported by regional research centers in the universities of Iaşi, Cluj-Napoca, Constanţa,

1. UNIVERSITY OF BUCHAREST – FACULTY OF GEOGRAPHY
2. ROMANIAN ASSOCIATION OF CLIMATOLOGY

Oradea and Braşov, according to EU research requirements and standards. On its turn, BIOCLIMALAB will create a standard reservoir of methods, techniques and procedures for bioclimatic research, by means of a specific web page (<http://bioclimlab.unibuc.ro>), which presents the main results of the project research work, on one side, and informs the public on the relevant or critical biometeo-climatic data in the territory they live in. The web page also provides specific software programmes so that everybody interested may actually calculate and find out, in due time, the current value of relevant directly-measured and computer-processed bioclimatic indices and the actual level of bioclimatic stress in their area of interest.

Fully complying with the provisions of the *Emergency Order nr. 99*, issued by the Romanian Government in 29 June 2000 (the methodological application norms being later established in the *Government Decision nr. 580* in 6 July 2000), which identifies the weather-related hazardous conditions and establishes the „measures to be taken in the periods with extreme air-temperatures in order to protect the working persons”, the activities associated to the present research-work are prone to improve public awareness and knowledge in the respective field, by providing the technical support to quickly adapt to modern research and report requirements in order to allow and favour the universal comparability of data and the relevant exchange of data, on one side, and by integrating highly valuable, new and exquisite data for human health (bioclimatic indices) in the www. network, on the other side.

The positive or negative role that various weather and climatic characteristics (solar UV radiation, air-temperature, air-pressure and air-humidity, wind-speed) as the most variable components of the environment, play on the health status of the Romanian population is reflected by many synthetic maps integrated into the “Bioclimatic Atlas of Romania”, which brings new contributions to the development of the scientific knowledge in the field of bioclimatology not only by regioning the Romanian territory on specific bioclimatic criteria (effective temperature, wind-chill, thermal /climatic comfort index, heating/cooling degree-days, relative strain index etc.), but also by analyzing specific case studies revealing the bioclimatic risks in some geographical regions and periods and by quantifying the potential financial losses due to the climatic stress.

The project also intends to contribute to the training of future highly-qualified professionals in the field of environmental health, as well as to the training of researchers in the domains of interference between climate and many other scientific fields and domains of practical activities. An important goal of this project is also to develop a long-term partnership in the field of bioclimatic research, between institutions of higher education and research, and specialized non-governmental organizations (like the Romanian Association of Climatology) or other private or public institutions (meteorological centres, radio-TV broadcasting companies etc.), in order to form and cultivate a cultural environment of constant and large preoccupation for the optimal protection and permanent conservation of human health, which might be beneficial to the national economy, because it reduces the fiscal burden of health care for the persons who had already fallen ill due to exposure to hazardous climatic conditions or whose illness has seriously aggravated due to adverse or extreme climatic conditions. Nevertheless, the theme of the project is relevant for the development of scientific knowledge in the field of environmental sciences either because it promotes a vast, complex and highly-professional approach, which will make the results of the research work highly representative and comparable or compatible to those obtained in similar labs in other countries (USA, France, Italy).

In this respect, the research team made of teaching staff, Ph.D. and MA attendants or students from the Faculty of Geography in the University of Bucharest (UB) and other Ph.D. attendants in Climatology from various Romanian universities, as well as researchers from institutions performing research and operational activities in the field of Meteorology and Climatology, professionally joined into the Romanian Association of Climatology (ACR), has

obtained important new and original scientific results, i.e. they identified and hierarchically classified the most important weather or climate-related factors of physiological influence, also establishing their application and variation limits; they have acquired and processed climatic data from 114 representative weather stations of the Romanian territory, also performing field observations and measurements on relevant meteorological and climatic parameters, in some representative regions/towns of the country; they have identified the most representative bioclimatic indices expressing the degree of comfort or discomfort of all the physiological mechanisms of integration and control of the human body (UV Index, Equivalent Temperature Index-TEE, Temperature-Humidity Index-THI, Thom Index, Relative Strain Index-RSI, Heat Index-HI, Arakawa Index, Summer Simmer Index-SSI, Humidex, Summer and Winter Scharlau Indices, Wind-Chill Index) subsequently modifying their computational methodology according to the system of units and available input data in Romania, but nevertheless making output data universally comparable and compatible to the worldwide-used scales, in order to allow and favour a relevant universal exchange of data; they have created electronic computing programs to calculate the values of the selected bioclimatic indices, also designing and building attractive graphical interfaces for the specialized web page; they have produced many synthetic maps presenting the spatial and temporal distribution of key bioclimatic indices, that reflect the potential bioclimatic risks in different geographical regions, all of these graphical representations having already been integrated in various paper-works presented at different national and international colloquies and conferences or published in important national or international scientific revues.

Obviously, the best way of exploiting the results of the preset project is by displaying them on the BIOCLIMALAB, thus ensuring free and open access of all persons who might take an interest in bioclimatical issues. An important part of the final concrete results referring to the bioclimatic resources and restrictions of the entire territory of the country will be included in the substance of some lectures that are currently being given to the students attending the Master courses in Applied Climatology, as well as in the curricula of the „Meteorology-Hidrology” specialisations of the faculties where some ACR members activate. Some of the results can also be provided to mass-media, according to their interest in the matter, in order to be included in their current weather forecasts, thus greatly increasing the level of public awareness of the potential danger to expose in a harmful climate or to hazardous bio-meteorological and bioclimatic conditions. Another possible way of exploiting the results of the research work is to make intense use of them in order to substantiate the measures that some health care institutions have to take or adopt in order to prevent and control the weather-related illnesses that might be generated or aggravated by the analyzed factors. Moreover, the results of the research work may also be included in the strategies of touristic development in Romania, since they point to the most favourable or unfavourable areas to practice spa and climatic treatment.

COMPLEX USE IN AGRICULTURE OF WATER OBTAINED FROM DIFFERENT SOURCES, IN THE PRESENT EUROPEAN CONTEXT AND THE SUSTAINABLE DEVELOPMENT.

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1-INOE 2000-IHP; 2-INCDMF; 3-INMA; 4-SC CAST SA; 5-ANIF SA

The paper presents for the Project 624: objectives, obtained results, contribution at regional and EU policies.

Objectives

Romania belongs to the European countries having less resources (the 11-th place for total resources and 21-st place for those only from its own territory). The project is a complex one, because it approaches both quantitative and qualitative management of some kinds of water resources. We have in view the elaboration of technical solution for using and developing the water resources in conditions of various, extreme, climatic phenomenon (drought, flood, climatic changes).

In the water Quantity Management are treated approached the following problems:

1) Use of unconventional water resources, with reference to the water obtained from draining works. Now it is searched the volume of this resource and the ways of developing it for irrigation of cultures.

2) Efficient water and energy use in greenhouses by rainfall water harvesting (collecting and storing). Mainly, the researches will put in evidence the volume of resource and technical solution for collecting-stocking-pumping of water.

3) In the Water Quality Management and the impact of Environment, on read the problem of „Monitoring water irrigation quality at source.“

The technical solution consists of an equipment which perceives critical situation at the pumped water, carrying out the monitoring of the irrigation water. When occurs a critical situation pumping is stopped till the situation gets back to normal.

Obtained results

A) Experimental emplacement for research of the water resource transited by drainage works (sited in Băneasa, the dike precincts Gostinu-Greaca-Argeș, Giurgiu county).

In the climatic conditions of the year 2006, for all the whole season April-September, in the emplacement Băneasa, Giurgiu county, where are analyzed 3 pumping stations with a role of draining off water resulted from drainage, were drained off the following specific volumes:

-4018 m³/ha from the total surface of 5400 ha owned by SPB Manta;

-819 m³/ha the surface of 6600 ha which belongs to SPE Cioranu;

-1649 m³/ha from the surface of 1650 ha which belongs to SPD- 2 ICITID.

The specific consumption of energy in kWh/m³ is of 0,027 for SPB Manta, of 0,043 for SPE Cioranu and of 0,047 for SPD-2 ICITID.

The three pumping stations are differently equipped.

The specific consumption of energy at the surface unit , in kWh/ha is of 112,4 at SPB Manta, of 37 at SPE Cioranu and of 78 at SPD -2 ICITID.

B)Experimental model of technical system for rain water catchment-storage-pumping and its use for greenhouse irrigation. The emplacement is located in the Research and Development Resort for Vegetables from Buzău, Buzau county. The main structural elements are: the hydraulic connectors for the waterspouts at the vertical collectors, horizontal

collector, stock basin made of reinforced concrete, electropump, transport pipes, watering equipment.

The connecting solution has been submitted as a request for being granted patent of invention at OSIM in 2007.

C) The experimental model of the equipment for monitoring irrigation water quality at source. The monitoring parameters are: turbidity, pH, electric conductivity at 25 °C, pH, Cl⁻, Na⁺.

The equipment consists of prelevation electropump, the board with transducers, the monitoring board, visual and sound warning device. The emplacement of study is located at the base pumping station Manta, Giurgiu county, which uses from the Danube river with – without being mixed with water from drainage.

The technical solution of equipment has been submitted at OSIM, as a request for being granted patent of invention in the year 2007.

Contribution at regional and EU policies

The problems approached in the project are included in the technology platform (PT) 25, in the TWG 4- Water in agriculture, in A.1. – Irrigated agriculture, A5-Greenhouses (Irrigation).

In the European view, agriculture represents an important user of water, which will become economically, viable and competitive on the world market. In order to fit sustainable development, the agriculture will increase the needs for technologies and new equipment for more efficient developing of the irrigation water, it will use more the unconventional water resources and will respect the requirements of the Quality Management..

In PT 25 is mentioned that irrigations represent the most important water user from agriculture and the water needs will increase due to climatic anticipated changes.

Also, the project corresponds to the thematic fields: 6.2 and 6.3.

Thus, in the thematic field 6.2 „Sustainable managements of resources” is approached the preservation and sustainable management of natural resources by using drainer water like an alternative water source for irrigation of the crops and using rainfall water like a new resource for irrigation in the greenhouse conditions.

In the thematic field 6.3. – „Environmental technologies” at the chapter „Environmental technologies for watching, prevention, diminishing, adaptation and restoration of the natural and artificial environmental factors” be the irrigation water, like a unconventional factor, is included the problem of monitoring the quality of the irrigation water at source.

DUAL-ENERGY COMPUTED TOMOGRAPHY AND DIGITAL RADIOGRAPHY INVESTIGATION OF DANUBE DELTA AND BLACK SEA UNCONSOLIDATED SEDIMENTS*

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The project presents final results of designing and assembling a dedicated dual-energy computer tomograph to work both on-board of a research vessel and in laboratory conditions

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able to investigate unconsolidated sediments cores as well as other objects of geological interest with a maximum diameter of 12 cm.

Computed tomography, as a high performance technique of non-destructive control has evolved since 1972 when the first computer tomograph was built by EMI firm to present days status by increasing both spatial resolution in reproducing the internal structure of a great variety of objects to and accuracy in determining the local values of various physical parameters such as density, humidity, porosity of effective atomic number.

Accordingly, various branches of geosciences such as soil science, mineralogy, palaeontology or sedimentology were among those who get major advantages from this new technique. In the present conditions of a rapid growth of petroleum and natural gases consumption, the problem of finding new reserves or to increase the degree of exploitation of older, almost exhausted ones becomes extremely actual.

At the same time, another consequence of the present degree of fuel consumption consists of the accumulation of greenhouse gases that are among the main responsible for the actual atmosphere warming. One of the best way to understand the actual tendency of climate change consists of investigating sediments accumulated in lacustrine and marine environment. Black Sea and Danube Delta, due to their local conditions as well as past history, are, from this point of view very adequate for such kind of investigations.

On the other hand, collecting bottom sediments can be in some circumstances a relatively difficult enterprise which needs a rapid *in situ* evaluation of collected samples. For this reason, we have decided to built and commission a computer tomograph able to work on-board of a research vessel so as a core to be thorough investigated immediately after it has been collected.

We have chosen a dual-energy computer tomograph because only this kind of instrument is able to furnish with great precision and accuracy numerical values regarding both density and effective atomic number values of each voxel of investigated sample. Moreover, because unconsolidated sediments core have an almost perfect cylindrical shape, a significant amount of information can be obtained by examining the radiographies of cores, perfectly possible because this computer tomograph was designed to be used also as a high resolution, parallax free, digital radiography machine.

The compute-tomograph we have built is provided with an Aion X-ray tube (Gilardoni SpA, Italy) whose maximum anodic potential of 160 kV allows the investigation in optimal conditions of unconsolidated sediment cores with a diameter up to 12 cm. At the same time two sets of X-ray linear array detectors separated by a 1 mm Cu shield allows a spatial resolution of both dual-energy computed tomography and digital radiography images of about 0.5 mm. A modified Shepp-Logan filtered back-projection algorithm was used to reconstruct tomographic images while for calibration in density and effective atomic numbers a set of five standard samples was used.

Parallel with the construction of dual-energy computer tomograph, a dedicated laboratory was created and furnished on the board of R/V Mare Nigrum, able to perform in real-time analysis of freshly collected cores.

Preliminary investigation of both standard and newly collected cores from the Black Sea Continental Platform allowed us to estimate the spatial resolution of both computed tomography images and digital radiography to about 0.5 mm while the relative error in calculating the local values of both density and effective atomic number was no greater than 2.5 to 3 %, performances that perfect compatible with design estimation as well as with similar instruments produced by other laboratories from United States and European Union.

It is worth to mention that this computer tomograph can be used to investigate any kind of geological sample provided that their diameter in no greater than 12 cm. At the same

time it can be used not only on-board, but in any laboratory that is authorized to host X-ray generators with an anodic potential up to 160 kV.

The reproduced figures are representative for the real performances of this instrument.

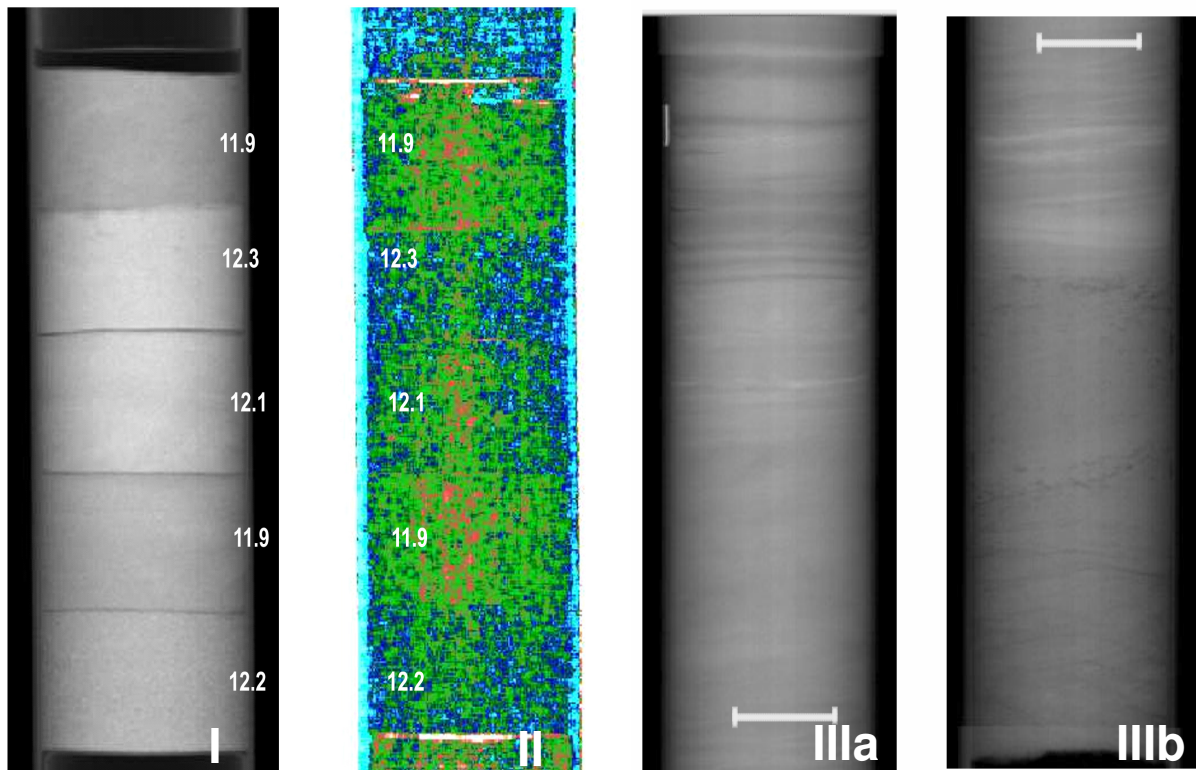


Figure 1 Two digital radiographies of a standard core composed of calibrated granulation sand (I) and (II) as well as of a unconsolidated sediments core collected from the Black Sea Continental Platform (IIIa and IIIb). The leftmost image (I) represents a classical radiography while the second image (II) reproduces the projection of the distribution function of the effective atomic numbers. The experimentally obtained values are much closed because the chemical composition of sand is almost the same. For a better illustration the Black sea core digital radiographic image (III) has been cut into two fragments that overlap on the horizontal marker.

ROLE OF SPECIES/ POPULATIONS IN SUSTAINING THE FLOW OF RESOURCES AND SERVICES IN ECOSYSTEMS - Results after the second year of project implementation

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Understanding the biodiversity and the components of natural capital as footprint of socio-economic systems development, represents a definitive feature of the ecosystem approach considered in the last 15 years. Necessity for conservation and sustainable use of biodiversity are universally recognised priorities for elaboration of the development strategies and of the management plans as well as for research programs aiming at scientific basement. Although the knowledge of the ecological processes that are basis of goods, resources and services generation became important, and tools for assessing, inclusively economic, of natural capital (NC) have been developed rapidly, possibilities of transfer and use of them are limited because of insufficient development of means of expression and quantification of the role played by populations/ species as units promoting the ecological processes generating resources and services. In this context, a consortium of seven partners, including University of Bucharest, Academy of Economic Studies Bucharest, Institute for Forest Research and Management Bucharest, National Research Institute Danube Delta, Institute of Biology Bucharest, Institute for Research and Plant Protection and University "Lower Danube" Galati launched a project aiming to evaluate the role of biological populations as promoters of resources and services for socio-economic development for two selected development regions of South-Eastern Romania. This project will facilitate the operationalization of the informational system for assisting the measures concerning the sustainable use of the natural capital as footprint of the economic development and social welfare.

The main expected results include: i) knowledge on socio-ecological framework for the studied components of biodiversity; ii) a joint data and knowledge base available for stakeholders; iii) structure of functions, goods and services provided by studied ecosystems; iv) relative importance of biological populations for ecosystem functioning; v) knowledge on causes, pressures and effects of the natural and human factors; vi) a preliminary set of sensitive indicators for ecosystem state and offer of goods and services; vii) identification of relevant adaptive mechanisms of dominant populations; viii) valuation of offer of goods and services in monetary terms; ix) differentiation of important/ threatened resources and services and risks and opportunities for local economy and population.

The results obtained after the second year of implementation, included: i). Reviewing existing data and knowledge and developing a joint database within consortium: identifying gaps in knowledge, collecting and completing the database with new data have been finalized through differentiation of structural and functional parameters representative and relevant for socio-economic system (SES) as well as through identification of dominant population, of trophodynamic modules (TDM) and through services provider unit (SPU) differentiation in

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representative ecosystems; ii) Assessing the role of dominant populations in performing ecosystem functions as well as in generating resources and services: the structure of ecosystem functions and services as well as the diagrams of energy fluxes specific for the studied ecosystems have been reviewed in accordance with the ongoing requirements in the world; the relative importance of populations in ecosystem functioning, dynamics and resilience have been also established; iii) Assessing the impact of different driving forces (including land use, alien invasive species, climatic changes) upon nature and performance of populations as SPUs: Reviewing knowledge on the effects of driving forces on the dynamics of studied ecosystems and SESs; knowledge of the adaptive mechanisms ale populations in studied ecosystems and SESs; models describing population dynamics in relation with the driving forces; set of sensitive ecological indicators for the state of studied ecosystems and SESs; iv) Economic valuation of the identified resources and services as well as of the benefits for the local economy and population: package of methods, techniques and tools appropriate for the valuation of resources and services; set of selected data for the economic valuation of identified resources and services; v) Development of stakeholder interface, capitalization and implementation of the project results: disseminating partial results of the project towards the main stakeholders; reviewing the consequences of different politics on the management and use of resources and services provided by the studied ecosystems.

These results are a consistent basis for approaching activities driving at reaching the project objectives in the next years as following: i) Finalizing completion of the database, ii) Modelling the relationships between socio-economic and natural driving forces, and the nature and performances of populations /SPUs, iii) Assessing complementarities between the offer of resources and services and the structure and metabolism of the associated socio-economic systems and iv) Selecting the important/ threatened resources and services needing special measures of conservation and rehabilitation and pointing out the benefits for local economy and population. In the next period, the activity will focus on the implementing of economic valuation methodology, the adapting and testing analyzing and prediction instruments in collaboration with the main users as well as on the dissemination of the project results towards users, decision makers and people and on the consultancy for the SPU approach implementation.

The findings and experience gained till now in this project would be useful to underlie the management plans for the selected development regions (2-South-Eastern and 3 – South-Muntenia) facilitating implementation of European directives and harmonization with communitarian policies. The activity performed by the consortium executing the project reinforced the premises of development of a national excellence network, connected to similar international networks working in this domain.

RAPID CLIMATE OSCILLATIONS RECORDED IN KARSTIC DEPOSITS FROM ROMANIA AS REVEALED BY ISOTOPIC AND PALEOMAGNETIC PROXIES (CLIMKARST)

Silviu CONSTANTIN¹

The project aims to establish several climate reference-profiles for the Holocene and the Upper and Middle Pleistocene, based upon the isotope analysis and dating of speleothems form Southern and Western Carpathians correlated with the analysis of the paleomagnetic

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signal from speleothems and cave sediments and with the study of fossil remains accumulations. The analysis was done on deposits whose general time frame were previously established by preliminary datings and it focuses on several periods characterized by rapid climate changes, such as the Holocene or the marine isotope stages (MIS) 3 and 5. The project implies the work of a multi-disciplinary team which includes speleologists, mineralogists, paleontologists, physicists and takes advantage of the expertise and, partially, the infrastructure needed for modern analytical techniques, such as mass-spectrometry U-series dating, magnetic properties analysis, etc. The aim of the project is to contribute to the understanding of rapid climate changes and the mechanisms that trigger them.

In order to achieve its goals, the team of researchers has selected several speleological sites which are suitable for a multi-proxy approach. The main sites investigated so far are: (i) Pesteră cu Oase, a multi-tiered cave system located in central Banat Mountains and where the oldest *Homo sapiens* remains in Europe have been found (Trinkaus et al., 2003; Rougier et al., 2007); (ii) Pesteră Cioclovina Uscată, a cave from the central part of Romania famous for its extensive deposit of cave bear remains; (iii) Pesteră Căloșani, a laboratory-cave from Southern Carpathians monitored by the “Emil Racoviță” Institute of Speleology; (iv) Pesteră Poleva, a cave that hosts an abundance of speleothems and ancient sediments, located on the Romanian side of the Danube Gorge. In addition, several other sites have been investigated in regions ranging from the Black Sea coast to Western Carpathians in order to assess their suitability to a multi-proxy approach of paleoclimatic interpretations.

The main results obtained so far are;

1. In Pesteră cu Oase, our team has cooperated with an international team of experts including anthropologists, palaeontologists and specialists in ESR datings. The members of our team have conducted excavations, samples collecting, U-Th datings (alpha spectrometry and TIMS methods), sampling and measurement of magnetic properties of sediments. The results of the datings have been used for constraining the age of the two human skulls discovered in the cave as well as constraining the ages of the cave-bear fossil remains. At the present stage, the cave appears to have functioned as a cave-bear hibernation den which was periodically flooded by high-energy river inflow. The U-series has proven that extremely violent torrential episodes have had occurred during MIS 3, at least within the time-period 45-42 ka. The frequency and duration of such episodes has yet to be understood by further high-precision datings.
2. In Pesteră Cioclovina Uscată a composite stratigraphic profile with ~8 m depth has been dug and studied – it has shown at least five distinct stages of sediment accumulation and cave genesis. The profile was calibrated by means of two radiocarbon datings on *Ursus spelaeus* fossil remains. One of the logs was measured for magnetic properties and extensive analyses have shown that the cave bear remains have not been accumulated *in situ*, but reworked from older sediments. In order to check the assumption, the P4 biochronological method was applied – it has confirmed the radiocarbon age thus confirming also the transport of bone remains following exceptional severe floods during MIS3, most probably caused by climatic changes.
3. In Pesteră Poleva, an isotope profile was measured for the last 70 ka. This profile is extremely detailed for the Holocene – the most accurate isotope record so far for the Romanian Holocene period. During the MIS 3, this profile has also recorded an episode of severe cooling, undocumented so far, which may be correlated with the torrential events recorded in Pesteră cu Oase and Pesteră Cioclovina Uscată. During the Holocene, several warming events have been recorded at 5.2 ka and 3.2 ka

respectively – these are correlated with similar events recorded in a speleothems from Pestera Ursilor, in Western Carpathians (Constantin, 2007).

4. In Pestera Closani, U-series datings correlated with paleomagnetic measurements on three cores taken from the flowstone in the entrance area have shown that the age of this calcite formation is older than 1.4 Ma – the oldest flowstone dated so far in Romanian karst. The results show that the combination of radiometric and paleomagnetic methods in speleothems study may considerably extend the range of both methods thus enabling inter-calibration and estimates of the incision rates of rivers. A selected stalagmite from the deep zone of Closani cave, C6, has been dated at high resolution by TIMS and a high resolution isotopic profile was measured at Bergen University, Norway. The profile stretches over MIS 5-3 and it is relevant for the timing of the Second Termination (beginning of the penultimate deglaciation). The profile is still under study and the results are going to be reported later this year.

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RECONDITIONING OF ENVIRONMENT AGENT IN AREAS AFFECTED BY PETROLEUM EXPLOITATION ADJACENT TO URBAN COMMUNITIES

drd. eng. Simona MALUREANU¹

The project purpose the elaboration and accomplishment of an re-establishment incorporated system of environment factors in the areas affected by petroleum exploitations near the rural communities and localities.

The orientations on which is inscribed the thematic proposed are for the completion of scientific research meant for substantiation and development of modern techniques, technologies and biotechnologies, for the assurance of environment (water, air, soil) and the assignment of theoretical and experimental results obtained.

General objective:

Restoration of environment factors in areas affected by petroleum exploitations adjacent to urban communities through to determine same specific measures and proposals of all levels:

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- institutional legislative;
- public authorities(national, regional, local);
- research – development institutes in domain of environment protection ;
- economical agents with preoccupations in domain of environment protection;
- social partners,

by elaboration of a National Programme, correlative with durable development of economy, regarding restoration of environment factors in areas affected by petroleum exploitation.

Specific objectives:

- Bordering of project general objective in general objective of Romanian industrial policy;
- Identification of the main polluted factors of physics and chemical nature for water, air, base;
- Evolution of present status pollution of areas affected by petroleum exploitation adjacent to urban areas;
- Identification of on incorporated system of monitoring polluted transmission;
- Elaboration of technologies and equipments to advertise and combat the environment pollution with products resulted from petroleum exploitation;
- Elaboration of an National Programme regarding restoration of environment factors in affected areas;
- Impulsion of projection- research- development activities through implementation of constructive – technological modern competitive solutions as quality/price configuration, with good products on international plan;
- Accomplishment of a great collaboration between economical agents- manufactures of equipments and technologies, certification organism and between those;
- Growth of products competitive at technical and qualitative level of European products, of API specification and of international norm of environment protection.

Expected results:

First, the land in the experimental areas shall be recovered and then, after the National Program has been adopted, all the natural factors in all the regions stipulated in the program shall be restored.

Stipulated benefits can be framed in two categories, as follows:

- in first category will be included benefits which concerns higher life standard in the urban communities adjacent to the areas where the natural factors shall be restored and that can be consequently transformed into entertainment areas or gardens;
- in second category benefits are represented by potential agriculture yields harvested from the restored areas.

Profit estimated, productivity:

Estimated productivity of the project results from expenses pay-off through the agriculture yields obtained from the restored areas and while the appreciation of the specialists predict a recovery of expenses in max 3 years.

Exploitation of results shall be performed by:

- implementation of monitoring integrated system for waste and transmissions from the oil and gas exploitation activities;

- the extension of technologies and equipments utility to prevent pollution with petroleum products, developed by project and other areas from country;
- elaboration of an National Programme associated with durable development of economy regarding restoration of environment factors in the areas affected by petroleum exploitation

The results of the research nominee project have a positive impact from technical, economical and social point of view, through:

- offers opportunities of technological transfer in domain of restoration the environment factors in the areas affected by petroleum exploitation adjacent to urban settings;
- offers solutions and new applications for healthier conditions in a cleaner environment, by use of updated technologies and equipments to prevent and control of environment pollution with products resulted from petroleum exploitation;
- offers opportunities for education through the input of knowledge into the curriculum of pupils and students, as well as by organizing specialised training courses for adults;
- offers an support for environmental policies;
- sustains the increase in the knowledge on the personnel working in the industrial fields the importance of the problems concerning environment climatic changes;
- economical advantage by turn to the natural circuit of the areas affected by petroleum products pollution in conformity with durable research requirements.

DEVELOPMENT OF HARDWARE AND SOFTWARE STRUCTURES COMPLYING WITH EUROPEAN REQUIREMENTS CONCERNING THE SAFETY INTEGRITY LEVEL - SIL IN OIL AND GAS EXTRACTION AND PRIMARY PROCESSING FIELD IN ORDER TO REDUCE THE IMPACT TO THE ENVIRONMENT - STRUCTSIL

Gheorghe SPIREANU¹

The project presents developing of some hardware and software structures for extraction and oil and gas primary processing which meet the functional safety and environmental protection requirements as these have been stated at European level within general standard EN 61508/2001.

The project targets as starting from basic activities of evaluation/quantification of process incident risk on the environment, to search and to develop control/safety system structures both on hardware and software. Further, in order to achieve evaluation and testing of results, the scope of this work include building of one testing platform for a process structure too, on that to perform verification, testing and functional demonstration based on pre-established test program.

Taking in consideration the environment conception under physic, human, legislative and politic aspect, the work targets not only the minimization of impact on natural environment through decreasing of potential risk by destructive events on this but also an efficient dissemination of results/knowledge by creation of one dedicated WEB page.

1. Institution: IPA SA Bucharest - RESEARCH & DEVELOPMENT, ENGINEERING AND MANUFACTURING FOR AUTOMATION EQUIPMENT AND SYSTEMS

The achievement of work is realizing of a consortium which gathered resources from R&D domain on process safety, from high graduated school institution for control systems (controlling) as well as from strategic R&D area of health and safety executive (HSE).

The main objective of project is to develop a new elaboration technique of control/safety systems in order to achieve a high level of **industrial safety** dedicated to an industrial domain with **high risk level on environment**.

The results obtained up to present are:

- Creation of one nucleus of competence gathering on national level the existing R&D capabilities and by constituting a representative consortium in order to create the conditions of connecting to European platform dedicated on industrial safety; the consortium consists of one R&D unit specialized on control/safety systems, one strategic R&D unit having experience in the HSE (Health and Safety Executive) and one university of technological profile.
- Elaboration of structures based on predefined subsystems at process level;
- Definition of **safety requirements** and determination methods of SIL (safety integrity level) for one typical installation;
- Elaboration of hardware and software documents which are available for testing within the next stage;
- Dissemination of information, in order to aware the potential end-users on existing capabilities at national level, by installing and publishing one WEB page with multiple functions which have national connections and one European connection to **industrial safety** technology platform;
- Elaboration of case studies from point of view of control/safety system, including major incidents on **HSE domain**;
- Realization of one testing/demonstration platform based on programmable system (PLC) for an quasi-complete installation complying with performance level within range: 99,9...99,99% (SIL 3).

The perspectives of project are:

- Developing application for installations which require high level of integrity;
- Increasing of national capabilities to develop complex system integration for oil and gas extraction and primary processing field.
- Realization of one demonstrable physical platform as a powerful instrument for marketing activities.

LONG-TERM EFFECTS OF AIR POLLUTION ON SELECTED FOREST ECOSYSTEMS IN THE BUCEGI NATURAL PARK

by Ovidiu BADEA¹, Ștefan NEAGU¹, Andrzej BYTNEROWICZ²,
Angheluță VĂDINEANU³, Iosif LEAHU⁴, Horia IUNCU⁵

In Central Europe, since the late 1980s, levels of pollutants have been considerably declining; the photochemical pollution, especially the ozone (O₃) and other phytotoxic agents (SO₂, NO₂, NH₃) registered an important increase with damaging effects upon forests. In the

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same time the climate factors exert a permanent influence, temporal and spatial fluctuant, but determinant upon forest ecosystem status at global, regional and local scale. Simultaneous with photochemical pollution intensifying process and phenomenon produced by climate changes, at global, regional and local level there were initiated multiple researches on effects of this phenomenon upon forest ecosystems.

The general objective of the proposed project is to characterise the air pollution and its potential effects upon forest ecosystems status and biodiversity in Bucegi Natural Park, in close connection with climate changes.

The specific objectives are to characterize spatial and temporal distribution of the ozone (O₃) and other phytotoxic agents (SO₂, NO₂ and NH₃) and to evaluate the influence and intensity of their concentrations and of climate changes upon forest health status, forest soils, plant nutrition and forest ecosystem's biodiversity.

Preliminary scientific results obtained in the framework of the project demonstrate that air pollution, as initiator and influencing (predisposing) factor of the climate changes plays a decisive role on the occurrence of the negative effects upon forest ecosystems' status. As a result, with reference to the health status during the year 2006, about 30.7% is the share of damaged trees (defoliation classes 2-4).

For the main species, the share of damaged trees was 23.9% for *Fagus sylvatica*, 33.3% for *Abies alba*, and 30.7% for *Picea abies*. Registered volume growth losses for all species is 2.59%, and for the main species is 4.28% for *Fagus sylvatica*, 5.1% for *Abies alba* and 5.99% for *Picea abies*. With regard to air deposition, soil solution, ozone (O₃) and other potential phytotoxic agents, in the year 2006, have registered normal levels of concentrations, between critical levels (O₃ < 55ppb, NO₂ < 0.6ppb), with the exception of NH₃, for which were registered high values, above 1.0 ppb threshold, in some locations.

In addition, the forest vegetation biodiversity indicator is specific and in accordance with forest composition and climatic and pollution conditions of the Bucegi Natural Park, with genuine flora elements, unchanged compared to previous research results achieved over 20-30 years ago. Also within the normal levels are the leaves/needles microelements contents (nitrogen, phosphorous, magnesium, calcium, natrium), without any major influences on the metabolic processes of the trees. For *Abies alba*, the needles' chemical elements is 10% for nitrogen, 46% for calcium and 56% manganese. For *Picea abies* and *Pinus sylvestris*, the nitrogen levels reached 9%.

For the Bucegi Natural Park, based upon the 2005 ortophotoplans have been obtained state of the art topographical plans (1:5000 scale), which have been updated with cartographical elements of the management planning activity, in this way obtaining a comprehensive geographical database in order to establish the link with the relational database, both making possible to build management plans in the Geographical Information System for the research area.

These preliminary results will be completed and based on scientific information that will be acquired in the following stages of the project, in this manner, building up the scientific foundation for continuing the researches on long term bases in the national and European programmes.

PROMOTION OF INNOVATIVE AND SUSTAINABLE TECHNOLOGIES FOR DRINKING WATER TREATMENT

Cristiana Cosma¹⁾, Margareta Nicolau¹⁾, Georgeta Burtica²⁾, Ioana Lupsa³⁾, I.Vlaicu⁴⁾

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⁴⁾ AQUATIM - Timisoara RA

Project goals are as follows:

- Development/implementation of efficient and sustainable technologies for potabilisation according to the pollution context of natural raw water resources;
- Optimization of drinking water management system in order to assure the quality compliance with national and European enforced regulations;
- Development of regional network of excellence in the field of water treatment mediated by *e-clean water* centre.

Objectives:

- Knowledge on the present status of the no complying treatment plants on regional level. Evaluation of pollution matrices (associated with no complying parameters via direct control) and nonconformities generation causes.
- Identification of pollutants/micro pollutants, which are less or not monitored, with a potential adverse effect on drinking water quality.
- Excellence research in order to elaborate cost effective, coherent, unitary technical solutions, in compliance with pollution matrix of raw water sources.
- Improvement of the chemical sludge / filter's washing water management system in order to diminish the environmental impact.
- Building the *e-clean water* centre – dedicated to the transfer of knowledge, information at sector level and setting/developing a national network of excellence.
- **Direct** dissemination by transfer to partners (water-sewer operators) and indirect dissemination (articles, communications, patents).

Novelty aspects:

- Systematic approach of water problem, emphasizing treatment possibilities, chemistry of the treatment in the frame of complex pollution of drinking water sources (organic micro pollutants - THM precursors, endocrine disruptors a.s.o.), in specific inorganic and/or organic and/or bacterial contexts, on large areas (no complying water treatment plants from Romania) in order to elaborate feasible solutions for the compliance of treated water with drinking water regulations at European level.
- Harmonization of treatment techniques for drinking water, sludge, washing water, with those used at European level and in correlation with specific pollution matrix.
- Elaboration of flexible and multiple-stage technologies based on combination of classical and advanced processes, using sequential/simultaneous application of specific treatment reagents.
- Attempt to coagulate the competences in the field of water treatment for building of *e-clean water* centre, dedicated to on-line transfer of information, knowledge, technical solutions and technical assistance; and also to project replication on central/regional level.

Results/ Progress Indicators

- Technical analyze of available data on national level regarding the quality of natural sources (surface water, groundwater), drinking water from central distribution system resulted from classical treatment plant, emphasizing the non compliance aspects comparing

with legal regulations: NTPA 013/2002 (modified in 2006), Law 458/2002 and Law 311/2004 (categories of indicators which are exceeding stipulated limits, non monitored or insufficient monitored indicators);

- Diagnostic analyze by direct control of water quality on treatment flows (raw water ± settled water ± filtered water ± drinking water) for 27 objectives (treatment plants) subordinated to water-sewer operators 4 partner operators + 8 voluntary operators): RA AQUATIM - Timisoara, SC SECOM SA - Drobeta, SC APAPROD Deva, Compania APA Brasov, SC APASERV Satu Mare, SC Compania de Apa Satu Mare, RATAFL Turda, SC AQUABIS Bistrita, SCAPA CANAL SA Galati, SC DETACAN Cernavoda, SC AQUASERV Tulcea, SC APA GRUP Botosani;
- Selection of representative case study for optimization/upgrading of treatment flows according with pollutant nature/ type /no complying micropollutants (raw water/drinking water), frequency, toxicity a.s.o.:
 - 4 stations feed with ground water/drain water(no complying parameters raw water/drinking water: Mn, Fe, Al, NH_4^+ , PO_4^{3-} , NO_3^- , turbidity, organic load/THM, turbidity, Al, Fe, NO_3^-);
 - 4 stations feed with surface water like river or lake (no complying parameters raw water/drinking water: PO_4^{3-} , Mn, detergents, TKN, organic load / Fe, Al, THM, turbidity).
- Documentary study on present development tendencies of water treatment processes/technologies:
 - advanced separation of colloidal suspended matters (turbidity ≤ 20 NTU) via coagulation-flocculation-flotation or membrane processes;
 - removal of inorganic pollutants from underground sources (nitrates, Fe, Mn);
 - generation causes of the by-products from oxidation/disinfection with chlorine followed by modification of organoleptic drinking water (taste, smell) and possibilities to diminish the precursors concentrations;
- Frame methodology to test the technological options for groundwater and surface water treatment on pilot installations;
- Public investigation related to “Relation between hydric factor and population health” – Case study Timisoara County;
- 14 work papers presented to scientific events at national and international level and 1 article accepted for publication.
- Experimental research on 2 mobile continuous pilot installations located at DWTP U1 from Timisoara (raw water: underground water, pollutants: Fe, Mn, NH_4^+ , bacteriological load) having the following treatment flows:
 - P1: aeration-filtration I (volcanic tuff)- ClO_2 oxidation/disinfection-filtration II (volcanic tuff), using an automate installation for generation (dosing of ClO_2 (OXIPREM)).
 - P2: ClO_2 oxidation-filtration on volcanic tuff-membrane filtration (MF+UF modules) in order to set up the optimal operating parameters for treatment of potable water sources

Perspectives:

Experimental research to be performed at pilot level for the potabilization of selected natural resources (underground water containing nitrate ions, surface water).

Elaboration of optimal treatment technologies for the selected case studies (technological parameters, analytical control schemes, management plan for the chemical sludge and washing water of the filters).

ADVANCED METHODOLOGIES TO PROCESS REFRACTION AND TOMOGRAPHIC SEISMIC DATA

CRISTEA P., MANJ V., NITICA C.¹⁾

In refraction prospecting and velocity tomography, the frequent methods involved in shallow seismic is stringently required developments of some techniques for data computerized processing. The researches with these subjects constitute the theme of an *CEEX* project, with dead-line in 2008.

Refer to the first subject it was created a program-package called *PROREFRACT*, which permit the valorization of *seismic data acquired with both field-techniques: the longitudinal refraction profiling*—based on the head-refracted waves and *seismography*—based on transmitted wave (real refracted wave) principle. The processing technique considers the aplanatic curve procedure (Musgrave et al., 1970). There are determined tautochrone curves which are borne as the geometric time-loci of the intersection between the two wave fronts, one emerging from the critical refraction point, the other from the receiver point, constructed with propagation velocities from the refracting space and the covering medium, respectively.

Configured in the modern, present version, with instructions in interactive visual Borland Delphi program, with menus and dialogs, the software has individual subroutines (Cristea et al., 2007) for *input initial data*, *processing sequences* and, finally, *graphical results displaying* (Fig 1). The software display the results as a seismic section with: a. the place of the tautochrone curved arcs, with their envelope generating the refraction limit; b. color-code representation of the limit fragments slope potentially situated along the tautochrone arcs.

The soft-technique has the capability to assess the whole processing of the refraction data, by means of analytical relations generating inclusive the refraction seismic boundary. Also, it enables optimal selection of the velocity values (average and refractor velocities) and provides high accuracy for stepped limits (Fig. 2).

Tests on of direct and reverse problem data sets, and also applications on salt deposits and landslide areas proved the *PROREFRACT* to be distinguish by efficiency, precision and comprehensive, chromatic illustration of results (section relief, source and receivers positions, and also seismic information).

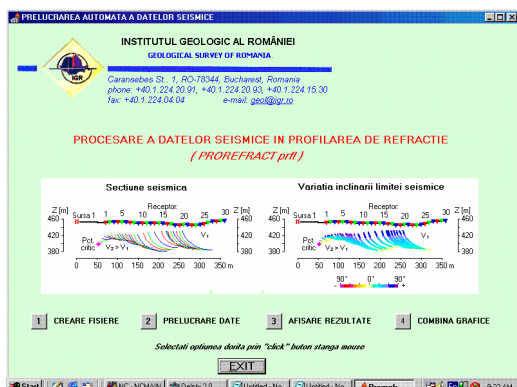


Fig.1 Main menu to activate *PROREFRACT* software

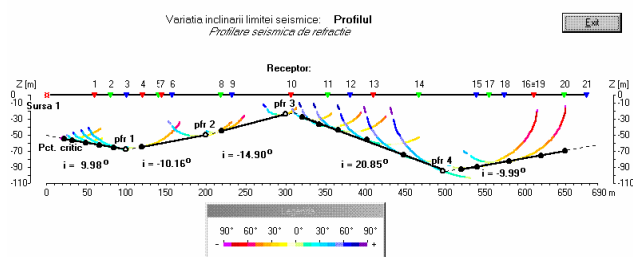


Fig.2 Software's ability to accurately reproduction of an irregular refractor

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The color scale refers to the dip of fragment for in-line profiling technology variant potential boundary along the tautochrone arc

Studies continue with the second methodology large used in shallow seismic, *velocity tomography*, for which exists software based on transmitted waves (Cristea et al., 2006). By valorizing the arrival time of the direct wave it was developed the *MIT* software-*Interactive Modeling for Tomography*, which solves the forward and also the reverse data problem, using the iterative distribution of the difference between observed and repetitive calculated time values. The tested program on a direct problem model reproduces the velocities with an error up to 10%.

An improved inversion algorithm, that needed additional velocity (V) information along the contour data acquisition system, was created.

Here we show an example of a medium characterized by a $V=4000\text{m/s}$ velocity, with three abnormal sources, $V=2000\text{m/s}$, with possibilities to access the observation system on three sides (Fig.3). After the first tomographic computation it is obtained the mean distribution of the velocities. Then, knowing velocity on some sides, the program selects successively unit cells crossed only by seismic rays for which the external path is included in velocity fields with anterior determined V values. The scrolling of the entire panel reconstructs with high accuracy the model of complex velocity pattern.

To increase the processing applicability, a new step in the process of the information extraction for the practical cases in which are present tandems of two cells crossed by some seismic rays was made. There were established analytical relations and was generated the first sequence of program that permit the computation of real velocities in the tandem-cells considered.

It was treated an example of a model with a center made of four cells, each one with other velocity than the surrounding medium (4000m/s).The software running conduct to an accurate reproduction of the abnormal velocities (Fig. 4), validating the concept and the formulas.

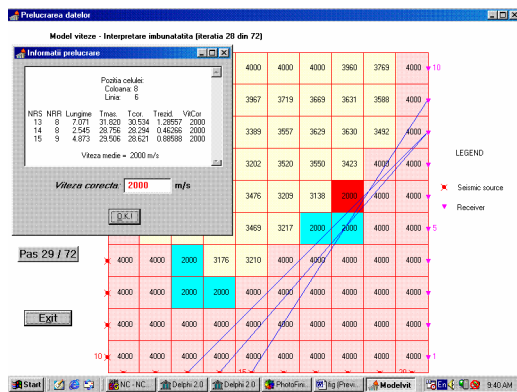


Fig.3 MIT processing episode to reconstruct forward model with abnormal velocity enclaves

Left corner- window for controlling results
main image, the red cell is processed
in connection with the blue rays

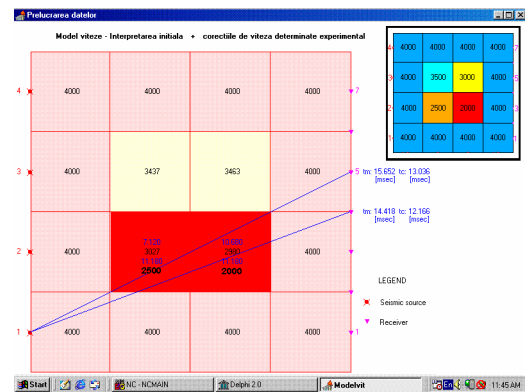


Fig. 4 MIT sequence to reconstitute real velocities or a model with mixed velocity distribution

Red cells –subject of processing sequence with In the the resulted velocity values (bolded numbers)

In the right corner- initial model replicated by processing

The analytical inversion system in tomography is original and it will continue to be adapted for the usual case of panels with observations systems on two sides of it.

CENTRE OF EXPERTISE FOR SUSTAINABLE EXPLOITATION OF ECOSYSTEMS - CASE STUDY: TERRESTRIAL AND AQUATIC ECOSYSTEMS FROM CIRIC RIVER BASIN, NORTH-EASTERN FROM THE CITY OF IASI

Nicolae STEFAN¹, Naela COSTICA¹, Ioan Manuel CIUMASU¹

The project implements the concept of sustainable development into practice. Sustainability of socio-economic development depends on the judicious use of the natural resources. Therefore, our approach is to develop expertise in we have worded as sustainable exploitation of ecosystems. As the implementation of sustainable development has been so far hampered all over the world by insufficient institutions, we concentrate our work, simultaneously on capacity building and resolving concrete environmental-economic-social problems. This research and development project is being carried out through what is known in the international literature as learning-by-doing.

At the mid of the project time span, the main achievements of the projects are both in development (capacity building) and research domains.

As development achievements count: the material establishment and endowment of the Centre of Expertise for Sustainable Exploitation of Ecosystems – CESEE (In Romanian, Centrul de Expertiză pentru Exploatarea Durabilă a Ecosistemelor), more details online at <http://www.bio.uaic.ro/content/view/190/105> ; and a series of outreach activities, meant to promote the Centre and its research and interests worldwide; in this abstract we only include a selection of meetings: *British Ecological Society Annual Meeting*, 9-12.09.2007, Glasgow, UK; *L'Université dans la Société – UNISO*, 09-12.07.2007, Versailles, France; *The 29th International Union of Biological Sciences General Assembly and Scientific Symposium*, 9-13.05.2007, Washington DC, USA; *Sustainable Neighbourhood – from Lisbon to Leipzig through Research (L2L) – "A conference on research for sustainable development in Europe"*, 08-10.05.2007, Leipzig, Germany.

As research activities, we count the successful close-up of the 1-year sub-project studies carried out by the team in geography and the team in sociology. The results are being prepared for publication in international journals, either as such or combined with results from the other teams (sub-projects) of the case study project. For geography we only mention the realisation of a complete survey of the Ciric river basin, in terms of thematic survey and mapping: geologically, hydrologically, climatically, demographically, biogeographically, as well as (or especially) with respect to supporting specialised ecological, social and economical questions. For sociology, we point out to the investigation (also including fieldwork and interviews) onto the cultural perceptions of the current environmental situation of this peri-urban area, in relation to the social and economical conditions and perspectives in the area.

By November 2007, most of the teams will have closed-up their specialty field: biodiversity in aquatic ecosystems (invertebrates, vertebrates, phytoplankton, aquatic plants); biodiversity in terrestrial systems (invertebrates, vertebrates, lower and higher plants); microbiology; chemical analysis of pollutants; ecotoxicological tests; genetics; and ethno-biology. Certain specific results, pertaining to disciplinary domains, will be pointed out at the extended presentation of this meeting.

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Then, until the end of the project, these biological-ecological studies will be integrated among them and with results from geographical and sociological studies, to make a multidisciplinary and integrated baseline study which will ground further research for the team responsible with ecological reconstruction and the team responsible with economic studies.

To give a general idea, we take the example of ecological reconstruction (because this team has officially started work already). Thus, preliminary results indicate environmental degradations like: erosion at surface and deep strata, land slides, hydrological changes (due to river regularisation), chemical and biological pollution, and water eutrophication. Chemical analyses are currently pointing to specific diffuse and point pollutions and current ecological work will complete this picture with various ecological indices. Ecotoxicological studies measure the impact of various pollutants onto the populations of algae and invertebrates. Together with biochemical and microbiological investigations, these will help formulate main potential risks to ecosystem and human health.

The ecological reconstruction team will draw on all natural sciences work in the project to identify appropriate approaches for the remediation and ecological reconstruction of severely polluted or otherwise degraded plots in the study area. Pending on the identified easiness or difficulty of technical methods identified, the team might also proceed already to applying them.

The economical study team will draw on specialty methods and multidisciplinary knowledge to construct scenarios of both sustainable and unsustainable paths possible in the study area. This is essential not only from a technical or scientific or economic point of view, but also socially – the sociology team is pointing out to the high expectations population in the area has for the next 10-20 years, and the responsibility they (naturally) put on both authorities and scientists and even themselves.

Finally, all team leaders will work on the final product of this problem solving-oriented case study, which will be a rounded-up, coherent reference study grounding further plans of development and investment in the area.

ECOLOGICAL GLASS THROUGH NANOTECHNOLOGIES FOR DIMINISHING, ADAPTING AND RESTORING THE NATURAL ENVIRONMENT ELEMENTS

Mihai ELISA¹, Cristiana GRIGORESCU¹, Cristina VASILIU¹,
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URSU², Zamfira PLAIASU², Ion STAMATIN³, Florin NASTASE³, Claudia NASTASE³,
Anca DUMITRU³, Ileana MATIU⁴, Elisabeta ROSU⁴, Gabriela STEFANESCU⁴

The project presents an advanced research on obtaining and characterization of ecological silicate and phosphate glasses. The final aim of the project is to develop two modern technologies to prepare silicate and phosphate glass as bulk and thin films. The investigated glasses are free of lead, barium and arsenic oxides, fluorine, cadmium sulphides and selenides. These technologies imply reduced costs of energy and fuels, the improvement of work conditions and the preservation of the environment. The objectives of the project are

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correlated with the Council Directive no. 96/61/EC dealing with preventing and controlling the environmental pollution. The eco-efficient production of ecological glasses and the stimulation of the activities that reduce pollutants' exhaust into the environment represent the fundamental elements of the preventive integrated strategy of long term environment protection.

Thus, a non-conventional wet method to prepare ecological phosphate glasses containing iron ions is developed. It is well known that iron improves the chemical stability of the phosphate glasses against water. The project presents the chemical reagents, the oxide compositions of the ecological phosphate glasses and the steps of the applied method applied to obtain these vitreous materials. The melting-finishing and annealing thermal diagrams specific for these glasses have been established as well as the thermal expansion coefficients and the characteristic temperatures (low and high annealing point, vitreous transition point, softening point). A study on optical and structural characterization of these vitreous materials has been done. Ultraviolet-visible-near infrared (UV-VIS-NIR) optical spectroscopy in the range 200-2200 nm, established the redox states of iron ions and their coordination symmetry with non-bridging oxygen atoms. FTIR (400-4000 cm^{-1}) and Raman (200-1600 cm^{-1}) spectroscopy revealed structural units of the glass matrix, putting in evidence the vitreous network-forming role of phosphorous pentoxide. A preliminary study of the surface morphology of these glasses was made by atomic force microscopy (AFM).

The ecological lead free crystal glasses free of lead oxide and harmful compounds have been studied. The main components of the glass SiO_2 , Na_2O and CaO were used as well as TiO_2 , ZrO_2 , MgO , ZnO , K_2O in order to replace the usual PbO from the conventional crystal glass composition. The project presents the chemical reagents, the oxide compositions of the ecological silicate glass and the steps of the technological method applied to obtain these vitreous materials. The chemical analysis of the toxic metals impurities from the raw materials (chemical reagents) revealed traces lower than tens of parts per million (ppm). As in the case of the phosphate glass, for the ecological crystal glass, the melting-finishing and annealing thermal diagrams have been established as well as the thermal expansion coefficients and the characteristic temperatures. The melting experiments concluded that a total amount of TiO_2 and ZrO_2 up to 18 wt.% is allowed to increase the glass refractive index. It is recommended not to exceed 8 wt.% ZrO_2 in order to prevent the glass crystallization. The increase of ZrO_2 and Al_2O_3 amounts leads to high characteristic temperatures and low thermal expansion coefficients values, whereas ZnO and TiO_2 decrease these parameters. Other properties as the dependence of viscosity on temperature in the range 500-700°C and the moistening angle in the range 800-1260°C have been measured. It was shown that ZrO_2 and ZnO provide an almost linear viscosity dependency of temperature according to Arrhenius law. The ultraviolet-visible (UV-VIS) spectroscopy revealed a strong optical absorption in the range 350-800 nm. FTIR and Raman spectra present bands specific for SiO_2 , TiO_2 and ZrO_2 in different coordination symmetries.

The project presents red-colored ecological silicate glasses, free of toxic cadmium and selenium compounds. This red color is obtained by colloidal copper. As in the case of the previous mentioned glasses, this study points out the steps of the technological method applied to obtain these glasses as well as the melting-finishing and annealing thermal diagrams. The thermal expansion coefficients and the characteristic temperatures have been determined. The temperature and the duration of the annealing stage together with the copper amount are the main technological parameters, which influence the intensity and the hue of the red colour.

The research project deals also on measuring the gaseous emissions (nitrogen oxides, sulphur oxide, carbon oxides) resulted from the ignition process and the chemical reactions, which take place during the glass fabrication. At the same time, the furnace emissions contain

powders and small amounts of metals. The analytical methods applied to measure these emissions (filtering and analytical analysis, IR and UV photometry, chemoluminescence, colorimetry and chromatography analysis, atomic absorption spectroscopy-AAS and induced-coupled-plasma-ICP spectrometry) are presented.

The ecological silicate glasses are used to decorate the borosilicate transparent glass. The main technological parameters are the pressure and the debit of the working gases. Different types of decorated glasses using coloured ecological silicate glass are evidenced.

The present research applied the sol-gel method aiming to obtain ecological silico-phosphate thin films. The technological parameters of hydrolysis-condensation process and the thermal treatments of the thin films are revealed. The starting precursors and the compositions of the thin films obtained by dip coating have been presented.

All these research results were published in different scientific events (congress, conferences, workshops, symposia, etc) as oral and poster communications and as articles in different scientific journals with international quotation.

In the next stages of the project, the technological parameters of the obtaining process for the ecological silicate and phosphate glasses will be optimised and the optical, thermal and structural characterization will be extended and deepened. The dissemination of the research results will be also carried on. Finally, the project aims to present and to demonstrate the functionality of these ecological technologies as well as the utility of the obtained vitreous materials.

METHODOLOGY FOR COMPUTING LOCAL SEISMIC HAZARD (MICROZONATION) FOR IMPORTANT CITIES LOCATED OUTSIDE OF THE CARPATHIANS BELT. CASE STUDIES FOR IASI, BACAU, BUZAU AND CRAIOVA

Prof.Dr. Gh. Marmureanu¹, Dr. S.F. Balan¹, Dr. C.O. Cioflan¹, N. Mandrescu¹, Em. Popescu¹, Prof.Dr. C. Marunteanu², Dr. D. Bratosin³, Dr. S. Borcia⁴

The objective the project "Methodology for computing local seismic hazard (microzonation) for important cities located outside of the Carpathians Belt. Case studies for Iasi, Bacau, Buzau and Craiova" coordinated by National Institute of Research Development for Earth Physics, is knowledge accumulation on the competitive base at the European and international level, to obtain results and experience in the Earth physics and to transfer them to the economic and social activities from Romania. The project is concerning natural hazards, observation and evaluation of the Earth and especially the earthquake research (deterministic and probabilistic analyses, linear and nonlinear waves propagation). Results of this project will consist of the local seismic hazard maps (microzonation) for the Iasi, Bacau, Buzau and Craiova cities and of data base for Romania SHAKE MAP performance. On the international level knowledge in this field were focused on the shallow earthquake which are numerous and notorious at the international scale.

In case of our country the most important are the intermediate–depth Vrancea earthquake which affect seriously the extra-Carpathian territory and partial neighboring country (Bulgaria, Moldavia, and Ukraina). The main goal of this project is to mitigate the effects of these earthquakes.

The consortium formed by NIEP, Geological and Geophysics Faculty, Bucharest University, INCERC and Institute of Solid Mechanics, Romanian Academy allows an optimal capitalization of the scientific potential from Romania and a real involvement in FP7

European Projects and increases the Romanian capacity to supplies experts for the international scientific and technical collaborative programs.

Results in the project progress can be found in the four phase accomplished till now, where were solved the following objectives:

Seismic sources definition: Seismic sources definition, analyze of the earthquakes catalogues for each seismic source, analyze of the seismic source mechanisms, fault plane solutions, geological, morphostructural and tectonic characterization of the Vrancea seismogenic zone (superficial and intermediate-depth earthquakes), modeling of the soil type as nonlinear viscous-elastic materials, processing of the seismic records available at the specific sites to be used as input for both probabilistic and deterministic analyses, attenuation laws;

Seismic input evaluation for probabilistic and deterministic seismic hazard analyses: frequency-magnitude laws, a and b parameters, for each seismic source to be used in the probabilistic analysis, choice of the controlling and reference earthquakes, geological, physical & mechanical characterization of the propagation path from the seismic foci to the crystalline basement of the sites (bedrock structure), nonlinear viscoelastic model for cohesive materials (soils) applied to the superficial geological deposits, processing of the seismic records available at the specific sites to be used as input for both probabilistic and deterministic analyses, attenuation laws.

Evaluation of the seismic ground motion parameters: simulation of the bedrock accelerograms for each site, analysis of the nonlinear behavior of the soils under seismic loads using the nonlinear viscous-elastic model, general geological characterization of the bedrock structure (Bacau) and more detailed models for the local structures, processing of the seismic records available at the specific sites to be used as input for both probabilistic and deterministic analyses, attenuation laws,

Seismic site effects evaluation: Analytical computation of the seismic soil response, Geological, physical and mechanical characterization of the propagation path from the seismic foci to the crystalline basement of the sites (bedrock structure) Buzau, Viscous-elastic nonlinear model applied to the non-cohesive soils of the local geological structures,

Perspectives: Local evaluations of the seismic hazard, correlation of the results from the probabilistic and deterministic analyses.

The project will end with the delivery of microzonation maps, generated using the GIS system.

RESEARCH ON FRUIT-TREE SPECIES BEHAVIOUR IN DIFFERENT CULTURE ZONES – PHYSIOLOGIC REACTION TO ENVIRONMENTAL FACTORS

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Existence and efficiency of fruit-tree ecosystems depend on natural factors and anthropogenic factors. Environment is defined as the exterior physical and biological system within which live organisms are living, including human beings –which is made of a set of

natural and anthropogenic factors found in close interaction that ensure the ecological balance. Inter-conditional relationships proved to exist within fruit-tree ecosystems too.

The assortment of cultivars and rootstocks in fruit-tree science is rich enough, which allows making choice suitable to different ecological areas, the fact being well-known that suitable zone-setting is one of prime factors in obtaining crops of higher volume and quality. Growth and fruit-setting are influenced by mutual and complex relationships among multiple physiological processes operating in the plant organs, depending on genetic, hereditary and environmental characteristics. Unfavourable environmental conditions do change the course of some physiological processes, which reflects in the organ's growth and plant's fruit-setting.

In order to improve crop quality, besides choosing the areas with highest degree of suitable weather conditions, a special importance has the obtaining of a balanced structure in vegetation, with evenly vigor.

Research was carried out in different fruit-tree areas in Oltenia, in apple-tree and plum-tree species, under different ecological conditions, in order to prove reaction of some species and cultivars to environmental factors. Based on research carried out under different weather zones and different weather years, one can see that species and cultivars have different reaction. Setting out from data obtained in different areas, the inter-relation between hereditary requirements in fruit-tree species and environmental factors is the essential condition in obtaining crops with higher volume and quality, with profit-making.

ROMANIAN CO₂ EMISSIONS: THE ASSESSMENT AND FORECAST MODELS

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Mioara IORDAN², Daniela ZISU³

Besides UNFCCC requirements (the reduction of the greenhouse gas emissions by 8% from base year level in the first commitment period 2008 – 2012), the EU Countries have to fulfil also the requirements of EU Directive 2003/ 87/EC, concerning the emissions trade in accordance to EU Emission Trading Scheme (EU - ETS). The essential element in EU - ETS is the preparation of a plan to allocate the emissions that can be trade. In order to elaborate the National Allocation Plan, a CO₂ emissions assessment and the forecast for the period 2007- 2012 has to be achieved, using some special models like these developed in this project.

Objectives

The main objective of the project is to develop two advanced forecast models for Greenhouse Gas (GHG) emissions, specific for Romania.

One of the models is a macro-economic forecast model at national level and other is a specific one, for GHG emissions released by iron and steel industry.

The specific objectives of the project are:

- the study of the international models for the GHG emissions, as well as the identification of the most relevant ones for the Romanian models;
- the identification of the most important input/output parameters for the two models;

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- the determination of the relations between the values of the GHG emissions and the relevant macro-economic indicators, through the statistical analysis of the historical data;
- the structuring of the models so that the harmonization with the European forecast models for GHG projections is to be obtained.

Results

At the **national level**, the case of non-linearity of data series from the last two decades drives to the idea to use forecast models that reflect specific periodicities for the evolution of the CO₂ emissions result series, such Fourier regression. Opposite, the planning specific trends (i.e. in the National Development Plan - NDP) are linear for the model parameters (even the GDP evolution and Energy Production are positive, but the population evolution are negative). It is normal that in the second above case to considere a multi-linear regression to be the most suitable and adaptive to the forecast development evolution.

The two types of evolution curves are expressed by:

- i) the Fourier curve replicates the basic behavior for 16 years in addition, starting with 2003. Using this model, the CO₂ emissions forecast shows for the year 2007 an amount of 181 727 kt, for the year 2012 (the last year of the commitment period) an amount of 179 335 kt, and for 2019 an amount of 142 905 kt.
- ii) the multi-linear curve describes a growing trend (with 5.9788 % / year as average) for this period. For the variables considered, we got a 5% / year growing for GDP and Energy production (these value results from NDP), and for the population we got a decreasing with 0.2 %/year.

The multi-linear regression equation:

$$EA_{CO_2} = 1.7 \cdot GDP + 2.975341 \cdot toe + 41698 \cdot Cap - 985450.7$$

where

EA_{CO₂} – CO₂ emissions amount (kt), GDP – Gross Domestic Product (mil.1995 USD), toe – Commercial energy production (kt of oil equivalent), Cap – Population (mil.)

Using this model, the CO₂ emissions forecast shows for the year 2007 an amount of 180 270 kt, for the year 2012 (the last year of the commitment period) an amount of 241000 kt, and for 2019 an amount of 361 868 kt.

For the **iron and steel sector**, the general macro-economic model for Romania, was completed by the elaboration of specific models for CO₂ emission assessment and forecast.

The assessment models for CO₂ emissions from iron and steel sector, could be classified on two types:

- a model based on emission factors, correction factors and activity data (CO₂- SAE1 as abbreviation);
- a model based on carbon balance (CO₂-SAE2)

The first model could be used both for evaluation at the plant level and for iron and steel sector level. In this case, the analysis made is not for each tehnological process who is producing CO₂, these analysis and the model is for the overall plant or sector. The inputs (raw materials and other materials wich is producing CO₂) are taking into account indirectly and aggregates for the whole sector (through the production and emission factors). The emission factors are taking into account as average amounts, either are national factors, or are recommended by Intergovernmental Panel on Climate Change (IPCC).

The second one gives the most rigorous results in the case of the assessment of historical data used by forecast models at the sector level (by aggregation of the data obtained for each iron and steel plant).

The forecast models for CO₂ emissions produced in iron and steel sector, could be divided in three categories:

- a forecast model based on equations, emission factors (national or recommended by IPCC) and activity data-steel, coke and pig iron productions ;
- a forecast model, which adjusts and refines the CO₂ – SFE1 model, by taking into consideration of some relations of dependence among pig iron and coke production on the one hand and Basic Oxygen Furnace (BOF) steel production on the other hand. The BOF steel production is in this case a reference amount;
- a forecast model, based on emission factors and activity data, conceived based on correlation with the national strategy, significant for the estimation of CO₂ emissions in iron and steel.

Perspectives:

- the evaluation of the dynamic evolution of the GHG emission factors for the period 2008 - 2012;
- optimizing the exchange release of knowledge in the frame of the S/T community;
- comparison of the Romanian models parameters with the parameters of other European models;
- establishing the beneficiaries and the utility of the developed models for Romanian Climate Change obligations (international and european).

RELATIONSHIP BETWEEN ENVIRONMENTAL CHRONIC EXPOSURE TO HEAVY METALS AND CARCINOGENIC RISKS IN NON-OCCUPATIONALLY EXPOSED HUMAN POPULATION

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The RISCANMET project (MENER/CEEX 639 research project) is mainly focused on investigating the plausibility of carcinogenic role played by non-occupational exposure to heavy metals in humans living in areas with different natural levels of heavy metals in their environment.

Objective. There are many relevant studies on potential carcinogenic role some heavy metals could play, particularly in occupationally exposed people. The role of chronic exposure to heavy metals in non-occupationally exposed population is less known. Our objective is to explore the potential carcinogenic risk of cancer in non-occupationally, environmentally exposed population to heavy metals.

Material and methods. We started a three-year study on this topic, in two counties in North-Western Romania, randomly selecting representative samples of exposed and non exposed subjects from general population. The level of heavy metals in that environment is cross sectional studied (in soil, air, drinking water, current food). Biological, toxicological and genetic tests are performed in human subjects too. Lab tests are correlated with morbidity and mortality profiles. Mapping the two selected areas in terms of heavy metals natural exposure, morbidity and association between carcinogenic cases and heavy metals relevant exposures would be tempted.

Results. The results are compared with historical results of similar studies performed during the last 30 years by same laboratories, and also with data presented in international literature. Biological tests are performed in order to establish the environmental exposure to heavy metals and its impact on peoples' health. The results of genetic tests will be correlated with environmental and biological tests in the final stage of this research project (called RISCANMET, www.riscanmet.umfcluj.ro) in 2008. All tests will be finally correlated with the health status of populations of the two regions.

Conclusions. Preliminary results show significant differences of non-occupational exposure to heavy metals of environmental origin in the two selected areas. Whatever the final conclusions, the significance of non-occupational exposure to heavy metals in human populations in relationship with carcinogenic risks is important to be answered for preventive reasons.

MORPHOLOGICAL, STRUCTURAL AND ULTRASTRUCTURAL BIOMARKERS IN THE EVALUATION OF ANTHROPIC IMPACT UPON THE BIODIVERSITY

Irina GOSTIN¹, Laramioara IVANESCU¹, Bogdan MINEA¹

Within the present project, we identify, test, select and use structural and ultrastructural morphological biomarkers in order to evaluate the impact degree that the anthropic modification of an ecosystem (especially under the action of various pollution sources) has upon biodiversity. The Ceahlau National Park and the adjacent area represent the area considered. The project proposed is in accordance with the European and international research directions regarding the monitoring and conservation of natural resources (in this case, forest and aquatic resources of a protected area).

There is the intention of standardizing structural modifications which appear at organs level both in animals (Tricklebank, 2001) and in plants (Rautio et al, 2002) as biomarkers. This is justified by the accessibility of the required analysis, as they have a much lower cost and degree of difficulty than the biochemical or ultrastructural analysis.

Ultrastructural aspects of the pollution impact upon living organisms have been studied considering two aspects: the modifications which appear at the level of various cell organelles in modified environmental conditions (Stirban et al, 1988, Poppe et al, 2002, De La Cruz, 2002, Rinnan, 2004) or the furnishing of ultrastructural biomarkers for the quantification of the ecosystem's damage degree (Schramm et al, 1998, Wai, 2000).

Project objectives: In this stage the main objectives of this project are:

- Evaluation of the morphological and structural (histological) parameters for the selection of the ones which can be used as biomarkers;
- Establishing and quantification of the ultrastructural biomarkers through TEM and SEM methods
- Screen testing verification of the previously selected biomarkers;
- Selection of the biomarkers which proved to have a significant correlation with the modifications which appear in the ecosystem under the influence of pollution.
- Communication and publishing of the results

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Material and methods

The vegetal material was collected from National Park Ceahlau and this adjacent area. The control sample (M) was collected from the protected area of the park and the variants from Tasca village (V1) (near the cement factory), rail station Tasca (V2) and carrying station (V3).

These morphometric traits were measured with a digital caliper (0.01 mm accuracy). To estimate the error of measurements, each measurement of the left (L) and right (R) sides for each leaf were performed twice during two independent sessions. Also, all measurements were performed by the same person.

For histo-anatomical analysis the material was fixed and conserved in ethylic alcohol 70%. Free hand sections were performed using a razor blade. The sections were observed without coloration in order to show the phenolic and tannin deposits from different tissues.

For ultrastructural studies the vegetal samples were fixed in 4% glutaraldehyde in phosphate buffer, and post-fixed overnight with 1% OsO₄, then rinsed with distilled water before dehydration in an ethanol series. A gradual substitution of ethanol by propylene oxide preceded sample infiltration and embedding Epon 812. Ultrathin (70–90 nm) sections were floated onto copper grids and air-dried before staining in 2% uranyl acetate and lead citrate (Reynolds, 1963).

Principal results

From morphological point of view total length of plants (for the herbaceous one) and fluctuant asymmetry (FA) for the leaves was followed. Plants from polluted sites perform better against stressful situations because they are adapted to these conditions. Adaptation can explain both the tendency towards decreased FA from unpolluted to polluted sites. The more symmetric plants from polluted sites were more tolerant to stress, than were the more asymmetric ones from unpolluted sites. Hoffmann & Parsons (1993) suggest that these stressful conditions can lead to rapid evolutionary change by causing intense natural selection.

From structural point of view the plants from polluted sites present important modifications especially regarding the schlerenchyma fibers and accumulation of phenolic deposits in leaf mesophyll and epidermis. The number of stomata and the shape of the epidermis and stomatal cells show no variations between control and samples from polluted sites.

From ultrastructural point of view, chloroplasts either had the usual lens shape but appeared more elongated and smaller in width or had a distorted lens shape. In both forms, however, the inner membrane system is less-developed compared to the plastids from the control sample. Unstacking of the thylakoid membranes was evident in some regions of the chloroplasts. The stroma was moderately to highly dense but showed fewer granulations. Occasional starch grains and osmiophilic globules were seen. Along with the growth of osmiophilic globules and conspicuous starch deposition, the damage of the thylakoid system is considered a symptom of the initial stage of accelerated chloroplast aging.

Morphometrical studies showed a significant increase in number of mitochondria, peroxisomes and cistern of the endoplasmic reticulum.

Perspectives:

New working methods and protocols will be conceived and they will be able to subsequently be applied for the diagnosis of the pollution impact degree in other similar ecosystems from our country and not only. Ceahlau National Park will thus be the first protected area that will have a complete diagnosis of the damage degree according with biomarkers.

THE STUDY OF THE DETECTION, PREVENTION AND CONTROL OF ASCENSIONAL POLLUTION

Mihai Pascu COLOJA, Constantin NICOLESCU, George IORDACHE¹

Ascensional pollution is a type of unconventional pollution, generated by underground workings. These workings are indispensable when exploiting underground riches, such as hydrocarbons, coal and other useful minerals. Although they have short, medium and long term effects, in the end, the process is always ascensionally propagated to the surface of the earth or of solid rocks found in the contact area with the sea or the ocean; this is also a reason for air pollution.

The project aims exclusively underground pollution and the way it emerges and shows up in the atmosphere, keeping in mind that in the present our way of life is in close connection to the usage of substances which linger in the subsoil and which may have a harmful effect, by their nature or by way of bringing them to the surface, processing and transporting them. The research programme is based on pointing out the pollution factors (the drilling-extraction workings on land and by sea, the deposit of fluid hydrocarbons, their transport and process in refineries, the exploitation of sodic chloride by dissolving and by wells, the mine working) and proposing solution for detecting sources, stopping the propagation of these factors and curing the affected areas.

The project's main objectives are: the presentation of ascensional pollution's appearance and propagation mechanisms; the identification of main polluting factors and of sources of potential ascensional pollution; establishing methods for preventing pollution and restricting its consequences; proposing solutions for stopping the propagation of polluting factors, fighting pollution's effects and curing the affected areas; turning green the technologies used at drilling wells and exploiting fluid hydrocarbons deposits.

The project has been structured in 7 stages, from which 4 have already taken place, their objectives being:

1. Documentary study;
2. Marking the limits of contaminated areas and representing on maps the intensity of ascensional pollution;
3. Identifying the sources, measures for stopping the pollution's propagation and methods for improving the quality of the areas by recovering or destroying the polluting factors;
4. New technologies for ecological activities in drilling, petroleum production, transport and deposit of hydrocarbons (Study that can be applied in petroleum exploitation).

The **main results**, presented in the research reports elaborated for each stage, are:

Stage 1:

- Showing the present state of pollution in Romania and around the world;
- Identifying the polluting activities and agents in different economic fields;
- Analysing ascensional pollution sources in the industry of petroleum: drilling of wells, oil and gas production, transporting, processing in refineries, distributing petroleum products;
- Identifying areas where ascensional pollution has been detected; presenting the geological frame of each such area; analysing the polluting factors and research of the possible contamination sources;
- Presenting the criteria for establishing and appreciating the risks.

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Stage 2:

- Delimitating and drawing the maps showing some of the areas affected by ascensional pollution (selected after stage 1), based on the information from drillings and field tests:
 - o Ascensional pollution with natural gas: Curteni, Tăuni, Sărmășel, Bulbuceni;
 - o Ascensional pollution with crude oil and deep water: round the area of well 201 in Zemeș field;
 - o Ascensional pollution caused by infiltrations of petroleum products in the walls of some houses: Chercea quarter, in Brăila;
 - o Ascensional pollution caused by petroleum activities: Ploiești area, referring to the refineries Petrotel-Lukoil, Astra Română, Petrobrazi and Vega;
- Designing and constructing an equipment capable of testing some technologies for recovering polluting factors and decontaminating the underground; it's emplacement is on UPG Ploiești platform, situated near the area affected by the propagation of polluting factors originary from Astra Romană Refinery.

Stage 3:

- The analyse of polluting activities and the proposal of technologies for finalising the workings without affecting so much the environment: in Romania, the affected areas and the sources of pollution can be related mainly to the activities extracting hydrocarbons, sodic chloride, coal and other useful minerals, but, mostly, they can be related to the process of their treatment, transport and deposit.
- Presenting the measures for securing the areas accidentally contaminated; the critic analyse of present technologies for decontaminating the soil and the subsoil; criteria of selecting methods applicable in situation of contamination; objectives that have to be attained by depolluting actions, conforming with the European legislation; solutions for improving the environment's quality by recovering or destroying the polluting factors.

Stage 4:

- Presenting the most recent technologies that are applied in the exploitation of hydrocarbons fields; we insist on new ecologic systems, that don't pollute and modifications of classical technologies for extraction, transport and deposit of crude oil are proposed; this aims eliminating the potential polluting sources and turning green these processes. The research report "New ecological technologies in drilling wells and exploiting hydrocarbon deposits" refers to all the activities typical for discovering and exploiting petroleum and gas fields: wells drilling, bringing crude oil to the surface using different extraction systems, exploiting marine wells, processing, depositing and transporting crude oil toward refineries.
- Knowing the "historical pollution" in Romania (large areas contaminated with crude oil, many slurry deposits in the operation area plant and residues from refineries, VOC emissions in the stations of treatment and deposit), it comes in subject destroying the existing residues and adopting some technologies capable of preventing the future pollution of soil, atmosphere and underground water. The research made by U.P.G and its partners is presented; the research materializes itself in technologies and installations for improving polluted soils, destroying VOC using biofiltering ways, processing of the slurry and petroleum residues.
- Keeping in mind the decline of fossil energetic sources and their impact on the environment, the main, non-polluting and able to regenerate, alternative sources of energy are presented: the solar energy, the wind and the geothermic energy, the biomass, the biocombustibles and the nuclear energy.

The project's **perspectives:**

The research's results will be put at the disposal of the present polluting agents and the potential beneficiaries (Petrom-OMV, PetromService, Petromar, Refineries, RomGaz, The Salt Society, Environment Agencies), who are interested in applying the proposed solutions.

We also intend creating a consortium of enterprises in Ploiești area (polluted mostly by petroleum industry), able of assuring: a quick diagnose on pollution, the emergency intervention in case of accidentally pollution, the choice of most appropriate ways of curing and their quick application, the monitoring of the results, no matter the type of industrial activity or the pollutant.

THE APPLICATION OF NANOSTRUCTURATED MATERIALS INTO AOPS PROCESSES FOR ADVANCED OXIDATION OF PRIOR POLLUTANTS FROM WASTEWATER - FOTOX

Ines NITOI¹, Tatiana ONCESCU², Maria CRISAN³

The aim of this project is to elaborate an advanced degradation technology for prior compounds specified in GD 351/2005 as chlorinated aromatic compounds (maximum accepted concentration level of $\mu\text{g/l}$), by photocatalytical oxidation using photo catalysts from nanostructured materials based on TiO_2 .

Objectives:

- Setting up the data base on the state-of-art of AOPs application for degradation of chlorinated aromatic compounds, pollution level and techniques for synthesis of TiO_2 based photocatalysts.
- Setting up the kinetics and advanced degradation mechanisms of chlorinated aromatic compounds in various operating conditions.
- Synthesis and characterization of various types of TiO_2 and modified TiO_2 based photocatalysts.
- Development of an advanced degradation technology via catalytic photo oxidation of chlorinated aromatic compounds.
- Dissemination and transfer of the project results.

Novelty aspects:

- Ecologic and modern treatment process, no researched up to now at national level.
- Using an unconventional energy source – solar light.

Results / Progress indicators:

- Documentary study regarding the AOPs applied processes in the field of advanced degradation of prior compounds like aromatic chlorinated compounds; influence factors of photo degradation processes.
- Setting the pollution level with aromatic chlorinated compounds and pollution context of some wastewater sources.
- Study of sol-gel method applied in order to synthesize macromolecular lattice of metallic oxide; the influence factors of the process.
- Preliminary procedures in order to synthesize the TiO_2 based photo catalyst (powder, film on support) and characterization of final products.

¹ INCD ECOIND

² University of Bucharest – Centre of Theoretical and Applied Physical Chemistry - CC CFTA

³ Institute of Physical Chemistry „I.G. Murgulescu” of Romanian Academy

- Kinetic equations and photo degradation mechanisms of Chlorobenzene via direct photolysis, homogeneous and heterogeneous catalyzes and evaluation of the influence of operating parameters (pH, pollutant concentration, photocatalist nature and concentration, O₂ concentration, temperature) upon rate constants and process efficiency.
- Assessment of pollutant structure influence and wastewater pollution context upon photo degradation efficiency.
- Setting the operating parameters for TiO₂ and TiO₂ doped with sulphur (powder, film) based photo catalyst synthesis and the characterization of obtained products.
- Treatment flow scheme for the water polluted with Chlorobenzene and variation range of operating parameters.
- 4 paper works presented to scientific events both on national and international level and one article proposed to a foreign scientific journal.
- Build up of the model laboratory installation for the treatment of water polluted with Chlorobenzene by heterogeneous photocatalysis in TiO₂/solar light system.
- Setting the treatment flow and the operating parameters which will assure the advanced removal of Chlorobenzene from wastewater according to enforced limits ($\leq \mu\text{g/l}$)

Perspectives:

The results obtained until now will be used during the fourth stage of the project the elaboration of the proposed technology presentation hand-book.

This document will represent the support for dissemination and transfer of the project results to potential beneficiaries in the frame of some workshops organized for promotion and demonstration of the functionality of the proposed technology for advanced degradation of chlorinated aromatic compounds from wastewater.

Potential beneficiaries / Users of the results:

- Large economic units or small companies who are generating prior substances like chlorinated aromatic compounds (chemical synthesis, rubber, paper, wood industry a.s.o.).
- Local Administration and water-sewer operators.
- Small and medium companies, which are able to integrate in their production processes the photo catalyst synthesis.

DECISION SUPPORT SYSTEM FOR LANDFALL RISK MANAGEMENT IN A GEOGRAPHICAL AREA WITH HIGH RISK FOR NATURAL DISASTERS – TERRARISC

Carmen Stan¹, Virgil Olaru², Cristian Marunteanu³, Beatrice Stefanescu⁴

The **main goal** of the project is to create an intelligent decision-support system for assessment of real-time environmental parameters needed in landslide risk management, using advanced hardware and software technologies like:

- automated field data acquisition systems – used to acquire data regarding: the underground water level (sensors installed inside caissons); the rain level; the temperature; the relative displacement of fitted terrestrial bench-marks (sensors for relative displacement);
- wireless communication – for transmission of field data to a risk management center;

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- modeling and forecast algorithms – for landfall risk assessment;
- GIS technologies – used to create hazard maps that depict the landslide risk for different areas;
- relational database management systems and business intelligence – for complex analysis of historical data in order to identify the evolution trend of environmental parameters and to foresee the risk of landslide.

The project intends to deliver complex monitoring and control services.

Objectives

TERRARISC project has the following scientific and technical objectives:

- Establishing the needs of observation and environment parameters assessment for high landfall risk areas from Suceava county;
- Elaborating probabilistic models for modeling and prediction of landfalls;
- Developing a real-time data acquiring, analysis and decision-support technological platform for on-line observation of environment parameters and intelligent landfall risk management;
- Creating the GIS support for analysis (hazard map and risk map of the area in study according to the methodological norms from the Government Decision no. 447-10.april.2003);
- Elaborating an advanced landfall evolution forecast and assessment solution using:
 - experimental studies based on real data collections, software analysis integrated environments (business intelligence) and pattern-recognition for landfall evolution
 - probabilistic methods
- Developing landfall risk management services;
- Real-time reporting for decision factors and for the population, on fixed and/or mobile devices:
 - automatic reporting about parameters evolution due to increased alarm/emergency quota;
 - interactive facilities for creating alarm strategies (actions, tasks, priorities) and generating emergency plans.

Current results

The project's fourth phase ended in May 2007 and so far the following tasks and activities were accomplished:

- The on-line environment parameters acquisition equipment (including: data sensors, control module and GSM/GPRS data communication subsystem) was built;
- The TERRARISC relational database containing environment-specific data as well as additional information about the monitored areas was created;
- All the necessary software applications were developed:
 - the dispatcher application (that communicates with the data acquisition equipment: monitors it and receives data from it by GSM/GPRS);
 - a data management application (for viewing and modifying information from the database);
 - the web services (implementing the business logic);
 - the web portal (both desktop and mobile) for information on and management of landfall risk;
- Hazard maps for the pilot area were created;

- A demonstrative system was set up to work in a laboratory environment in order to test and evaluate it;
- Result presentation and dissemination web pages and documentation were created (dissemination activities included: publishing articles in magazines, participating in national and international fairs, exhibitions and symposiums).

Future directions

Although the system was installed in laboratory for tests, it will be deployed in Suceava, where the local authorities have started the necessary procedures for installing the equipments on the field in those areas already established by mutual agreement.

In conclusion the next steps are:

- installing the equipments on the field;
- installing the software applications on a server computer inside the Observation and Control Center in Suceava;
- starting the whole system and the field data acquisition from the sensors.

By capturing enough data for a longer period of time (approximately one year) will allow specialists to:

- adjust the modeling algorithms;
- determine evolution trends for environment parameters;
- create more accurate hazard maps, based on real field data.

RISK ASSESMENT AND ADMINISTRATION CONCERNING THE RADIOACTIVE ANTROPICAL SOURCES FROM POTENTIAL TOURISTI AREAS - REMED

Bujor Dan Nica¹, Georgeta Maiorescu², Mihaela Melinte³, Lucian Matei⁴

The project presents the risk analysis in the geographic zones to the nearby or inside touristic areas where geological researches or uranium activities were performed.

As a result of geological research and uranium are mining great amounts of waste rocks and poor ore were stored as waste rock dumps.

These mining waste present a real danger for environmental factors, human health as well as for other economical activities based on the utilization of natural capital, such as the touristic activity. Similar situations were noticed in the touristic areas from Apuseni Mountains, Oriental and Meridional Carpathians and Banat district.

In order to remediate these areas, the economical activities are not necessary to be restricted and tourism is one of them.

The objective of the project is to promote solutions with positive long term effects regarding the mining perimeter ecology after closing the uranium extraction and the sustainable economical development of the touristic areas, nearby the anthropical radioactive sources by radiological protections of the geosystem.

The announcement regarding the natural background or the maximum admissible limits in radionuclides (U and Ra) and external gamma radiation requires the risk situation

¹ INCDMRR

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assessment based on complex relation between contaminated sources, transport mechanisms, exposures pathway and receptors.

The Carpathian touring potential – the most intense aggressed by the radioactive resources extraction – consists in the big variety of natural landscapes and also the background of historical elements, architectural, ethnographic and folkloric.

These attractively elements determined that the tourism represent one of the most significant economical activity, because improved the natural capital in areas with few economical development.

The obtained results from the beginning of project are registered on three stages rapport finalized so far.

In the first stage, according with conceptual plan, were registered the following aspects:

- the geographical distribution and radioactive sources classification;
- the estimation of pollutant potential for radioactive mining wastes;
- the natural capital estimation with tourist value for uraniferous mining areas.

The appropriate rapport for the **second stage** had containing based on radioactive evaluation on uraniferous mining areas with tourist potential from the carpathic geographic space.

The radioactive sources analyses (dump and mining water) had as result the contain establishment and concentration in radioelement and also the outlining for anomaly areas from area sources and critical groups. Based on field and laboratory measurements, was estimated the aspects due to the aggressed environment quality.

The possibility that these areas returning on economical circuit by tourism activities result from the following aspects analyze:

- the natural and antropical resources relieve with patrimony value;
- the actual level assessment of tourist efficiency.

The radiological security analyze in risk areas made the object for the **third stage** which results consist in:

- radiological data base design;
- risk analyze elaboration for human health;
- the establishment of gestion principles for risk situation;
- recommendations for geographic space re-organizing in uraniferous mining areas for re-introduction respectively perimeters on touring circuit.

Finalizing the project by examine the last two phases which having as objectives the presentation of case study and elaboration the gestionated strategy for radiological risk associated "front end" part of cycle with natural uranium.

The perspective offered by the present project consist in the obtained results transfer to the economical environment through implementation of some solutions to realize the necessary support for practicing some touring forms in ex uranium extracted areas in safety conditions with loose limitation from the radioactive contamination danger point of view.

CONSERVATION AND SUSTAINABLE MANAGEMENT OF FISHERIES RESOURCES (COMADUREP)

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Valentin IORGA⁵

Open access to fisheries resources has conducted to catch declining and loosing of the biodiversity duet to overfishing. Anthropogenic impact through damming, hydrotechnical works and pollution has conducted to habitat loosing and degradation. Sustainable use of biologic resources has become an priority objective for environment protection all over the world, especially after ratification in 1992 of Convention of Biological Diversity from Rio de Janeiro, adopted also by Romania.

Project objectives

The project Conservation and Sustainable Management of Fisheries Resources (COMADUREP) is included in Centre of Excellence Program.

Overall objective of project is “Establishment of a excellence network for estimation, conservation and sustainable and responsible management of fisheries resources through attaining a critical integrated mass of research resources, for assisting and fundament of decision in sustainable use of fisheries resources, public property administrated by state, in order of sustainable development of poor regions depending by natural resources exploitation in harmony with conservation of biodiversity and habitats”.

Specific objective of project is” Elaboration, development and validation of methodologies and tools for research, preservation and sustainable use of fisheries resources”.

The project include 6Work Packages: WP1 - evaluation of knowledge and gaps; WP2 - development of methodologies; WP3 - fishery estimation (validation of methodologies); WP4 - GIS data base design and software; WP5 - elaboration of strategy and action plan for sustainable use of fisheries resources; WP6 - dissemination of results.

Complexity of project consists in elaboration of methodologies for fisheries estimation on four categories of aquatic basins (Danube delta – DD, Black Sea – BS, Danube River – DR and Inland lakes and rivers – LRI).

New research proposed to improve estimation and will deliver to administrators the necessary tools (methodologies and data base) for planning the sustainable use of Romanian fisheries.

Intermediary results

It was established a Network of Excellence for fisheries research formed by two university, respectively University “Dunarea de Jos” from Galati and Bacau University and 3 research institute, respectively Danube Delta National Institute for R&D from Tulcea, National Institute for Marine R&D Grigore Antipa from Constanta and Institute for Reasearch-Development for Aquatic Ecology, Fishing and Aquaculture from Galati.

1. Danube Delta National Institute for Research & Development
2. University “Dunarea de Jos” from Galati
3. Bacau University
4. National Institute for Marine Research “Grigore Antipa”
5. Institute for Research-Development for Aquatic Ecology, Fishing and Aquaculture

All together the Network includes 71 specialists represented by 4 University Professors, 25 doctor scientists, and 9 young researchers under 35 years.

The project has developed an internet site (www.comadurep.ro) through what members of networks could communicate through upload or download project files. The website has also a public access part for project dissemination.

It was adapted the fisheries estimation methodologies to be applied for specific water basins of Romania (Black sea, Danube delta lakes, Danube river and Inland lake and rivers and had developed decision tree choosing diagrams for:

- fish sampling methods per type of aquatic basin;
- fish stock estimation methodologies per type of fisheries and aquatic basin;
- fish stock estimation in accord with fishery data availability.

The Windows based software (WinESP) was developed as a tools for fish stock estimation. This software help to estimation of grows and exploitation parameters and simulate different exploitation scenarios for fishing optimisation and calculation of Maximum Sustainable Yield.

The fisheries estimation methodologies were checked by real fisheries estimation from Black sea, Danube delta, Danube river and Inland lakes and river for year 2006 and prediction to year 2007.

Romanian Fishery Data Base was developed for fishery monitoring and management actions, but also for research data information on catch and fishing effort.

Project perspectives

Technical impact of project results consists in elaboration of adapted methodologies and tools of research and sustainable management of Romania fisheries.

The socio-economic impact consists in durable development of rural communities dependent of fisheries resources from poor regions of Romania, through improvement of conservation and sustainable management of fisheries resources.

Potential users of the project outputs are:

- National Agency for Fishing and Aquaculture (ANPA), which has legal responsibilities for sustainable use of Romanian fisheries (politics, strategies, methodologies, regulation);
- Danube Delta Biosphere Reserve Authority (ARBDD), with attribution in conservation and sustainable use of natural resources from Danube delta;
- National Companies for Administration of Fishery Found (CNAFP), with attribution in sustainable administration of Danube rive basin fisheries;
- ROMSILVA, that is responsible for administration of mountain fishery;
- Private fishers, Association & Organization of fish producers, which together with state administrators are responsible for conservation and sustainable management of fisheries.

ESTIMATION OF THE SOUTH DOBROGEA WATER RESOURCES VULNERABILITY DUE TO THE POSSIBLE ACCIDENTAL POLLUTIONS FROM THE DANUBE-BLACK SEA CANAL ZONE AND DUE TO ITS SLOPES STABILITY

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The basic objective of the project is to put in disposal for the resort institutes data which are useful for the protection and preservation of the aquifer structures and of the catchments for water supplies.

The Danube-Black Sea Canal (CDMN) is the biggest hydrotechnical structure carried out in Romania. CDMN is making the connection between Cernavoda harbor and the marine harbor of Constanta, making shorter with about 400 km the distance between the Danube harbors and the harbor of Constanta.

From the geoecological point of view, the CDMN represents a new aquatic ecosystem which extends on 64.4 km length, with 90 – 140 m width, 7.00 – 8.50 m depth and an annual traffic capacity of 75 mil. tones.

Due its nature, the CDMN produces permanent changes of the environment, including the waters quality, deposits and ecosystems.

Any multidisciplinary approach of the study of the influence performed by the CDMN presence over the adjacent zone must take into consideration the following aspects: aquatic environment quality knowledge (water, deposits, biota), evaluation of the ecosystem ecological parameters, CDMN ecological system knowledge, influence of the incidental, permanent and/or accidental of pollutants discharge which may occur from a large area of entropic activities (as ex. energy production, navigation, agriculture, mining industry etc.).

2. Obtained results

The project will be performed in many stages. Up to now 3 stages have been performed. The obtained results from the 3 stages are presented below.

2.1. The first stage objectives

The first stage of the project was subject of “*Gathering of the existing data, inventory of the monitoring operating works, land scouting*” and contained:

Gathering of the biological, geological, hydrological, deposits, hydrochemical, hydrogeological data known up to now; inventory of the operating/damaged piezometers, site scouting, establishment of the drilling locations; inventory of the slide zones; carrying out of the maps containing the slides location; carrying out of the project and of the technical documentation for the drillings execution; synthesis of the biological, geological, hydrological, deposits, hydrochemical, hydrogeological data known up to now.

In order to solve the theme contained in this first stage the following information sources have been used: elements from the data base of SC ISPIF SA, INCD GeoEcoMar, Bucharest University – Geology and Geophysics Faculty.

Information provided by the Canal Administration through the general designer, SC IPTANA SA, have been used concerning the location of the piezometers to be inventoried on site.

The works location (hydrogeological drillings and land slides) have been marked on a 1:50,000 site plan.

Based on the existent documentary material and of the site scouting, a resume which presents the processed synthesis and land researches was fulfilled.

The following data were presented, containing: the studied zone geology; the studied zone tectonic; the studied zone hydrogeology; the geological-depositological researches, hydrochemical and bio-ecological – methods and results; bathymetry mapping of different sectors of the Canal – methods and results; hydrological and meteorological considerations; preliminary data concerning the main pollution sources; affected by the physic-dynamic phenomena and the ones with instability potential; inventory of the piezometers from the canal zone and coordinates determination; execution project for the drilling.

Based on the obtained material in this stage a schedule containing the site works program which are to be carried out in the IInd stage were fulfilled.

2.2. Objectives and results of the II stage

The II stage of the project deals with “***Hydrological and hydrochemical monitoring drillings carrying out and water sampling from drillings and surface water and deposits; seismic investigations, depth of the consolidated foundation determination, inclinometer measurements***” and contained:

- execution of monitoring and geotechnical drillings; soil samples geotechnical analyses; bathimetric and seismic-acoustic investigations carrying out; surface water samples and deposits sampling; execution of the project and of the technical documentation for the drillings carrying out; analyses of the deposits and surface water samples from the hydrochemical and biological point of view; water sampling from the drillings; topographical measurements of the observation drillings; inclinometer measurements into drillings; lithostratigraphic columns carrying out.

In order to obtain information about the infrastructure works impact over the hydrogeological conditions of the study zone (variation of the underground water level, of the preferential flowing directions and of the underground water quantity) a number of monitoring hydrological drillings were carried out.

In order to get a functional system of monitoring drillings, a number of 29 new piezometers were carried out, which together with the existent ones, can lead to significant results in the research project context.

The recognition of the site situation performed in the first stage of the project led to the identification along the two navigable canals of 3 zones which present slide phenomena. These zones are monitored and presently reclamation works are performed, in order to prevent the continuous damage of the slopes. Also, along the canals have been identified zones in which important phenomena of erosion surface and of “flowing” of the rainy water, which have created ravines and gullies with different dimensions.

Six geotechnical drillings have been performed in order to monitor two slides (CDMN at km 58 and Poarta Alba – Midia – Navodari Canal at km 12).

These have been equipped in order to make periodical inclinometer measurements. The registrations which are to be performed in the next stage with the inclinometer equipment will offer real information concerning the characteristic phenomena occurred at the sliding plan level and of the sliding mass (the sliding dynamic).

The geological-deposit, hydrochemical and biological researches and the bathimetric ones have been extended along the Canal.

2.3. Objectives and results of the III stage

The IIIrd stage of the project concerns **“Underground water level monitoring; periodical sediments sampling and analyzing; sediments, geochemical, biological, hydrochemical analyses; bathymetric survey; preliminary hydrodynamic models programming; surface and underground water sample analyses”** and contains:

- bathymetric measurements, geologic, water and biota sampling; hydrochemical analyses; biological analyses; sediment and mineral analyses; geochemical analyses; underground water levels monitoring; settling periodical sampling; inclinometric slides monitoring; hydrodynamic models programming for sliding risk areas localization.

3. Estimated results

Information obtained as following stage I and II performance and of the next ones will be materialized by performing, completion and finalizing of an informatics base concerning the hydro-dynamic integrate models getting, to the marking of the areas with pollution potential risk. The integrated hydro-dynamic models performed for the adjacent zones of the navigable canals from Dobrogea will be used for the intervention program appliance in case of severe accidents. The hydrogeological and hydro-chemical monitoring program performance and the recommendations concerning the intervention plan will be used in order to diminish the effects of a major accidental pollution.

The inventory of the land slides already started will be helpful for the beneficiary in order to take necessary measures for prevention of their evolution, which may induce the hydrotechnical structures destabilization.

CRUSTAL SEISMICITY AND ACTIVE FAULT SYSTEMS WITHIN THE WEST OF ROMANIA

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The main objective of the project: “Correlation of crustal seismicity with the active fault systems...” is to provide the essential data for assessment of seismic hazard and for seismic microzonation, particularly to localize the active fault fields in correlation with crustal seismicity data.

The most significant seismicity of Romania is located in the SE Carpathians, in the Vrancea zone, where 2-3 strong earthquakes $M_w > 7.0$ per century occur. Nevertheless the crustal seismicity can not be neglected because it is dispersed almost on the whole territory and the highest magnitudes recorded, although moderated $M_w < 6.0$, have resulted in local damages or even casualties.

In the last year a study of crustal seismicity in correlation with fault systems was performed for the eastern and southern parts of country. In 2007 the study has been continued for the south-west, west and north-west of Romania that is in the Danubian, Banat, Crisana and Maramures zones. Crustal seismicity is a result of the neotectonic activity and it is observed both at the contact of tectonic units and inside of the same tectonic unit.

Banat and Danubian zone (the W margin of the South Carpathians adjacent to the Danube) showed an important seismicity in the last century with events up to $M_w 5.6$.

In the Danubian zone some fractures oriented towards N and NE represent the main sources of seismicity as the fault plane solution for the event from 16.07.1991, Mw5.6 have shown. The density of seismic events is relatively high within the area of border with Serbia and along the Danube. A correlation between earthquake epicenters and the known fault systems is done.

Banat is a seismically active zone proven by events generated within the basement of the Pannonian Depression and at its contact with South Carpathian Orogen. In the last century more events with $M_w \leq 5.6$ were recorded. They are connected to the fault systems which separate the uplifted blocks of the deep grabens or at the contact of depression with orogen. A correlation of epicenters with the fault systems is as well done for this zone. In addition a rheological crustal model for the Banat zone is built and a correlation with the focal depths is performed. A statistical analysis of the hypocenters distribution in the depth for the last century events displays a strong concentration in the first 5-10 km depth. Others secondary peaks arise around 20 km and 35 km depth, respectively. The first peak is in a good agreement with the shear strength peak of the rheological model suggesting the strong influence of rheology on the rupture depth for an earthquake.

Study is in progress for the Crisana and Maramures zones.

Historical data suggests potential earthquakes of $M_w \geq 6$, but only an event $M_w \sim 5$ was recorded in the last century for the two zones. In the Oradea and Carei areas some earthquakes are located at the crossing of some fractures oriented towards NE and W-E. Along the plane of those crustal fractures some thermal water ascends in the Oradea-Petreni area. In the Maramures zone some historical events from the end of the 19th to beginning of the 20th centuries are recorded with intensities up to 5 degrees, with many aftershocks. They are originated in the some fractures parallel to the Eastern Carpathians structures.

In the next half of this year the study of seismicity in correlation with the crustal faults will be deepens for last two zones.

In 2008 a synthesis of the peculiarities of crustal seismicity in correlation with distribution of active fault systems will be done.

ECOLOGICAL EQUIPMENTS AND TECHNOLOGIES FOR THE EFFICIENT CONVERSION OF RENEWABLE ENERGIES (SOLAR, WIND, BIOMASS AND WAVE ENERGY) IN THE SCOPE OF REDUCING THE CONSUMPTION OF CLASSICALL POLLUTING

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Introduction

In the current context of the worldwide scientifically studies related to developing new alternative solutions for producing electrical energy from renewable energy sources (RES), this project comes to add up to these global interest, aiming to illustrate possible technical solutions for the implementation of renewable energy sources in the geo-climatic and socio-

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economical conditions in Romania. Renewable energy sources have an important potential and offer unlimited usage availability at local and national level.

Valorification of renewable energy sources can be done on basis of three main assumptions: accessibility, availability and acceptability. Renewable energy sources ensure an increase in the supply with energy from own sources and thus limitation of the imports in energy resources, supporting sustainable economical development.

This abstract presents shortly the mode of action in the project, in relation to the aim and the proposed objectives, the research activities being focused on obtaining electrical and thermal energy through conversion of solar energy, wind energy, wave energy and biomass.

The main objective of the project:

The main objective of the project is the production of efficient and ecological equipments and technologies that can assure the optimum usage on large scale in Romania of renewable energy sources (solar energy, wind energy, wave energy and energy produced by the biomass). The project will approach this theme in a systematical and balanced fashion, taking into account the economical, psychological and social factors not only for the *existing systems*, but also for the *new built ones* or *for the ones that will be built*.

Specific objectives of the project

- Increasing the weight of renewable energies in the energy balance of Romania, through promotion of some efficient and economical technical solutions, which will consequently contribute to the future large scale integration through identification of a greater number of potential users;
- Education of potential users by underlining advantages and the simplicity/easiness in using these installations, with long-term positive effects in environmental protection such as reducing the greenhouse effect;
- The development of scientific knowledge in the field of renewable energy conversion.

The research project will be carried out in 36 months (October 2005 – October 2008 – the project development including the following main stages (steps):

- Elaboration of a study regarding the state of the art in the field and presentation of reference models in using renewable energy sources;
- Design of experimental models for perform ant systems that can use solar energy (thermal and photovoltaic), wind energy (an eolian source will be integrated into a hybrid system, including a diesel generator, batteries and a PV source), wave energy and biomass (theoretical technical models);
- After developing the small experimental models for thermal and photovoltaic energy, wind energy and wave energy conversion, a system for monitoring the main parameters of these models will be developed;
- Experimenting, testing and evaluating the performance of the models;
- Elaboration of dissemination material, of the optimization studies related to the use of renewable energy sources, analysing the opportunity for technological transfers.

The stage concluded until now (June, 2007). Research results

a) Stage I: Documentation study on RES / deadline: 30.12.2005

Research results: study and analysis regarding: the importance and the state of the art in renewable energy field in Romania and worldwide; methods for optimal and efficient usage of RES, the alignment to European standards referring to RES; national legislation aspects

related to environmental protection and environmental quality improvement in the field of energy; preliminary analysis of the solutions regarding the design of a hybrid system (wind – diesel generator) for the production of electricity – basic structure.

b) Stage II: Design of the experimental models / deadline: 15.10.2006

Research results: finalizing the technical solutions and elaboration of the technical documentations needed for implementing and testing the following experimental models: a) small PV system; b) PV system for water pumping; c) small solar - thermal system for domestic water; d) system for the recovery and conversion of wave energy; e) experimental model project of wind blades for small turbines; f) analysis of the different structures for the hybrid system (wind – diesel generator) and of the technical solutions for developing its functions, in view of the physical implementation; g) theoretical technical solutions regarding experimental applications based on using biomass.

c) Stage III: Implementation of the experimental models / this stage is still under development / deadline: 30.06.2007

Research results: Physical implementation of the experimental models for the small PV system using two PV module types (monocrystalline Si and polycrystalline Si), PV pumping system, solar – thermal system, hybrid system (wind – diesel generator), wave energy system. The experimenting and testing of the PV system will also include a Passive Solar Tracker (ETATRACK 360), on which one will mount PV modules based on monocrystalline silicon.

SYNTHESIS AND CHARACTERIZATION OF STYRENE BASED PROTON CONDUCTING POLYMERS AS ELECTROLYTE FOR PEM ELECTROLYZERS

Daniela EBRASU, Irina Petreanu, Laurentiu PATULARU, Vasile STANCIU, Ioan STEFANESCU, Mihai CULCER

Renewable sources of energy can be directly converted into electricity. Hydrogen seems today to be the most promising candidate. This light molecule can be obtained from various earth-abundant chemical sources such as water and from electricity using electrolysis. Water electrolysis has therefore a key role to play in the hydrogen economy. In particular, the Proton Exchange Membrane (PEM) technology offers the safer and most effective way of producing electrolytic hydrogen. This paper presents the results obtained using a commercial block copolymers of the styrene-butadiene in structural design of a Proton Exchange Membrane for PEM Electrolyzers. The membranes were structural tested by FTIR spectroscopy, it was measured their thermal stability by DSC, Ionic Exchange Capacity (IEC), protonic conductivity and current voltage curves were recorded.

The commercial breakthrough of PEM electrolyzers is hindered by the high price of electrolyzers components. PEM is the most expensive part of the fuel cell. Lower prices will be achieved by developing new materials and improving performance. Perfluorinated copolymers are the current state-of-the-art proton exchange membranes (PEM).

Tri-block copolymers produced by DAIS-Analytic Corporation which may be based on sulfonated styrene-co-ethyleneco-butylene, have been described in the literature [1]. These sulfonated Kraton[®]-type block copolymers are post-sulfonated. The stability of these aliphatic hydrocarbon copolymers is, in general, inferior to the current state-of-the-art perfluorinated

copolymers. In order to increase the stability and to decrease the price, we were preparing a new type of membrane as is shown below.

The ion-exchange membrane was prepared using raw polystyrene–block-butadiene 21% styrene (PBS) from Aldrich. The solvent was chloroform chromatographic grade from Merck. The sulfonation agent was made from sulfuric acid 97%, acetic anhydride and dichloroethane chromatographic grade from Merck. Methanol from Merck was used to stop the sulfonation reaction. Divinylbenzene (DVB) 80% mixture of isomers from Aldrich was used as reticulation agent and Dimyristylperoxidicarbonat – Degussa used as an initiator for reticulation. PBS (5.2 g) and chloroform (150 ml) were successfully added to a 500 ml, four-necked flask. The solubilization was done at 40°C, using a mechanic stirrer. The mixture was stirred for 30 minutes then was left to cool down to room temperature. From this mixture 100 ml were taken and were deposited as film, called Non Sulfonated Membrane (NSM), using „Doctor Blade” technique and tested by FTIR spectroscopy. Sulfonation was done using a solution made from of sulfuric acid 97% (1.4 ml), acetic anhydride (3.2 ml) and dicloretan (20 ml). dicloretan. The sulfonation agent was added, at room temperature, slowly using a dropping funnel and continuously stirring (500 rpm) in order to prevent the secondary reactions. The mixture is warmed till 50° C for one hour in order to activate the sulfonation process. The reaction is stopped by adding methanol (15 ml) and the mixture is filtered.

The synthesized sulfonated polystyrene–block-butadiene 21% styrene (300 ml) was placed in a 1000 ml, four-necked flask to which divinylbenzene was added (0.5 ml, based 5 wt %) that has the role of crosslinking. Dimyristylperoxidicarbonat (0.4 g) was dissolved in methyl acetate (6 ml) and added to the mixture in 2 steps: 4 ml and after one hour the rest of 2 ml. The reaction takes place under reflux and stirring. From this mixture 100 ml were taken and it was deposited as a film, called Sulfonated Membrane (SM), using „Doctor Blade” technique and tested by FTIR.

The structural characterization was achieved using Fourier-transform infrared (FT-IR) spectroscopy by Nicolet Magna 750 apparatus with 4 cm⁻¹ resolution. The morphological characterizations of samples were performed using scanning electron microscopy on a Scanning Electron Microscope (SEM) by JEOL TEMSCAN 200 CX. The differential scanning calorimetry (DSC) spectra of sulfonated and polymer was obtained on SETARAM DSC Model 131. Measurements were performed over the temperature range of 25–200° C at the heating rate of 5°C/min in hermetically sealed aluminum pans. Membrane samples were allowed to attain steady state with the solvents and the sample pan conditioned in the instrument before running the experiment. Ionic Exchange Capacity (IEC) and degree of substitution (DS) has been measured by common techniques [2].

From the FTIR analyses was proved that sulfonated membrane *SM* presents an absorption pick at 3400 cm⁻¹ corresponding to the hydroxyl group that is formed due to the oxidation during the synthesis; 2) 2985, 2914, 2829 and 2761 cm⁻¹ for ν CH and ν CH₂ stretching vibrations from substituted aromatic ring; 3) 1630 cm⁻¹, for C=C symmetric stretch; 4) 1548, 1494, 1406 and 1375 cm⁻¹ corresponding to bending bands for CH₂ and CH; 5) strong band from 970 cm⁻¹ indicate the presence of 1,4-*trans* butadiene; 6) 916 and 881 cm⁻¹ correspond to CH₂ and CH out of plane bands from vinyl unit; 7) 820 cm⁻¹ indicate the presence of poly-butadiene with vinyl configuration; 8) 677 and 595 cm⁻¹ indicate the presence of *cis*-1,4 ale poly-butadiene. The most important feature is band at 1100 cm⁻¹ corresponding to R-SO₃H sulphonic groups.

The morphology of the membranes investigated by SEM. It was shown that at higher resolution we may see that the polymer chains are crosslinked, though at the lower resolution we may see some non homogeneity. Obviously, the structure should be improved.

The DSC spectrum of the sulfonated PBS has shown that the spectrum presents two *T_g* values are situated at 60° C and 100° C and a band corresponding to an exothermic effect. The first *T_g* is corresponding to the sulfonated polystyrene and the second one to the row

polystyrene. The exothermic effect indicates a further reticulation of the sulfonated PBS. The non-neutralized free acid forms ($-\text{SO}_3\text{H}$) of all the sulfonated polymers have the effect to lower T_g than the non-sulfonated ones. This may be ascribed to the structural changes introduced into the polymer on account of sulfonation.

Ion exchange capacity provides an indication of the content of acid groups present in a polymer matrix which are responsible for the conduction of protons and thus is an indirect and reliable approximation of the proton conductivity. For sulfonated PBS, IEC value is 3.8 meq/g and DS is 30.7% that are comparable or even higher than ones for Nafion.

NEW GENERATION OF FUEL CELLS WITH ELECTROLYTE SOLID ACIDS AND SUPERACIDS (SAFC), FOR EXPLOITATION AT TEMPERATURES 200-300°C

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The strategic goal of the project is the implementation of a new fuel cells generation with electrolyte based on solid acids with super-proton conductivity and super acids (SAFC). Innovative solutions are proposed for a new type of fuel cell that will include a variety of advanced materials: new catalyst, solid acid structures, superacids, micro/mezocellular carbon materials, superacid aerogels, systems of superprotonic solid acid, nanocomposite membranes based on superacid.

The solution with highest novelty level are solid acids which at temperatures $>1500\text{C}$ have a phase transition accompanied by a several-order-increase of proton conductivity. In the superprotonic conduction research field, Haille and collaborators (Solid acids as fuel cell electrolytes, Nature, Vol. 410, 19 April 2001) have shown that solid acid and superacids promise to replace actual Nafion membranes or polybenzimidazole used in proton exchange membrane fuel cell (PEMFC). There is an interesting conduction mechanism: SO_4^{2-} or PO_4^{3-} groups are characterized by a strong mobility exhibited above transition temperature, that induces an increase in proton conductivity of some orders of magnitude due to "hopping"-type conduction mechanism. The same phenomenon was observed also for other acid classes (an excellent review in this field: Chem. Rev. 1995, 95, 559-414) with Hammet constant >14 (super acids) which are currently used in catalytic processes for chemical synthesis.

The novelty regarding fuel cells is that solid acids and superacids inserted in polymer pyridine matrix with high thermal stability obtained by thermo-centrifugal oxidation of polyacrylonitrile can replace proton exchange membranes. The development of these new types of nanocomposite membranes (polymer matrix-solid acids/super acids) will be an important step for Romanian research in SAFC field and for future technologies. SAFC will operate at minimum 150°C for different solid acids classes with superprotonic conductivity without exceeding 200°C .

The second element of novelty is the nature of electrodes. Graphite electrodes or carbon paper are limited by their hardness, high electrical resistivity, uncontrolled porosity, therefore, the appropriate material is the carbon nanotube. Mesocellular carbon structures with

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high yield of carbon nanotubes and nanofibers have been obtained by catalytic pyrolysis with ferrocene and thermal treatments in centrifugal fields. Electrodes obtained using the method described above, will revolve the electrode concept for fuel cells, especially for SAFC.

The third novelty element is represented by Pt-VO and Pt-Ni catalysts, inert to CO. It will be carefully reconsidered the low risk solutions to use black platinum and other catalysts deposited on different oxide nanoparticles. The deposition of nanometric catalysts will be performed by ink-jet printing and by our technique: ionization by electro pulverization of nanocatalysts in plasma reactor.

The actual stage of research. The experimental bench for all the experimental models to be evaluated has been defined. The calibration of SAFC-reference based on CsHSO₄ solid acid and experiments on the new types of electrode materials, supports for the membrane have been performed. Synthesis and characterization on solid acid, superacid, catalysts and supplementary nanometric components was reported, as follows:

- Synthesis of microcellular carbon materials by polyacilonitrile/ phenol formaldehyde resin pyrolysis, metallic insertion in the carbonic material structure from functionalized precursors during sol-gel processes; electrochemical behaviour studied by cyclic voltametry.
- Synthesis of hydrogen selective mezostructured materials containing zirconium oxide. Characterization methods: X- ray diffraction (XRD), nitrogen adsorption-desorption, scanning electron microscopy (SEM), XPS and infrared spectroscopy (IR).
- Synthesis of solid acids with superprotonic conduction properties (sulphates, selenates, phosphates): CsHSO₄, CsH₂PO₄, CsHSO₄/YSZ composite. Characterisation methods: XRD, SEM, Raman spectroscopy and Fourier transform infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA), differential thermal analysis (DTA) and differential scanning calorimetry (DSC).
- Synthesis of mezostructured oxide (SBA-15, MCM-41, MCF) and mezostructured nanocomposite- preliminary results on mezostructured oxide- superprotonic solid acid obtained by mechanical mixture and *in situ* synthesis. Characterisation methods: XRD, nitrogen adsorbtion and ²⁹Si MAS NMR.
- Synthesis of solide superacid based on oxide-aerogel (ZrO₂) modified with Keggin heteropolyacids (H₃[PW₁₂O₄₀], H₃[PMO₁₂O₄₀]H₄[SiW₁₂O₄₀]) and acid phosphates (H_xPO₄)^{3-x}. Characterization methods: Raman spectroscopy and IR spectroscopy.
- Developing solid acid and/or superacid composite materials embedded in polymeric matrix- preliminary results. Characterization methods: optical imaging, atomic force microscopy (AFM), electrical measurements.

The following phases are focused on evaluation and testing of SAFC performances with different combinations of materials, characterization of properties and functional characteristics and establishing the optimum combination. The next step is to improve SAFC performances to the theoretical limits. This will open directions and opportunities in applications and implementation on technological level.

INTEGRATED SYSTEM, DECISIONAL SUPPORT BASED ON MULTISENSORIAL INFORMATION FUSION FOR BEHAVIOUR SURVEILLANCE AND PREDICTION OF DAMS

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GENERAL INFORMATION

The project FUZIBAR aims at creating an integrated system, which, based on multisensor fusion of data acquired from surveillance and control equipment placed within the hydro technical constructions (dams), correlated with meteorological and geophysical factors, will offer decisional support for the surveillance and prediction of hydro dams and hydro sites behaviour. The system will detect and diagnose structural faults or functional anomalies and will offer decision support in assessing their severity and taking actions to prevent their further development. Various acquisition equipments specific to dams surveillance: tele-pendulum, limni-meter, automatic data acquisition station, laser telemeter will be developed during the project, and will be connected to a complex information system that will handle/process the collected data and will present its statistics and processing/interpretation results to the user in a customisable user-request fashion.

This project is supported by a multidisciplinary consortium, with a strong background in the project's topic, composed by two research & development institutes: S.C. IPA S.A. (project leader) and ICI Bucharest, and by two Universities: Technical University of Cluj-Napoca and Transilvania University of Brasov.

The system will embed sophisticated numerical techniques (e.g. statistical, machine learning) to implement the multisensor fusion and image analysis, to interpret and analyse the information acquired in the surveillance process, in various modalities (electrical, mechanical parameters, visible and infrared images) and implement the expert system and decision support components. For all these tasks, modern algorithms will be implemented on the technical support provided by the integrated sensors. The resulting distributed hardware-software subsystems, with monitoring, prediction, diagnostic and decision support capabilities, able to implement complex models of the static and dynamic behaviour of the hydrodams and hydrotechnical sites (integrating qualitative and quantitative, multimodal and multisensor data) will constitute the quantifiable results of the project.

MAIN OBJECTIVES

The general objective of the project is the creation of an integrated decision support system, which, through the means of multisensor information fusion (from different hydrotechnical structure surveillance devices as well as meteorological and geophysical factors), will assist the surveillance and the behaviour prediction of hydrodams and hydrotechnical sites.

The specific objectives (scientific and technical objectives) of the project are:

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1. To create a system for the acquisition, transmission and storage of the parameters which describe the state of the hydrodams and hydrotechnical structures, with high speed communication facilities at very low error rates
2. To elaborate and implement new mathematical algorithms for multisensor information fusion
3. To elaborate new dynamic modelling methods – input-output dynamic models – of the behaviour of hydrodams and to predict the evolution of some parameters of interest based on these models
4. To create an expert-like information system able to incorporate multi-expert knowledge and to provide expert-like interpretation of the acquired relevant data, thus allowing minimising the human operator subjectivity in interpreting the multisensor information.
5. To create a decision support system, that will be able to offer support to the human operator in predicting the behaviour of the hydrotechnical structures and sites and their interaction with the surrounding environment.

RESULTS AND PERSPECTIVES

The project development has entered the third phase: „Development of hardware and software modules”; this follows the first phase (December 2006) that concluded with the functional analysis and the second phase (May 2007) whose outcome was the system’s design.

The following issues were successfully addressed so far:

- 1) Elaboration of a comparative analysis regarding the possible approaches suitable to the proposed topic. A set of candidate solutions were described as well as the technical requirements of the system.
- 2) The technical documentation of the pilot system was delivered, emphasizing the technical characteristics of the acquisition equipments, processing equipments and communication modules.

Also some papers have been published so far at various international conferences and workshops, presenting systems for data acquisition (e.g. laser telemeters) and novel mathematical algorithms to be implemented within the project (image processing algorithms and data fusion techniques, change detection and data segmentation methods).

The current phase of the project (having the deadline in October 2007) addresses the development of the hardware and software modules, according to system’s design and technical documentation.

The hardware architecture expands on two levels: 1) the local (dam) level, where the data acquisition equipment resides, the communication server and the local data concentrator, and 2) the central level, where a powerful server will maintain communication with local level computers, store the measurement data and other observations, and the post-processing modules. The main software application has a modular architecture, with various components: the monitoring component, based on multisensor information fusion and artificial intelligence algorithms, the prediction component, based on the dynamic model, and the decision support system, based on the integration of the expert system components.

In order to check the viability of the functional model of the system, experiments are to be carried out at Tarnita dam, on Somes River, or at Dragan dam on Cris River, depending on the agreement that will be reached by the consortium and Hidroelectrica, the owner of the dams and the main economical entity that could benefit of the project’s results.

ADVANCED HYDROGEN STORAGE MATERIALS FOR FUEL CELLS

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The project aims to develop new hydrogen storage materials and an experimental hydrogen storage container able to meet the requirements of the fuel cells. The novelty consists in approaching, with new methods catalysts and procedures, the types of hydrogen storage compounds on which the attention is focused now in Europe, USA and Asian countries. The opinion of the experts is that, as for metal hydrides of the intermetallic compounds „ *the gravimetric hydrogen density is limited to less than 3wt%H*” , only the complex hydrides of aluminum (boron) or amides of the light metals in combination with hydrides may be considered viable materials for vehicle applications. NdNiIn type intermetallics, a class of compounds which allow reduced H-H distances still remains of interest.

The most promising types of compounds will be studied in parallel, by making use of the complementary competences of the partners, to improve the performances for each type with their own problems and peculiarities: i) for amide-hydride complex systems which still need the lowering of hydrogen desorption temperature and the increase of absorption/desorption rates - new catalysts based on organometallic compounds will be studied in order to find correlations between the surface state of hydrogen and the catalytic activity for hydrogen transfer from the gas into the solid phase, able to lead to catalyst tailoring and to improve the storage performances; ii) hydrides of NdNiIn type intermetallics, in which the H-H distances are lower than 0,21 nm (considered critical till recently) - an improved understanding of electronic interactions between the components and their effects on the H-H distances should help to explain why the H atoms may lie closer to each other and might open new ways for improved storage capacities. An experimental hydrogen storage container will be developed and tested, using the materials with the best characteristics obtained during the stages of the project, developing new technical solutions and aiming to meet the requirements of on-board hydrogen storage for applications to fuel cells.

The **general objective** of the project is to reach the competitive level required for integration into the European Research Area. The main objectives of the project are devoted to promote the excellence through the approach at high scientific level the research on hydrogen storage materials, modern and alternative processing methods, complex investigations of new materials, compounds and structures, theoretical approach of basic phenomena and mechanisms implied for tailoring the properties of the materials; development of a network and a Romanian school in hydrogen storage and large scale dissemination of the knowledge.

Specific objectives envisaged are:

- synthesis of new catalysts, organometallic compounds, to increase the hydrogen absorption/desorption rates in H₂ – amides/hydrides systems
- increase of hydrogen storage capacity, absorption/desorption rate and lowering of the desorption temperature for H₂ – amides/hydrides systems *by ball milling*
- a better understanding of the role of electronic interactions on the H-H distances and storage capacity in NdNiIn type intermetallic compounds and the evaluation of their hydrogen storage capacity
- build-up and test a hydrogen storage container close to the requirements for fuel cells

Results

The following linear and cyclic ligands were synthesized: 2,2'-methylimido-(ethylamine)trichloride ; NN,N',N''-pentamethyl-bis-ethylene-triamine ; N,N''-tetramethyl-N'-o-bromo-benzyl-bis-ethylene-triamine ; 1,4,7,10-tetraazocyclododecane-1,4,7,10-tetraacetic acid ; 1,4,7,10-tetraazocyclododecane-1,3-dimethyl-7,10-bis-acetic acid and 1,4,8,12-tetraazacyclotetradecane-1,4,8,12-tetraacetic acid. The complexes of these ligands with Ti, Zn, Cu, Fe, Ni were obtained.

From these complexes, those with suitable characteristics are used as catalysts by *ball milling* with light element amides/hydrides systems, to study the effects on the hydrogen desorption. The hydrogen desorption curves vs. temperature are reported and discussed comparatively with other systems. The efficiency of the ball milling procedure and in situ reactor used were previously tested with experiments on LiAlH₄: the results show better characteristics as compared to the most of literature data.

Intermetallics of the composition PrNiIn and PrNi_{0.9}Fe_{0.1}In were prepared by arc melting under argon atmosphere. XRD on powder samples revealed that the dominant phase is of ZrNiAl type structure characteristic to NdNiIn type alloys. Mössbauer studies show that Fe is accommodated in two positions revealing either magnetic ordering either paramagnetic state; for each case there are two nonequivalent sites from magnetic interactions, local distortion and symmetry point of view. These aspects may be correlated with the pressure-composition isotherms measured.

The desorption isotherms for the PrNiIn-H₂ and PrNi_{0.9}Fe_{0.1}In-H₂ systems were measured in an extended pressure range. A third desorption region in the range 10-40 bar has been evidenced, in the range of composition 1.3-1.6 H/mol, which was not yet reported in literature. The desorption enthalpy for the region II (**β↔γ transformation**) of these systems

	ΔH	ΔS
Literature[5]	$-34.6 \pm 2.1 \text{ kJ/molH}$	$-70.7 \pm 3.6 \text{ cal/K.molH}$
PrNiIn -H ₂	-34.2 kJ/molH	-65.8 J/K.molH
PrNi _{0.9} Fe _{0.1} In - H ₂	-34.0 kJ/molH	-64.4 J/K.molH

is in good agreement with the literature data. The partial substitution with Fe for Ni does not induce significant changes of hydride stability. The hydrogen desorption rates for γ-hydride phase (corresponding to the formation-decomposition of H-H pairs at short distances) are much lower than for LaNi₅H₆ (typical hydrogen storage material) and the half-time reaction time is much higher – parameters not favoring efficient storage characteristics.

Perspectives

An improved knowledge on metal-hydrogen systems and on hydrogen storage materials is expected and possible. The foreseen results of the next stages will lead to a step forward to improved hydrogen storage materials and systems, ensuring a level of excellence and competitiveness consistent with the integration in ERA and „Hydrogen and Fuel Cells „ Platform of EU.

ULTRAPURE HYDROGEN THERMAL COMPRESSOR BASED ON METAL HYDRIDES FOR FUEL CELLS AND HYBRID VEHICLES

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CONDREA⁵

The project proposes the research and development of metallic hydrides integrated systems for hydrogen purification, storage and compression. Characteristic for these hydrides systems is the wide area of possibilities to absorb hydrogen at low pressure from any source of hydrogen, to store it and deliver this hydrogen at high pressure (compression ratio more than 30).

Hydrogen compression is a key step in the production, transportation, storage and utilization of hydrogen. Whatever particular hydrogen storage method is selected, the efficient compression is an unavoidable step. Hydrogen compressors based on the reversible absorption/desorption ability of metal alloys/hydrides have been intensively studied in the last decade, and they can reach high hydrogen delivery pressure with many advantages: high reliability and low maintenance cost because they have no moving parts, low noise and vibration, low energy costs and conserve the high purity of the hydrogen.

The main purposes of our proposal are the following:

- Elaborate hydride alloys with high storage capacity, resistant to poisoning, and higher thermodynamic characteristics acquired by the modeling of their properties, based on the solid state physics and surface area studies.
- Elaborate new technical solutions based on advanced materials, and fast mass and heat transfer for a H₂ storage and compression unit.
- Develop a functional model of a thermal H₂ compressor, incorporate new and unconventional technologies using H₂ absorbent alloys/hydrides.

Project Results

After a very careful screening of metallic compounds hydrogen absorbent were selected three kinds of H₂ absorbent alloys, function of properties: for purifying, storage and compression of hydrogen. It was prepared and studied by structure and H₂ adsorption/desorption properties of alloys/hydride. The alloys prepared and studied are: LaNi_{5-x}Sn_x and MmNi_{5-x}Al_x, where (x = 0.1, 0.2, 0.3), Mm = lanthanides "Mischmetal" mixtures. After selection, the work up of the alloys composition on the basis of detailed solid state studies, new multi-component alloys were developed, with suitable thermodynamic and kinetic properties for a hydrogen compressor.

Metallic hydrides used for a three stages hydrogen compression system have different equilibrium pressures, in such a way that: for stage 1-low pressure H₂ absorption and resistant to poisoning with impurities of hydrogen, stage 2- medium pressure H₂ absorption and stage 3-high pressure hydrogen delivery (5 MPa).

On the basis of innovative concepts and advanced materials for H₂ storage/compression (and fast thermal transfer), a fast mass (H₂) and heat transfer unit was studied and developed suitable to be integrated in a 3 stages thermal compressor. The new technical solution makes a step forward in reducing the time of an absorption-desorption cycle, which combines the effective increase of the heat transfer and good permeability to the hydrogen gas. The material

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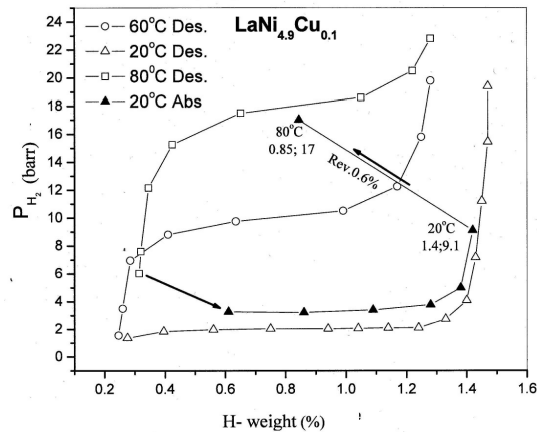
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selected to characterize the cyclic behavior is $\text{LaNi}_{4.9}\text{Cu}_{0.1}$, in the temperature range of 20–80°C, with the p-c-T experimental isotherms shown in previous figure.



An experimental study was made upon the alloy-hydrides reactor design: function of thickness of solid alloy bed, characteristics of porous filters for hydrogen and reactor wall thickness. Also was performed studies concerning the hydrodynamic circulation of hydrogen and for the heating and cooling fluids through the futures compressor elements. Two storage elements have been studied in parallel: one filled with about 120 g hydrogen storage powdered alloy of starting grain size ~ 0.4 mm and another with conducting additive to increase the effective heat exchange of the solid bed. A comparison of the parameters of the two storage elements reveals, as we expected, that cycle duration is significantly reduced by using our novel additive due to the increased effective thermal transfer of the bed. A satisfactory hydrogen flow rate was also obtained.

Project outlooks

According to the results obtained in our work, this project serve both for the optimization of geometry of a compressing element and for the design of a multistage (three stages) hydrogen compressor based on absorption/desorption of hydrogen in alloys/hydrides. It will be realized the design of the multi-stage thermal compressor and would be measured the functional parameters of the compressor elements.

The influence of the absorption/desorption cycles about alloys performance using the analysis of the structural and surface characteristics will be made.

The efficiency of thermal compressor in an integrated system: renewable hydrogen source-compressor-storage tank-fuel cell, will be also studied.

TRIGLYCERIDES TRANSESTERIFICATION IN HETEROGENEOUS CATALYSIS ASSISTED BY UNCONVENTIONAL ENERGIES: ULTRASOUNDS AND MICROWAVES

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The goal of this project is to develop a procedure for the transesterification of triglycerides found in the composition of vegetal and animal fats by using short chain mono-hydroxyl alcohols under heterogeneous or homogeneous catalysis and also for the conversion of glycerol, resulted as by product, to cyclic acetals and inferior ethers or esters of these. The mixture of inferior esters of fatty acids resulted by transesterification form a diesel like biofuel. The derivatives resulted from glycerol transformation can also be used as additives in fuels or biofuels. The biodiesel fuel is non-toxic, fully biodegradable and it is obtained from renewable resources.

The project is structured in 5 working packages

1. Selection of solid and homogeneous catalysts for use in trans-esterification reaction of triglycerides and glycerol conversion in products compatible with biodiesel
2. The study of triglycerides trans-esterification over catalyst assisted by ultrasonic or microwave irradiation and comparison of performances with those of classical transesterification performed in the presence of alcohol soluble basic catalysts
3. Study of glycerol conversion to products compatible with bio-diesel in one pot with trans-esterification or in a parallel phases
4. Demonstration on micro-pilot level of the performances of optimum developed procedure
5. Progress and project results dissemination

Main results have been obtained up to this stage from the following experiments:

1. Transesterification of triglycerides in the presence of a magnesium based solid catalyst with and without microwave field or with ultrasound assistance
2. Transesterification of triglycerides in the presence of an amine based homogeneous catalyst with and without microwave field
3. Development of a computer program for fitting kinetic data to complex kinetic models including parallel-consecutive reactions
4. Kinetic data regarding transesterification with classic basic catalysis without and with ultrasound assistance
5. Acetalisation of glycerol with long chain aldehydes to generate additives with carbon-oxygen ratio similar to biodiesel components

In the next stages kinetic models will be selected for each of the specific reaction conditions and based on that processes will be optimised and the one with highest performances will be selected for pilot level demonstration.

Patent applications will be filled for some of the results.

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PHOTO-ELECTROLYTIC PRODUCTION OF HYDROGEN

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The **production of hydrogen from water using solar light** is very promising for generation of an ecologically pure energy carrier. Although visible light has sufficient energy to produce hydrogen and oxygen from water, the energy of solar photons is too small for direct excitation of water molecules; water does not absorb this energy. Therefore, **semiconductor photocatalysts** are used to harvest the light energy and induce the hydrogen and oxygen redox reactions. In particular, **semiconductor electrodes** are immersed directly into the **water photoelectrolysis cell**. The efficiency of **photoelectrochemical (PEC)** conversion of solar energy is largely determined by the **photoelectrode photosensitivity**, e.g., the amount of solar spectra the semiconductor absorbs. The selection of specific semiconductor materials for PEC hydrogen production is difficult due to the necessity of simultaneously optimizing such very important characteristics of semiconductor band gap, flat band potential, overpotential, and stability to corrosion. The ability of a **semiconductor photoelectrode to drive the water-splitting** reaction is determined by its band gap and its position of valence and conduction band edges relative to the **water redox** reactions. The **main objective** of this research project is to develop high efficiency and low cost thin-film **semiconductor photoelectrodes for PEC devices** to directly **produce hydrogen from water using sunlight as energy source**. To reach this goal, our approach has included parallel research efforts in:

1. **Device modeling** to compare alternate materials and system configurations;
2. Extensive **experiments in materials** synthesis and testing to identify critical materials issues (such as stability and catalytic activity);
3. **Photoelectrode fabrication and testing** to identify and address critical photo electrode-operations issues;
4. Identify **materials systems** best suited for achieving the long-term **goals in efficiency, stability, scalability and cost**;
5. **PEC devices fabrication in different system configurations : PEC Monolithic Multi-Junction and PEC Tandem Advanced devices.**

To accomplish the above **objectives**, the participants will undertake individual and collaborative research within the framework of **two coordinated Material Studies and System Studies** subtasks.

The proposed research is also based on the recent success of our research group in design of a photochemical and Dye Sensitized TiO₂ PV Cells. These advances along with the research expertise of other contributing , including aerosol reactor design, material theory and characterization, enable us to take an integrated approach to designing, fabricating, and optimizing a multi-functional Photoelectrochemical (PEC) cell for photoelectrolysis of water.

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Material Studies

A multiplicity of approaches will be taken to discover and design the necessary materials and integration options for a low-cost high-efficiency, stable PEC based water-splitting system. These various approaches are presented below:

Titanium Dioxide (TiO₂)

There is a growing awareness that titania (TiO₂) and TiO₂-based oxide systems are the most promising candidates for the development of photoelectrodes for photoelectrochemical cell (PEC) for solar-hydrogen production. The PEC is equipped with a single semiconductor photoelectrode (photoanode) and cathode, both of which are immersed in an aqueous electrolyte. Exposure of the photoanode to sunlight results in charge transport within the PEC and evolution of gases at the photoanode and cathode. The oxygen energy level (O₂/H₂O) should be above the valence band of the photoanode in order to allow electron transfer and, for the same reason, the hydrogen energy level (H⁺/H₂) should be below the Fermi level of the metal cathode (or the conduction band of a semiconducting photocathode). Nanocrystalline semiconductor films are constituted by a network of mesoscopic TiO₂ particles which are interconnected to allow for electronic conduction to take place. Because of their ultra low density and high surface area, **TiO₂ aerogels** are attractive for their applications in solar energy conversion. However, there are some disadvantages with TiO₂. A major one for solar energy applications is that the band gap energy, being 3.0 eV for rutile and 3.2 eV for anatase, only allows ultraviolet (UV) absorption. To improve the PEC efficiency of the material, it is desirable to red-shift the PEC onset to also include the less energetic but more intense visible part of the solar spectrum. Traditionally, this has been achieved by anchoring organic dyes to the surface, and this approach has been successful in dye-sensitized solar cells (DSSC).

Dye-Sensitized TiO₂ Photoanodes – A large number of dyes of different kinds have been tested in dye-sensitized TiO₂ photoanodes. The most efficient and commonly used in dye-sensitized TiO₂ solar cells are based on ruthenium complexes. Different ligands have been tested all in the aim to broaden the absorption spectrum and in this way improve the solar cell efficiency.

Different types of TiO₂ aerogels have been successfully synthesized and the sample with the highest BET surface area was morphologically characterized with the help of SEM measurements. Structural and dimensional investigations of this aerogel sample heat-treated for two hours at temperatures between 300 and 600 °C have been performed by means of SAXS, Raman and XRD techniques. Correlations between the morphology and spectral characteristics of the annealed aerogels have been evidenced by assuming the occurrence of the finite-size effect of nanocrystallites.

Doped TiO₂ – Efficient photocatalytic or photoelectrochemical response of TiO₂ doped with other anion materials has been reported. A series of ZnO / TiO₂ aerogels were prepared by the sol-gel method followed by supercritical drying. By transitional metal ions doping it was observed a hinder of photogenerated electron/hole pair recombination, a stimulation of oxidizing species photoexcitation and formation, and an enlargement to visible range of the titania photoexcitation spectral domain.

Key issues for continued enhancement of the photocurrent levels include the development of WO₃ films with better electronic properties (reduced photo-generated carrier recombination). In order to optimize the performance and efficiency of PEC devices, the research activity will be focused on the development of a water photolysis device combining two mesoscopic semiconductor oxide films and it is desirable that the optical responses of the two chosen oxides complement each other in the visible wavelength range of the solar spectrum.

BIOFUELS AND HORTICULTURAL OILS BY CONTROLLED CYANOBACTERIAL PHOTOSYNTHESIS

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Keywords: *Renewable energy, Biofuels, Biomass, Biopesticides, Microalgae.*

Most of anthropogenic emissions of carbon dioxide result from the combustion of fossil fuels for energy production.. The debate of the effects of increased carbon dioxide levels on global climate makes it more difficult for Romania to achieve its target of reducing emissions by 8%, according to the Kyoto Protocol signed by Romania, and the risk management of carbon dioxide emissions becomes one of the priorities in ensuring Romania's economic competitiveness.

The carbon dioxide mitigation profitable solution presented on the project related it to the main Romanian / EU governmental strategies and spot the relevance of the project in the field of reducing the emission of greenhouse gases (GHG) and its integration into the national / EU policy.

Photosynthesis has long been recognized as a means to sequester anthropogenic carbon dioxide. Aquatic microalgae have been identified as fast growing species whose carbon fixing rates are higher than those of land-based plants by one order of magnitude.

Biological carbon sequestration might be the most promising, environmentally friendly and cost-effective means of reducing carbon emissions in the energy sector.

Our paper aims at quantifying the GHG emissions in Romania , especially carbon dioxide flue gas from Romanian thermoelectric systems and sustainable sequestration of carbon dioxide by clean – up technologies in the accelerated process of microalgae or cyanobacteria photosynthesis, in bioreactors with special design, and using the obtained biomass as biofuels and biopesticides. The most likely option currently available for carbon dioxide sequestration from combustion flue gas includes gas absorption (both physical and chemical) in sodium or potassium carbonate solutions.

A study of carbon dioxide absorption and sequestration from a synthetic mixture of gases, containing 7% CO₂ , 14 % O₂ , 79 % N₂, was made with various concentrations of sodium or potassium carbonate into a designed laboratory equipment. The control of carbon dioxide sequestration was made by chemical analysis of sodium/potassium carbonate – bicarbonate content and by an electrochemical flow system, with pH measurements. Comparative data obtained by analytical measurements and electrochemical calculus are done from experimental carbon dioxide sequestration, which can be applied in monitoring of consumption of carbon dioxide in controlled microalgal photosynthesis.

Another goal of this paper is the selection of the species of microalgae that are able to convert a significant fraction of carbon dioxide outputs from a power plant into controlled composition biomass by accelerated microalgae photosynthesis. Thirty four strains of microalgae have been isolated and tested in a laboratory scale based on exponential rate of growth and the doubling time of microalgal cultures. The most promising microalgal strains were *Chlorella homosphaera* AICB 424 (3,59 days) and *Chlorella fusca* (strains AICB 292-3,8 days, AICB 166 – 3,95 days and AICB 272 – 4,7 days).

This application is ideal for a system engineered to use specially selected strains of microalgae to maximize carbon dioxide conversion to biomass and thus reducing the gas emissions into the atmosphere with effects on the environment.

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ASSESSING THE RADIOLOGIC RISK TO PUBLIC HEALTH OF THE USE OF NEW COMPOSITE BINDING SYSTEMS IN BUILDING STRUCTURES DESIGNED FOR DWELLING – CENRAD –

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For the building materials industry the use of fly ashes originating from power stations has both ecological and economical benefits which ensue from preserving the natural resources, reducing the landfill sites and abating the toxic emissions such as carbon dioxide.

The purpose of the project is to monitor the radioactive content in cement-based building materials with fly ash addition.

The project will present the results of the research carried out on a series of binding systems and concrete both of which will be prepared on the basis of fly ash originating from power stations. In the binding systems the fly ash will be used both as a raw material and as an addition and the concrete will be prepared with fly ash cement. The quality characteristics and the concentration of radionuclides Ra²²⁶, Th²³² and K⁴⁰ will be determined both on both the binding systems and on the concrete. The radioactivity index will be calculated as well.

Objectives

- Investigation and analysis of the physical and chemical characteristics of the fly ashes taken from the main power stations and the fly ash present in the ordinary cement. Determining the concentration of polluting radioisotopes U²³⁸ and Th²³², and the radionuclide K⁴⁰ existing in the fly ashes. Determining the radioactivity index.
- Making and characterisation of the cement by employing fly ash as a raw material and determination of the concentration of polluting radionuclides U²³⁸ and Th²³² and the radionuclide K⁴⁰ existing in the cement.
- Making and characterisation of the cement by employing fly ash as an addition and determination of the concentration of polluting radionuclides U²³⁸ and Th²³² and the radionuclide K⁴⁰ existing in the cement and determination of the radioactivity index.
- Making and characterisation of the concrete with varying ratios of fly ash cement.

¹ SC CEPROCIM SA

- Analysis of the concentration of the polluting radioisotopes U^{238} and Th^{232} and the radionuclide K^{40} existing in the concrete prepared with varying additions of fly ash cement and determination of the radioactivity index.
- Analysis of the concentration of the polluting radioisotopes U^{238} and Th^{232} and the radionuclide K^{40} existing in the concrete prepared with various types of aggregates and fly ash cement and determination of the radioactivity index.
- Dissemination of information regarding the assessment of the risk to public health by employing fly ash cement in the preparation of concrete for dwellings.

Obtained results

The analysis of building materials such as cement and concrete has to be carried out not only in conformity with the standards but also in terms of level of radioactivity so as to check compliance with the effective legislation.

The level of radioactivity in various materials is expressed as the radioactivity index. In Romania the upper admissible level of the radioactivity index, set by Order No. 381/2004 of the Ministry of Health, is calculated by means of the equation below and has to be lower than 0.5.

$$I = (C_{Ra-226} / 300 \text{ Bq.kg}^{-1} + C_{Th-232} / 200 \text{ Bq.kg}^{-1} + C_{K-40} / 3000 \text{ Bq.kg}^{-1}) \leq 0.5$$

In the above equation C is the concentration, expressed as Bq/kg, of the respective radionuclides.

The outcome of the project will lead to setting maximum admissible limits for the proportion of fly ash in manufacturing cement and concrete so that the risk to public health due to inhabiting dwellings built with building materials including fly ash be negligible. The limits will correspond to the investigated fly ashes.

The investigations carried out until now led to the results presented below.

- The concentration of the radionuclides Ra^{226} , Th^{232} and K^{40} , and the radioactivity index of the fly ash. The values are presented in the Table below.

Power stations	Concentration of radionuclides, Bq/kg			Radioactivity index I
	Ra^{226}	Th^{232}	K^{40}	
Mintia	118.30–158.51	56.17–76.26	613.50–826.30	0.89–1.08
Doicești	150.96–195.00	51.70–72.57	482.00–751.20	1.07–1.12
Rovinari	280.53	82.00	654.17	1.56
Ișalnița	123.28–140.90	53.30–72.57	594.70–613.48	0.94–0.99
Oradea	100.64–182.41	54.94–70.52	428.80–575.90	0.79–1.10
Suceava	303.80	130.00	216.90	1.40
Bacău	205.00	45.50	563.40	1.10
Govora	93.09–157.20	49.61–81.59	550.88–807.54	0.76–1.07

The radioactivity index determined on the fly ashes from the above power stations has values lying above the upper admissible limit (0.5). However, these materials are not yet finished products. Therefore, these fly ashes may be employed as an addition in cement up to the ratios stipulated in SR EN 197–1/2002 and limited to the value of the radioactivity index (I) of the obtained cement. They also may be employed as a raw material in cement manufacture in a ratio which should depend on the chemical characteristics and the radioactivity index.

- The radioactivity index determined on ordinary cements has values ranging within 0.17–0.44.

Future perspectives

On the basis of testing and analyses, the project will lead to establishing the fly ash/cement proportions that allow the finished product to constitute the basic raw material in making concrete able to comply with the radioactivity requirements set by legislation.

The envisaged results will contribute to gathering the necessary experience in the research field regarding the use of non-traditional materials such as fly ashes from power stations, which contain natural radionuclides, and yet that may be employed so that they shall not exceed the admissible radioactivity limit.

BASIC RESEARCHES CONCERNING DAMS RATING IN SEISMIC RISK CLASSES. PROBABILISTIC AND DETERMINISTIC APPROACH FOR DAMS SITUATED IN THE MOESIAN PLATFORM

INPUT FOR SEISMIC HAZARD ASSESSMENT FOR DAMS SITES SITUATED IN THE MOESIAN PLATFORM

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The main goal of this project is rating all the dams situated in the region of the Moesian Platform into seismic risk classes. Dam owners and regulators must ensure that dams are safely operated and present no risk to the public in case of an earthquake. In such cases, owners of many dams or officials in charge of dam safety programs may consider comparative assessment of the seismic risk associated with their dams and establish priorities, as needed. Risk classes can be used to establish the necessity of detailed assessment of seismic safety of the dams and to establish the priorities of these evaluations.

The risk is expressed as a product between hazard and vulnerability. In particular, seismic risk in the case of hydrotechnical arrangements is computed as a product between seismic hazard (corresponding to the location of the respective hydrotechnical arrangement) and the seismic vulnerability of the respective arrangement.

Among the current stages in the seismological scientific research are the seismicity studies and the seismic hazard evaluation in vital sites like dams and hydroelectric stations. This priority involves not only studies in sites situated in seismogenic regions but the research of zones which have increased seismic risk conditions due to adiacente seismic sources. Such an example is the Moesian Platform (MP) which is strongly affected, especially by the Vrancea seismogenic zone.

It can be said that seismic risk factors in dams sites situated in Moesian Platform are determined by the Vrancea subcrustal zone (VRI) and crustal zones: Fagaras-Campulung (CMP), Vrancea (EV), Intramoesian Fault (IMF), Predobrogean Depression (DP), and from Bulgaria by the crustal zones Dulovo (DUL) and Shabla (SH) (see fig. 1).

An important step in seismic hazard and risk assessment is the achievement of a seismological, geophysical, geological, seismotectonic, hydrological and hydro technical data bank for this zone (MP), as being a base for all periodical verifying computings regarding the dams. The data bank contitutes a complex data base, that contains seismological and geophysical data in numerical and graphical representation. The achievement of the

seismological data bank for all the dams situated in Moesian Platform is necessary and imperative for usual verifying computings regarding the behavior of the dams and its associated buildings.

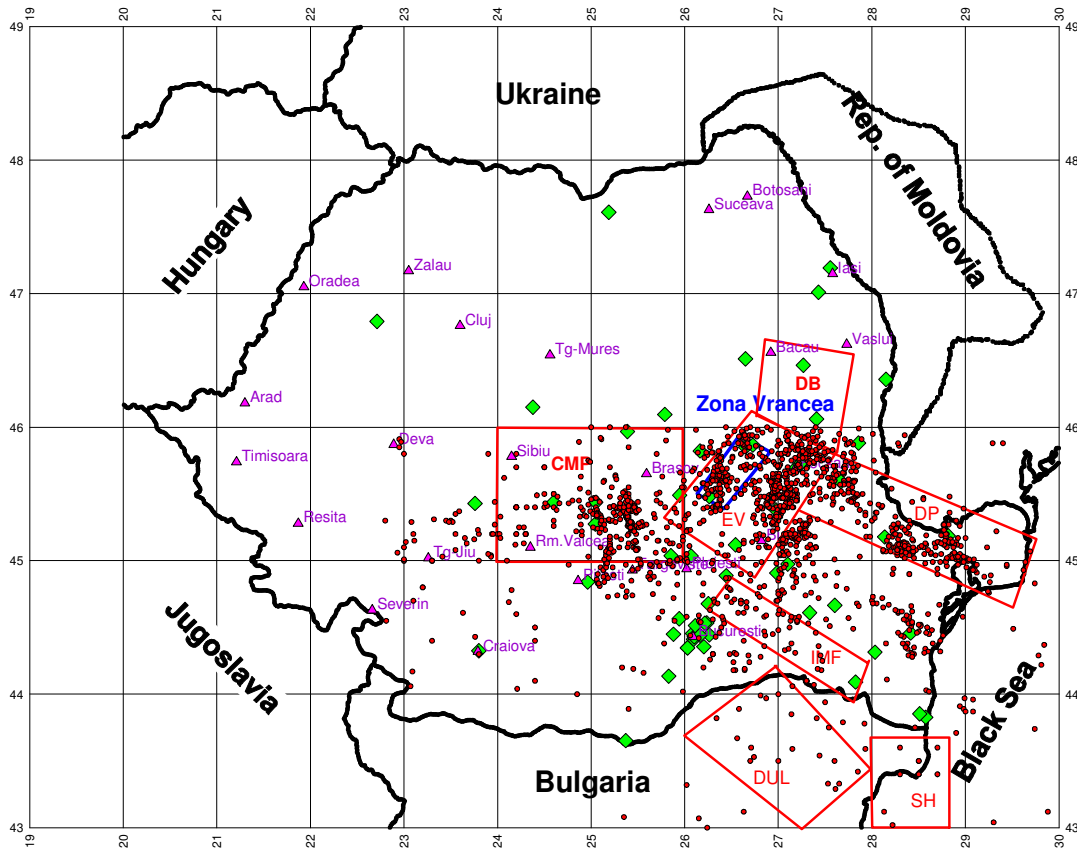


Fig. 1- Epicentral distribution of crustal earthquakes from Moesian Platform and associated seismogenic zones.

The seismic risk assessments are very important to specialized organizations, as these studies reveal (physically meaning) the neuralgic points of certain sites that contain hydrotechnical constructions having large accumulation capacity, representing real centers of potential disasters when stroked by natural catastrophes and having large socio-economical impact.

Collapsing of hydroenergetic facilities would have negative consequences under all aspects: social, economical, and ecological.

INVESTIGATIONS REGARDING THE INTEGRATED PROTECTION OF ECOSYSTEMS WITHIN THE CONCEPT OF SUSTAINABLE DEVELOPMENT IN THE BUILDING MATERIALS INDUSTRY IN ACCORDANCE WITH DIRECTIVES 96/61/EC, 1999/30/EC AND 2000/76/EC

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The project “Investigations regarding the integrated protection of ecosystems within the concept of sustainable development in the building materials industry in accordance with Directives 96/61/EC, 1999/30/EC and 2000/76/EC” aims at abating the toxic emissions from the cement manufacturing process by reducing specific emissions and other substances released into the atmosphere. The objective will be attained by—

- Reducing the energy consumption in existing processing plants
- Improving the systems and installations aimed at reducing the pollution resulted from industrial processes
- Implementing state-of-the-art BAT technologies that are available at the European level and can ensure the lowest emission values and the lowest energy consumption.

Description of BAT at the European level is done in codes of practice, of which some are applied in specific industries—vertical BAT—and some are applied to several to many industries—horizontal BAT.

Environmental protection represents a significant part of domestic economic activities which aim at maintaining the ecological balance and preserving and enhancing the quality of environmental factors by taking into account the basic principle that, in terms of pollution, prevention is easier than reduction which would require re-establishing of the ecological balance. The transformations taking place at a global level with regard to the quality of the environment demand finding basic solutions in order to ensure maintaining of the planetary ecological balance under conditions of sustainable development.

Therefore, the strategy of environmental protection which is the basis of the environmental policy in Central and Western Europe to which Romania’s policy has recently adhered is based essentially on—

- Sustainable development
- Sustainable industry
- Industrial activity allowing for an ecological balance
- Upgrading or replacing existing outdated pollution reduction technologies so that the emissions may comply with the limits stipulated in standards and legislation.

When speaking of Romania’s orientation towards sustainable development we speak of preserving the natural resources, using clean technologies, utilising waste, lower exploitation of natural resources—all according to the provisions in the IPPC Directive 96/61/EC, which was adopted in Romania by the Urgency Ordinance No. 152/2005, later approved by Law No. 84/2006.

The industrial sector covering the building materials sector (cement, ceramics and glass), including large production units and releasing significant particulate and gas emissions, should comply with the requirements stipulated in the international conventions regarding environmental protection.

The objective of the first stage of the project carried out throughout 2006 consisted in inventorying the toxic emissions inside and outside the manufacturing units, the polluting sources and the existing equipment for abating pollution of all environmental factors according to Directive 96/61/EC.

The first stage occasioned presentation of the European legislation and its application at the national level for the toxic emissions inside and outside the manufacturing units, grouped by the environmental factors. Moreover, the first stage led to inventorying the toxic compounds at—

- A CARPATCEMENT HOLDING's cement plant (the cement sector)
- A sheet glass plant, GECSAT SA, Târnăveni (the glass sector)
- SICERAM SA, Sighișoara (the building ceramics sector).

The first stage of the project led also to analysing the specific toxic compounds from each industrial sector. The mechanisms of formation and the corresponding process flow charts were also presented.

The following stages will quantify the emissions inside and outside the manufacturing units by means of measurements specific to each industrial sector included in the analysis. Also, the toxic compound dispersion model will be drawn up for the process technologies in the building materials sector. The obtained results will be published in speciality publications in order to disseminate the information gathered from the industrial units in the building materials industry and to find out possibilities of continuing the activities within FP 7.

ECOLOGICAL, ADVANCED CONCEPTS AND TECHNOLOGIES, IN ACCORDANCE WITH EUROPEAN REGULATIONS, REGARDING ON-SITE REGENERATION AND RECYCLING OF USED FLUIDS FROM HYDRAULIC INSTALLATIONS, APPLIED ON FIXED OR MOBILE, MODULAR REGENERATING UNITS

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Objectives:

Overall Objective of the Project

Decreasing of hydraulic fluids consumptions and conservation and sustainable management of resources, by applying of integrate advanced concepts and technologies for on-site regeneration and recycling of used fluids from hydraulic installations, on fixed or mobile modular regenerating units.

Specific Objectives

- Defining of the physical and chemical phenomena peculiar to filtering methods of the used fluids;
- Mathematical modelling of the physical and chemical phenomena peculiar to the flow of used fluids through a filtering/recovering installation;
- Defining of the technological parameters of the filtering and recovering systems;
- Making off the new technology (method) for filtering and recovering the spent fluids and the procedures to sample and analyze the technological parameters of spent fluids;

- Elaboration of the manufacturing and execution documentation for the experimental model of the installation for filtering/recovering and for the data acquisition system;
- Achievement of the experiments in order to validate the technology and the equipment for filtering/ recovering; establishing the impact of the new technology on the environment;
- Homologation of the new technology for filtering and recovering of the used hydraulic fluids;
- Results analysis and systematization, and also its dissemination, including articles publishing in specialty reviews and integration into the European Platform “Advanced Materials and Technologies”.

Results:

The Technical Study of Variants and Technological Parameters; the Intermediary Report of Activity from First Stage; Intermediary Report of Activity from Second Stage.

Technological parameters:

- Viscosity Range	15 ÷ 750 cSt
- Flow Rate	2 ÷ 8 l/min
- Fluid Temperature	10 ÷ 80 °C
- Outlet Pressure	2 ÷ 8 bar
- Filtration rating	< 2 µm
- Filtration efficiency	> 99,5 (β>200)
- Level of contamination by solid particle	14/13/10 ISO Cleanliness Code
- Water Removal Rate	
- free water	100%
- dissolved water	80 ÷ 90%
- Air and gases Removal	
- free air and gases	100%
- dissolved air and gases	90%
- Chamber Vacuum	
- Temperature	65 °C
- Pressure	0,6 ÷ 0,9 bar
- Total power	3 kw/380 V
- Inlet connection	G ¾
- Outlet connection	G ¾
- Oil pump	gear/vane
- Ambient temperature	5 ÷ 40 °C

Conclusions:

- Filtration is defined as the physical separation of constituents from a fluid by means of flow through a permeable as a porous medium.
- Filtration efficiencies and performance can vary with actual “real world” condition. Filter manufacturers rate their filters under laboratory conditions. The field performance of a filter can be affected by flow rate, viscosity of the fluid being filtered, concentration of contaminant, and measurement techniques.
- The overall removal efficiency of the element forms the core of fluid cleanliness levels. The correct degree of filtration is chosen based on the required fluid cleanliness level, not based on one β - value

COMPETITIVE TECHNOLOGIES OF PROCESSING THE TEXTILE AND LEATHER WASTES INTO HIGH ADDED VALUE PRODUCTS

Eftalea Carpus¹, Emilia Visileanu¹, Razvan Scarlat¹, Alexandru Popa², Valeria Gribincea³

The preserving of harmony and balance between man and nature, at the same time with the economical-social progress, a basic concept for durable development, represents the conciliating solution for the two opposing tendencies: the economic growth and the environment resource protection. The textile industry affects the environment by a high water, energy and chemical substance consumption, as well as by the large waste quantity generated as a result of using an impressive number of chemical substances and technological processes. The textile waste management has two basic components: the waste minimizing (front of pipe treatment) and pollution controlling (end-of-pipe treatment). Out of these, the waste minimizing is a component with effects both on waste quantity reducing and on company financial effect results.

Within this context, the general objectives of the project are the establishing of the flexible, ecological technologies of conventional, non-conventional processing of textile cotton type/wool/bast and leather wastes into high added value products, of the experimental model for the thermal decomposing of wastes and of the method of activating the resulted solid product for obtaining fibrous active carbon.

The achieving of this objective is supported by going through the following stages:

- *The substantiation of the technical-organizing framework of conventional and non-conventional processing of textile/ leather wastes for durable and ecological textile engineering:* as regards the comparative analysis of the scientific, social and political mechanisms concerning the implementing of the notion of zero waste in ERA, the evaluation of the anthropic impact over the environment, the technical-economical and impact analysis of the network of collecting/sorting/stocking/processing of textile/leather wastes, the textile/leather waste classifying, the establishing of research and education strategic directions in the field of textile waste bio-utilization.

- *The accomplishing of a modern information system regarding textile/leather wastes* based on the technical-economical and impact analysis of the network of collecting/sorting/stocking/processing textile/leather wastes, the elaborating of a unitary methodology of forming a data background regarding the waste processing and stocking, the selective drawing up of the data background.

- *Technological experiments of processing the recovered fibers into non-conventional products,* the physical-mechanical, physical-chemical and structural characterization of the new products, experiments regarding the textile waste thermo-chemical treatment, the cost-benefit analysis of the various methods of waste valorization, the impact of the achieved technologies as part of the sustainable development concept.

- *The demonstrating of the functionality and utility of the technologies of processing textile/leather wastes into competitive products having a high added value, contributions to establishing the strategy of textile/leather wastes recycling* with reference to assessing the technical data of textile/leather waste ecological processing into conventional and non-conventional products, establishing of the technical data for obtaining active carbon from textile wastes, achieving of managing plans (collecting,

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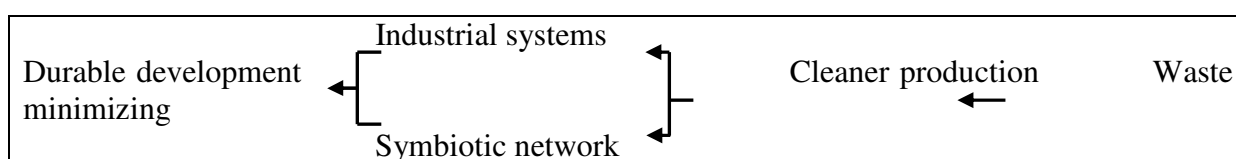
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sorting, processing) for textile wastes and processing norms, study elaborating for the strategic directions of textile/leather waste ecologic valorization, achieving of information feed-back.

Out of the additional objectives one can mention: implementing the zero waste concept, new strategy defining in the field of textile/leather waste processing, life quality increasing by defining the solutions that make possible the achieving of the desideratum “the future of wastes is disappearance”.

Going through the first two stages brought forth the following:

An industry is durable when: it is viable from the economic point of view/ uses the material, human and financial capital to obtain value and profit; it is environment -compatible / uses clean, eco-efficient technologies, prevents pollution, avoids natural resource diminishing, is socially responsible/ uses responsible initiatives in an ethic manner. The applying of waste minimizing, as an instrument for cleaner production, leads to improved operational performance, the concepts being interconnected.



The European Commission identifies four action directions that could lead to increasing the recycling agent competitiveness and to expanding this activity: standardizing, market developing and transparency increasing, innovation stimulating, regulating measures.

In Romania the data centralizing in the field of textile/leather wastes (selective sorting, stocking, transport, ecologic processing) is not a permanent activity. Having in view the defining of an evidence methodology for the data referring to wastes, there were elaborated framework record cards with the following structure:

- the quantitative indication of the resulted/valorized/stock wastes as a consequence of the fiber, yarn, woven, knitted fabric processing operations by types of consumed raw materials (cotton, wool, bast, silk);
- the quantitative indication of the wastes resulted from the spinning processes (beating, drawing, stripping, roving, yarn wastes), yarn processing (ends and weave, knit, non-woven strips), weave and knit cutting, clothing (cotton type, wool type, silk type, bast type, leather and fur).

The data obtained from highlighting both the economic agents producing wastes and the waste collecting/processing centers will lie at the basis of selectively drawing up the data background that will be included and references to the minimum quality conditions for wastes, potential processing technologies and utilization fields.

The project objectives are achieved by research-education business specialists, that is from the Research-Development National Institute for Textile and Leather, The Center of Industry and Service Economy, Aurel Vlaicu University, Gheorghe Asachi University, S.C. OVM ICCPET S.A., S.C. FIRI-VIGONIA, SC Industria Iutei, SC LACECA SA.

Having in view the importance of the “zero waste” notion within the scientific and business medium, the project accomplishing team was permanently concerned with the aspects referring to the rapid stocking and disseminating of the information. A synthesis of this activity can be defined by participating in national (2 scientific reports) and international (8 scientific reports) events.

The elaborating of the competitive ecological flexible technologies of conventionally and non-conventionally processing textile/leather waste into high added value products, of the technology of superior textile waste valorization by thermal decomposing and resulted

solid product activating, elaboration of the information system, specialty articles, scientific materials, work-shops/ scientific sessions, E-waste web page, technological network initiating, will contribute to creating an organizational and technical framework of implementing the “zero-waste” concept.

IMPROVEMENT OF QUALITATIVE PARAMETERS FOR FOOD INDUSTRY WASTEWATER TREATMENT PROCESSES THROUGH ADVANCED CONTROL SYSTEMS (ACRONYM APEPUR)

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Vasile LIGA³, Simion PAVEL³

The project deals with wastewater treatment – an essential issue of sustainable development concerning not only local communities, but the whole society, due to the major impact on human health and environmental safety. Insuring an effluent within standard quality limits is a priority in the European Union. Studies developed in the European Community have shown that, although well designed, wastewater treatment equipments cannot live up to standards, overflow being as high as 9% during operating time. Special interest in this field can be seen also from its framing as a priority theme of the Frame Project 7 program, i.e. Environmental Research: Water-related Research. In this context, mathematic modelling and control of wastewater treatment has become subject of great interest to automatics research, e.g. Delft – Holland, Lund – Sweden, Nancy – France, Patras – Greece. Accession to the European Union has led Romania to adopt the *acquis communautaire*, including water standards. Two EU directives establish these standards: 98/83/EEC, on the quality of drinking water, and 91/271/EEC, on the treatment of urban wastewater. Thus, within the National Plan for Environmental Protection, issued in 1995 and revised in 1999, one of the strategic objectives is the construction of wastewater treatment plants and the upgrading of the old ones.

The main objectives of the project are the following:

1. characterization of wastewaters resulted from food processing plants and assessment of wastewater production; determination of mathematical models for different types of water and their validation in numeric simulation conditions;
2. implementation of a pilot plant for real time experiments as to validate the control laws determined in the project;
3. dissemination of partial results: presentations to different economic agents and producers of equipment; special interest will be given to the pilot plant which is controlled on-line by a process computer;
4. bioreactor experimentation with model and real substrates, using the existing equipment of the Faculty of Food Science and Engineering;
5. analysis of structural identification and practical (experimental) identification of some food industry wastewaters treatment parameters;
6. study and implementation of state estimators as to use them in control algorithms; pilot plant validation in numerical simulation regime;

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7. study and elaboration of advanced control laws that could satisfy the legal requirements; pilot plant validation in numerical simulation regime;
8. evaluation of qualitative indicators and establishing of specific solutions for different food industry wastewaters, which will be at the disposal of Romanian equipment producers;
9. dissemination of final results: organization of a workshop in Galati for presenting the results of the project, publishing the results of the project on the web-page, submitting minimum two scientific papers to peer review journals and conferences.

Currently, the project is in its second phase. Completion of the first phase, on November 30th 2006, succeeded the following activities:

1. sampling of wastewaters from food industry operators, i.e. beer and baker's yeast production plants and a milk processing unit;
2. wastewater characterization (determination of: temperature, pH, total suspended solids, biochemical oxygen demand, chemical oxygen demand, conductivity, total nitrogen, total phosphorous, bacterial count, total coliforms);
3. development of mathematical models for food industry wastewater treatment processes (for BOD reduction and for nitrogen removal); systematic study of models available in literature, starting with a simple one, i.e. Nejjari's 4 state variables model, and ending with Henze's 13 state variables ASM1 model.

Within activities 1 and 2 the following problems were approached: the choice and the establishing of drawing equipments, the establishing of drawing points, the establishing of frequency, moment and period of drawing, the choice of drawing method, the preservation, transport and storage of the wastewater proofs, the determining of the main characteristics of the wastewater from food industry operators, i.e. beer and baker's yeast production plants and a milk processing unit.

Within the third activity an analysis based on mathematical models of the wastewater treatment processes, treated as multivariable processes, has been performed. Consequently, an analysis of the interinfluence degree between the channels and the establishing of the main command channels was necessary. This issue has been accomplished using RGA (Relative Gain Array) method, applied for unsquare systems.

Within phases II and III, which are due on November 30th 2007, and, respectively, on September 15th 2008, the following activities will be accomplished:

- acquisition of the pilot plant for carrying out the experimentation;
- plant set up and trials as to guarantee proper functioning (installation of probes and execution elements, plugging to the power supply, connection to the steam generator, checking of electrofaucets etc.);
- installation of the control equipment (computer equipped with a process interface system);
- development of real time software for process control;
- development of the basic software for the process control system (state parameters data acquisition software, programs for the actuators command and electrovalves, programs for the control of the main parameters of the process etc.);
- the analysis of the structural identification and practical identification of the wastewater treatment process parameters from food industry;
- the study and implementing of the state observers for their using in control algorithms of the wastewater treatment processes from food industry; the design of the control laws able to satisfy the legal requirements with validation through numerical simulation and on the pilot plant.

A very important activity of the project is the dissemination of the results obtained through different methods: building a site of the project (www.apepur.ugal.ro), publishing scientific papers in journals and presented to conferences that are well-established in the field and a workshop organization with the participation of specialists from food industry.

EXCELENCE NETWORK FOR ENVIRONMENTAL QUALITY CONTROL AND IMPACT DECREASE OF POLLUANT FACTORS FROM CENTRAL AND SOUTH ROMANIAN REGION

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The aim of the project is an important problem at national and international level, the problem of environmental quality control and impact decrease of pollutant factors resulted from social-economics.

One of the project directions is the theoretical substantiation and practical development of analytical methods and environmental biomonitoring, preliminary steps to develop new and advanced technologies used in environmental heavy metals pollution monitoring. This research direction correspond with specific objectives of project and also correspond with one of the priorities directions of national policy in the context of the further integration in European Union. Atomic and nuclear spectrometric methods, like an applicative part of atomic and nuclear spectroscopy, offer a high potential in important problems solution linked to environmental protection by elemental composition analysis of different environmental samples and vegetal bioindicators with a high sensibility and precision.

Another research direction of this project is to find a solution to the problem of the reduction in pollution by polymeric materials by setup of more performing recycling technologies. It is considered that an effective way to increase the recycling capability could consist in providing of materials exhibiting long lifetime under service conditions and their failure to be caused mainly by either mechanical destruction, not by oxidative degradation of plastic components.

The objectives which give originality of our project are:

- ✓ Bioindicators selection which can give statistical essential information concerning environmental heavy metal pollution, both periodical and global, giving so possibility to estimate the ecological risk;
- ✓ Performing a bioindicator standard cell, which can be replicate for position in different points of monitoring network
- ✓ Adaptation and optimization of atomic and optic spectroscopic techniques for compositional analysis of biological samples – bioindicators, and environmental samples (water, soil, aerosols)
- ✓ Performing an experimental model for environmental biomonitoring and proving the functionality of this;

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- ✓ Performing a regional diagramme with polluting indicators through heavy metals, diagramme which will have a public utility
- ✓ Preparing of a prototype of recycled polymer material, exhibiting high lifetime under photooxidative stress and improved compatibility
- ✓ Developing of some plastic waste recycling technologies, more performant in order to contribute to reducing of environment pollution by plastic wastes;
- ✓ Results dissemination in a large scale by communication at national and international conferences and by publication in national and international revues;

The project expectable results are:

- Methods and techniques ameliorated for monitoring the environment and natural resources (already obtained at this moment)
- Atomic and nuclear spectroscopic measurements - we proposed to realize technically more complex but more advantageously comparatively to classical methods (chemical methods) in the conditions of measurements on any kind environmental samples (at this moment the measurements were made and the experimental data processing sare in progress at this moment)
- Alternative use of vegetal bioindicators could represent a solution economically advantageous that may allow the integrate monitoring of heavy metal pollution (cumulative contribution of air, soil and water), by constructing of dense network of survey from which samples are periodically collected (measurements of bioindicators-mosses are in progress at this moment)
- Databank, diagramme concerning degrees of environmental pollution with heavy metal
- Experimental and functional model of recycled polymeric material prototype , with ameliorated compatibility (characterization by electronic microscopy, RTL, mechanical tests, functional test)
- Prototype of recycled polymeric material, with ameliorated compatibility and obtaining technology

By realizing this project, we estimate results in scientific, economic and socio-human fields. We expect to obtain original contribution in the field of use of bioindicators for controlling heavy metal pollution of environment and in the field of reducing environmental pollution by plastic materials.

THEORETICAL AND EXPERIMENTAL RESEARCH FOR SEISMIC RISK REDUCTION OF NATIONAL CULTURAL HERITAGE BUILDINGS - CETERS

Dan LUNGU¹, Sergiu NISTOR², Dan MATEI³, Cristian VASILE⁴, Radu VACAREANU⁵

The project tackles the very important subject of the seismic protection of historical and monumental buildings, namely of constructions dating back from the ancient age up to the mid of the 20th century. Its main objective is to develop sustainable approaches and methodologies for the seismic protection of existing constructions, with particular emphasis to

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⁴ GEOSYSTEMS

⁵ CNRRS

buildings of historical and artistic interest. This would primarily involve saving human lives and reducing both economic and cultural losses due to earthquakes. Although historic and other older buildings can be retrofitted to survive earthquakes, many retrofit practices damage or destroy the very features that make such buildings significant. The integrity and significance of the historic building, paired with the cost and benefit of seismic upgrading, need to be weighed by the owner and the consulting engineers. Buildings in severely active seismic zones may need extensive intervention. Options for the level of seismic retrofit must fulfil the special requirements.

In the past, only the constructions built by famous architects or the buildings of particular relevance were called “monuments”. Nowadays the importance of the preservation of the ancient buildings is increased in comparison with the past tendency. Experience of various countries (US, Japan) in seismic rehabilitation of heritage buildings is difficult to be simply imported in Romania due to the peculiarities of cultural heritage buildings and to the peculiarities of the Vrancea subcrustal seismic source in Carpathians, soil conditions in Bucharest etc.

The project should built a homogeneous GIS database containing heritage buildings at risk and risk management activities, notably through the identification, prevention and mitigation of risk.

The improvement of the knowledge of seismic behavior of existing constructions, in terms of both structural repairing and upgrading techniques is addressed. Seismological aspects, which allow the effects of earthquakes to be correctly accounted for, by inspecting the correlation between seismic input typology and structural response. Furthermore, besides to provide greater protection of Romanian citizens from the risk of the earthquakes, the research project proposal aims at increasing seismic safety of historical buildings based on accurate assessment of natural hazard and damage or vulnerability class of buildings.

The Project will greatly contribute towards the improvement of seismic risk management of cultural heritage buildings.

SUBSIDENCE OF TERRAINS AFFECTED BY UNDERGROUND MINING EXPLOITATIONS. THE CASE OF PETROȘANI MINING BASIN

Victor MOCANU¹, Laurentiu MUNTEANU², Cornel PAUNESCU, Octavian HERBEI³

This projects presents the studies of the vertical and horizontal movements of terrains from above the intensive – exploited terrains and next to them, in case of intensive, non-rationale and long-term works. This is an important component to evaluate the major risk of the industrialized and inhabited areas affected by less-controlled mining activities (from the points of view of 3-D expansion), within the local social-economic environment. From this viewpoint, the example of the Petroșani mining basin is notorious, and still not as dangerous as the Ocnele Mari case. The proposed investigation cannot be completed in a professional way by any other approach but also performing long-term studies by satellite (Global Positioning Systems – GPS) and classic technologies, modeling and interpreting the results within the local and regional framework. The immediate connection with severe environment

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and natural hazard aspects is obvious, same as applications of satellite technologies allowing very high accurate monitoring of the displacements (as good as mm/y). The general objectives take into account to shape a time – space model for a pilot area which has to be selected based on strong reasons. This will allow to shape the evolution model of the investigated area. In such a way, the competent authorities could take the right actions in order to avoid catastrophes of Ocenele Mari type. It has been already a few years since buildings in Vulcan Mine area have to be evacuated because their infrastructure was severely affected due to the overdevelopment of the mining works like exploration and exploitation galleries. The risk of such uncontrolled activities send the proposal into the the Thematic Field 6.1. Due to the research and monitoring proposed by the present proposal, the thematic field 6.3 becomes natural.

Studies of the time variations of vertical and horizontal movements of the mining areas isn't a new idea. Due to the instrumental evolution for the last 10 yers, the technology was totally changing and the accuracy of monitoring was also increasing in a significant way. The importance of the monitoring process is special in order to studz the evlotion of such mining areas. These yones, due to underground and on+surface explotation are permanently stressed bz uplifting, subsidence, collapsing, sliding effects. The movements are extremlz dangerous for the mining areas as well as for the communities, transportations network in the area, and thez could become real catastrophs for the natural details like lakes, rivers. The main target of the present studz is mainly repreysented by shaping the high risk areas, getting the velocities and accelerations of their movements.

In order to be as complete as possible, the study has to take into account all facts which could generate movements of the Earth's crust: mining works, geological structure of the area, detailed lithology and so on. This is why data processing will be carried out by more approaches, depending on the ellements to be considered in processing.

From the point of view of organizational details, the main stages for a study would be:

- Geological study and careful analysis of the plans of the mining works from the area of interest in order to decide on the network design of future markers which will be considered references;
- Designing the network (establishing the types of markers, surveying the area in order to decide on their final locations);
- Implementing the network (fixing the markers and flagging them according to the international rules);
- Carrying out the satellite monitoring of the displacements;
- Data processign using multiple computational approaches;;
- Shaping an evolution model;
- Editing the research study.

The undesirable effect of extensive industrial activities of little (if any) space and time control on the development of economical and social life will be significantly decreased in the less+favourable area of Petroşsani Basin. The velocity vectors for the displacement of the pilot area will be shaped out for the area affected by coal exploitations of hundred years duration. An area of interest (pilot area) will be selected in parts where the terrains are severely affected by significant displacements. They have already determined a significant number of buildings (apartment buildings and other destinations buildings) to be abandoned. Scientifically-supported solutions could be presented because long-term evolutions of these terrains can be anticipated and modeled ina proper way.

GEOLOGICAL RISK MANAGEMENT CONNECTED TO NATURAL AND HUMAN-CAUSED HAZARDS FROM THE IMPACT ZONE OF THE FORMER URANIUM ORE EXPLORATION AND EXTRACTION AREAS, USING GIS

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Mineral exploitation and particularly uranium exploitation has a major impact on the ecosphere, affecting the environmental quality (water, air, soil) and destroying the sensitive equilibrium of ecosystems. The anthropogenic processes related with surface or subsurface exploitation of ores or fossil fuels degrade the media due to infiltration of pollutants, landslides or mining subsidence and destruction of large (potential) agricultural areas.

Presently, in Romania the environmental remediation measures by using risk management systems, were less applied and without reliability. The local protection agencies and other authorities noted this situation.

Thence, the problems of managing the interference situations induced by natural hazards to areas that contain radioactive sources are not solving. There are some assessments and proposals but without solving the problem in a integrate way. As usually, the specific risk (radioactive contamination) is treating apart from those generated by natural hazards, without taking in account their synergic effects. For drawing up the local plans' actions measure or urban planning are using some qualitative estimations of risk zones.

Practically speaking, there aren't concise programs for setting up the recommendations (using an integrated analysis and decision system) for land using after closure measures (after mine closure) , potential vulnerability degree of human and biotic receptors due to a hazard impact, restrictions that has to be imposed (totally or partially) and the scenarios and predictions for possible or future situations.

The practical results of the project shall be materialize through the creation of a complex informatics system that could be used for monitoring and hazard prediction and could be very useful in taking decisions when crises occurred. In addition, these systems shall permit its utilization on a large scale for a future territorial planning in former uranium impact zones. The project approach shall be done on two main directions:

- *scientifically*, which aim the settlement of conceptual models referring to the dynamic of natural and human-caused phenomena that are potentially risk producer and the modalities that could be used for quantizing the particular parameters;
- *technically*, which describe the methodology and the steps required for risk identification, data achievement, the processing procedures, decisional analysis and prediction.

These approaches will solve at least two of the actual priorities with positive long-term effects:

- decrease of receptors vulnerability finded out in the zone of major impact;
- reduce the losses, starting from the point that the disasters prevention is much cheaper then repairing costs.

In the first stage, delivered on November 30, 2006, there were analysed formers' uranium survey/exploitation perimeters in conjuncture with a geological hazard phenomena

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induced by a natural or a man-caused activity. The tasks involved in this stage developed a bibliographical study on most used methods for geological risk assessment, prediction and monitoring techniques on national and international stage. In this stage there were achieved results regarding the actual situation of radioactive sources in the former uranium facilities and was drawn a primary geographic delimitation of susceptible zones on concerning the phenomena of geohazard by the help of historical data, existing precursor's phenomena and specific patterns.

Next stage is focused on designing the GIS system and relational database used for collecting, analyzing and achieving all the necessary information needed for being able to monitoring the geological risk that may occur close to uranium survey or exploiting areas.

Based on generalized conceptual models regarding the specific mechanisms involved in environment media degradation by mining activities, a **geospatial data processing system** for analyzing a complex informational volume will be developed and realized. This system will include data acquisition and storage modules (relational data base system) and also processing modules, thematic analysis and geospatial representation (GIS module), and will be able to produce a dynamic presentation of geological risk triggering phenomena evolution involved in environmental degradation.

The functionality of the system will provide an easy access to soil, groundwater, surface water, air, geological phenomena (landslides, subsidence, etc.) data on a specific site. Data-retrieval and viewing of specific information, for example certain parts of an area, soil quality parameters or pollution levels will enable the user to get a spatial insight regarding soil quality as well as estimate soil pollution through aerial views. Information on soil quality and extent of pollution can be critically analyzed by using other spatial data and thus in a relatively early stage remedial/mitigation decisions can be considered by taking into account other types of information (e.g. remote sensing maps).

In perspective, the project is planned to achieve the methodologies/techniques required for drawing the estimation maps, thematic risk maps, designing the monitoring system and decision analysis. These methodologies/techniques will be applied on a real situation in a former uranium exploitation site.

Geospatial estimation maps (e.g. concentration maps for Rn (radon) in soil) will be converted into geospatial risk maps. This conversion will be performed in the risk model by using the concentration value in each modeled block as exposure concentration. Spatial risk maps will be also used in other decision making frameworks, such as identification of areas of concern, production of probability maps, identification of boundaries in areas of concern, and minimizing /maximizing the number of samples required in each case (through the use of geostatistics).

The thematic risk maps will be used, by taking into account the spatial nature of input and output data, as well as software-based analysis to evaluate possible scenarios related to geological phenomena evolution that may increase the risk level. This task will take into account multi-criteria analysis (MCA) to enable evaluation of feasible alternatives based on land use data and also aid the identification of the most suitable management options.

An important component during decision making is cost/benefit analysis where the level of effort or cost required to achieve a desired goal is modelled or estimated. Geospatial analysis will provide cost/benefit curves for a range of remedial action alternatives in the sites considered (study case). These goals should take into account minimum and maximum sample values, corresponding human health risk values, ecological benchmark ratios, etc.

THE IMPACT OF THE STORAGE LAKES ON THE ENVIRONMENT (ENVIRO-LAC)

Ion GIURMA¹, Constantin RUSU², Constantin-Marin ANTOHI³, Dumitru BURLACU⁴

OBJECTIVES OF THE PROJECT

The main concerns of the environmental policy in Romania include: a pure natural environment for the health of its inhabitants, the eradication of environmental deterioration, regenerative and innovative economic growth for the benefit of the actual and future generations, alignment of the specific Romanian Environmental Law to that of the European Union in order to accelerate the process of European integration. A stable, durable development cannot be assured unless natural environment is protected. The durable development includes environmental protection and environmental protection is a must for the durable development.

The actual requirements and demands of the European Union sets a new approach of the global issues of the environment from the point of view of effects and stress on the environment because of all the consequences of the socio-economic development. The storage lakes are facilities that satisfy the need for water supply of the usage. At the same time, these storage lakes generate variations of the natural environment from geographic, ecologic and social point of view. Evaluation of all the impact elements is a solution in what is concerned the measures to be taken in order to minimize the negative effects and finding of some solutions in accordance with the lasting development. It comes into discussion the ethic problem with regard to how much we should use at this moment and how much we should keep for the next generations and this is a key matter of the strategy of lasting development.

“The Impact of the Storage Lakes on the Environment” project aims for researches on: water supply and demand, lasting development and the necessity of systematic approach of the aquatic ecosystems, analysis of the influence of the storage plants on the environment and their socio-economic impact; methods on the evaluation of the impact of the storage plants on the environment; monitoring of the meteorological, hydrological and water quality parameters; researches of the dangerous hydro meteorological phenomena; the flood attenuation with the help of the storage lakes; safety in exploitation the dams and storage lakes as well as the damage impact of the storage lakes dams; water storage impact on water quality; the shaping of the storage lakes impact on the natural environment and the performance of study cases; the elaboration of optimal solutions in order to solve the problems concerning the impact on environment and the best exploitation of the storage lakes for the diminution of the impact.

RESULTS OBTAINED

In this moment we finalized two stages:

1. ***Studies of the correlation of the Romanian standards with EU water resources standards and the evaluation of the environmental impact of hydrotechnical structures.*** Were analysed the following aspects: water resources and water demands, durable development and the necessity of systemic approach of aquatic ecosystems, the new european approach in the field of water management, analysis of influence of hydrotechnical arrangements against the environment, methodologies regarding the environmental impact evaluation of hydrotechnical arrangements.

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2. Recording, management and administration of hydrological, meteorological land water quality data base which can offer information regarding the impact of storage lakes against the environment. Case studies. The following aspects were solved: monitoring of meteorological elements, hydrological monitoring, and innovative techniques for hydrological and meteorological monitoring, research regarding the dangerous hydro meteorological phenomena, monitoring of water quality parameters of storage lakes and proposed solutions for improving it, influence of the storage lakes on the environment, case studies.

Physical indicators:

- technical books on CNCSIS editions 3 (three);
- papers: 1 (one) paper at Int. Symp. on Env. Biotechnology, July 9-13, Leipzig, Germany; 6 (six) papers on Int. Conf. of Env. Engineering ICEEM/03, 21-24 Sept., Iasi; 6 (six) papers on Bulletin of Polytechnical Inst. „Gh.Asachi” of Iasi, Hydro technical section, 2006; 2 (two) papers at Ovidius Univ. Annals of Constr., Civil Eng. Constantza, May, 3-5, 2007; 2 (two) papers on Proc. of XIX Int. Conf. of Inventics “Researches and inovative and performant technologies”, Iasi, May 30-June 2; 1 (one) paper at Excellence RESEARCH Conf. Brasov, AMCSIT Politehnica Bucharest; 2 (two) papers on technical Revues (Paper and Cellulose Rev., Constructorul Rev.); 4 (four) accepted papers on the 5th Int. Conf. Management of Technological Changes, Alexandroupolis, Greece, 25-26 August 2007.
- posters: 2 (two) on Int. Conf. of Env. Engineering ICEEM/03, Sept. 21-24, Iasi; 3 (three) on Xth Int. Invention and News Technologies INVENTIKA, Oct. 3-7, Bucharest; 3 (three) at Vth National Invention Saloon PRO INVENT, April 2007, Cluj-Napoca; 8 (six) at Int. Inventory Saloon ECOINVENT 2007, Iasi, May 30 - June 2;
- 2 (two) organizing Int. Conf.: 3rd International Conference “Env. Eng. and Management”, ICEEM/03, Sept. 21-24, 2006, Iasi, ROMANIA; Int. Inventory Saloon ECOINVENT 2007, Iasi, May 30-June 2;
- post university courses “Monitoring of Disasters and Pollution”, Faculty of Hydrotechnics, Nov. 6-11, 2006 and May 14-20 Iasi;
- prix: silver medal at Xth Int. Invention Saloon and News Technologies INVENTIKA, Oct. 3-7 2006, Bucharest for invention „Filtrant dam by prefabricated elements”; Excellence Diploma and Gold medals with special mention for CEEEX project „The Impact of the Storage Lakes on the Environment-ENVIROLAC”, at Vth National Invention Salon PRO INVENT, April 2007, Cluj-Napoca; „Henry Coanda” Medal and Excelence Diploma for the CEEEX Project “The Impact of the Storage Lakes on the Environment (ENVIRO-LAC)”, Int. Inventory Saloon ECOINVENT 2007, Iasi, May 30 - June 2; gold medal for invention “Filtrate Dams for torrential formation arrangements”, Int. Inventory Salon ECOINVENT 2007, Iasi, May 30-June 2; silver medal for invention “Device to measurements the groundwater direction”, Int. Inventory Salon ECOINVENT 2007, Iasi, May 30-June 2; gold medal for invention “Sorous rain gauge”, Int. Inventory Salon ECOINVENT 2007, Iasi, May 30-June 2; special prize from OSIM for invention “Sorous rain gauge”, Int. Inventory Salon ECOINVENT 2007, Iasi, May 30-June 2
- web-site: [www.hidromed.ro/ceex724\(ENVIROLAC\)](http://www.hidromed.ro/ceex724(ENVIROLAC))

PERSPECTIVES

Finalizing the following stages: Stage 3 - The safety exploitation of the dams and storage lakes and the damages impact resulting after the water flooding; Stage 4 - Dissemination of results and promoting of news conception regarding the monitoring techniques of environmental factors and evaluating the impact of storage lakes about the environment; Stage 5 - Modeling of the storage lake impact and optimization of the exploitation.

Publications and dissemination of the project results:

- acquisition of equipment for monitoring the water quality of the storage lakes and adequate software;
- publishing 4(four) technical books;
- publishing 30(thirty) scientific papers (ISI, Bulletin of P.I."Gh.Asachi" of Iasi, Annals of „Al.I.Cuza" University of Iasi, Int. Conference);
- organizing 2(two) Int. Conf. (ICMDP.03 Monitoring of Disasters and Pollution, Nov. 2007, Iasi, Romania; the 4th Int. Conf. on Env. Eng. and Management ICEEM/04, 12-15 Sept.2007, Iasi, Romania.
- organizing Int. Invention Saloon INVENTICA 2008, Iasi, May;
- participation at Int. Inventory and Invention Saloon;
- organizing workshops and post university courses.

SEISMOTECTONIC LITHOSPHERIC MODELS FOR THE VRANCEA, DOBROGEA AND MOESIAN PLATFORM SEISMOGENIC AREAS FOR ESTIMATION THE LOCAL GEOLOGICAL STRUCTURES DYNAMIC RESPONSE TO STRONG SEISMIC EVENTS - SEISDIN.

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The project scientific objectives are the following:

- geophysical delimitation of the geological units, crustal blocks and major fault systems within the studied regions;
- outlining of relative displacements between the geological units and crustal blocks situated in the Carpathian Orogen foreland;
- contouring of geodynamic active areas with potential for stress accumulations (seismogenic zones) within the studied regions;
- determination of actual deformations in the Vrancea seismogenic zone, using two types of GPS observations (permanent and temporary GPS stations) and repeated levelling observations;
- computation of synthetic accelerograms for shallow geological structures from densely populated urban areas (Bucharest, Focsani, Buzau, Galati, Braila, Tulcea, Constanta), for seismic risk evaluation in these high seismicity regions;

The relative displacements between lithospheric blocks that are components of major outer-Carpathian tectonic units represent the source of stress accumulations in the Eastern Carpathians Bend Zone and adjacent areas.

This project that involve the integration of an immense volume of information related to geosciences such as geology, geophysics, seismology and geodesy will offer the necessary knowledge for the elaboration of seismotectonic models explaining the sources of seismic events and contouring high seismic risk areas.

The research planning of the project:

1. Elaboration of seismotectonic models (2D and 3D) consisting on the following:
 - delimitation of the crustal blocks in the studied regions, the distribution of seismic foci being controlled by major tectonic features and seismic discontinuities of the crust;

- relative displacements between the crustal blocks by studying selected earthquakes focal mechanisms and the interpretation of geodetic data (GPS and repeated levelling);
 - active fault systems;
 - construction of crustal and subcrustal physico-structural models using seismic sections, velocity and density sections, GPS data;
2. Numerical modelling of the local seismic response, determination of the response spectrum computed at shallow depths.

In order to achieve the project scientific objectives the following measurable objectives are envisaged:

- Measurements of crustal deformations which will offer information on the models of actual (?) subduction processes and/or continental collision. The repeated GPS measurements will provide two sets of information: a) the precise location of actual deformations; b) the direction and velocity of crustal blocks displacements;
- Directions of compressional and extensional crustal deformations provided by the selected earthquakes focal mechanisms;
- Computation of anomalous gravity and magnetic effects (2D and 3D modelling) for the studied regions;
- Numerical modelling of the local seismic response, determination of synthetic response spectrum for shallow formations and its transfer to the bedrock.

The obtained results will be used to the elaboration and updating of the seismic hazard map of the Romanian territory, the national standards regarding "Scale of seismic intensities" and re-evaluation of macroseismic intensity maps.

Until now we redraw the perimeters of the seismic sources in the Carpathian orogen and its foreland. We already evaluate the physical parameters and dynamic characteristics of the geological structures formations situated in the Eastern Carpathians Bending Zone foreland in case of applied stress determined by major earthquakes generated by the following seismic sources: Vrancea seismic source (intermediary and normal earthquakes); North Dobrogea seismic source; South Dobrogea seismic source; Moesian Platform seismic source; Shabla and Dulovo seismic sources (Bulgaria).

The authors highlight a new seismogenetic area in the eastern part of Central Dobrogea (North-East of Medgidia city), and emphasize the active character of the Horia -Pantelimonu de Sus fault.

After the installations of the TIRR broadband stations and Sf. Andrei and Mangalia K2 stations, the quality of the data improved and we already have recorded more than 150 new seismic events.

More of them, 83, are situated in the prolongation of faults which framing the Medgidia city, to the west and east, respectively. 20 earthquakes are situated along Horia - Pantelimonu de Sus fault (fig.2). We eliminated around 15 seismic events which are situated in/or nearby quarry or the depth is 0 km. The depths of the foci are situated in 1-15 km domain. The largest earthquake have $M_w=3.6$.

For the Medgidia fault system the focal mechanism shows left-lateral strike-slip fault type, and for Horia- Pantelimonu de Sus fault, reverse type fault.

In the very next step we: do a gravity and magnetic 2D and 3D modelling and analysis and modelling of dynamic and nonlinear properties of geological structures in the studied regions. After this year GPS station installation we can evaluate in the future the displacement vectors based on GPS measurements.

ATTENUATION PROPERTIES OF THE SEISMIC WAVES IN LITHOSPHERE FOR THE SEISMIC HAZARD ASSESSMENT IN ROMANIA

Luminita ARDELEANU¹, Maria TUMANIAN²

¹ INCDFP; ² IGAR

OBJECTIVES OF THE PROJECT

The territory of Romania is exposed to a high seismic risk, due mainly to the seismogenic source of strong earthquakes located at the bending of the Eastern Carpathians (the Vrancea region). The destructive earthquakes of the Vrancea region are rare events and consequently the deterministic methods – based on the numerical reconstruction of the ground motion – are of highest interest for the evaluation of the seismic hazard in Romania; the key element in the deterministic approach is the availability of detailed, appropriate models for both seismic source mechanism and Earth structure.

The present project aims to study a less known structural parameter, which characterizes the anelastic attenuation of the seismic waves: the quality factor of the medium Q . The local 1D models for the Q -factor will be estimated by the modelling of high frequency wavetrains from low magnitude earthquakes which may be approximated by point sources.

The seismic wave attenuation is determined by the elastic properties of the propagation medium, properties strongly depending on the composition and temperature of the constitutive rocks. The project will develop thermal models for the tectonic and geologic processes which affected the territory of Romania, to refine the temperature distribution in the crust and upper mantle and to evaluate the rheological behaviour of the constitutive rocks.

Finally the results concerning the thermo-mecanical peculiarities of the lithospheric rocks will be integrated with the characteristics of the anelastic propagation of the seismic waves, in order to evaluate their consequences for the distribution of the seismic hazard on the Romanian territory.

RESULTS

- Selection of the digital seismic records of low magnitude local events for the Q -factor estimation in the study area.
- Algorithms and computational programs for the evaluation of the anelastic attenuation of the seismic waves in lithosphere beneath the Romanian territory. Proposed algorithms are original and they are based on fitting the normalised amplitude spectra of the observed data to those of the synthetic seismograms, generated as response of the local structure to point seismic sources.
- Synthetic experiments to test the effect of the approximation of the seismic moment tensor by its deviatoric component (neglect of the volumetric part), and of source duration on the estimates of the optimum Q models.
- A detailed exposition of the major tectonic compartments on the Romanian territory and of the geodynamic processes which determined their structural peculiarities resulted from an exhaustive documentation on the architecture of the lithosphere.
- Synthesis of the most recent geophysical information/data relevant for the crustal and subcrustal structure of the lithosphere, supplied by the large tomographic and seismic refraction experiments CALIXTO'99, Vrancea'99 and Vrancea2001.
- Evaluation of the available information concerning the thermal structure of seven tectonic units from the investigated area. A review of the tectonic evolution models for the

major lithosphere compartments of the Romanian territory, able to explain peculiarities related to the convergence process which dominated the contact of plate margins since Cretaceous.

- A refinement of the space distribution of the thermal parameters, by using shear-wave velocity models to reduce the uncertainties in temperature estimates. The technique which is applied allows an analysis of the temperature effects in producing velocity variations, and uses the thermally dominated seismic structures in conjunction with surface heat flow observations, as an additional constraint on the estimates of the temperatures.

- Dissemination of the results by a paper accepted for publication in „*Geophysical Journal International*”, a paper submitted at „*Natural Hazard*”, 15 papers presented at 5 international scientific meetings, and by the WEB page of the project.

PERSPECTIVES

- The local estimates of the Q-factor will result in more reliable deterministic hazard analyses, the project contributing in this way to the mitigation of the seismic risk in Romania.
- The new local models for the Q factor aim to explain the observed ground motion field generated by the major earthquakes of Vrancea, and to identify the causes/sources of the attenuation, responsible for the peculiar shape of isoseismals.
- The project will provide a better evaluation of the spatial distribution of thermal parameters and structures used in thermal modelling, by proposing a tool which incorporates also the information concerning the characteristics of the seismic wave propagation in the lithosphere supplied by tomographic and seismic refraction experiments beneath the territory of Romania.
- The integrated interpretation of the obtained seismological and thermal results is aiming to contribute significantly to answering several disputed questions regarding the deep structure within the Eastern Carpathian bending area, and the processes responsible for the occurrence of the strong seismic events of the Vrancea region.

HYDROGEOLOGICAL RESEARCHES ON THE SPACE AND TIME MONITORING OF POLLUTED ZONES WITH HYDROCARBONS AND RESIDUAL WATERS IN THE AREA OF ASTRA, PETROTEL, PETROBRAZI AND VEGA REFINERIES

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The hydrocarbons and residual waters contamination of ground and groundwaters in the vicinity of large oil refineries, fuel deposits, oil extraction facilities and even transportation pipelines is one of the greatest problems for the environment's protection. At this time, the location and determination of the spatial and temporal distribution for the contamination is based exclusively upon using direct biochemical analysis methods of soil and water samples, taken from the surface or boreholes. The information thus obtained are punctual and, due to this reason, cannot provide a general image of the ground's and groundwater's contamination. Furthermore, these analyses are extremely expensive and the observations take lot of time.

The integration of punctual information in a tridimensional spatial and temporal image for the areas contaminated with hydrocarbons and residual waters is possible through an adequate employment of the hydrogeophysical methods

The main purpose of the project is to set up a hydrogeophysical research program (PCH) for the spatial and temporal monitoring of hydrocarbons and / or residual waters contamination, resulted from the refining, storing and transportation of oil products from major refineries located around Ploiesti city area. The elaboration of this program is based upon carrying out simultaneous hydrogeological and geophysical investigations over several periods of time (time-lapse investigations), in the areas with a high risk for contamination with hydrocarbons and residual waters but also in the uncontaminated areas.

PCH will facilitate the elaboration of a specific strategy for geophysical investigations, in agreement with the pollutants nature, the characteristics of the polluting source and the local hydrogeological conditions. PCH will be used for the observation, prevention and spatial-temporal evaluation of the contamination plumes in the area of the refineries. Also, the program may be employed for the restoration of environmental factors by applying various rehabilitation methods for the contaminated areas.

The preliminary geophysical results refer to geoelectric investigations carried out in the area of two oil refineries located at the limits of Ploiesti city: VEGA and PETROBRAZI. Vertical electric sounding (VES) has been utilized as geophysical technique able to locate plumes with contaminants within the geological formations and underground waters. The measurements have been performed along two profiles situated outside the refineries, their interpretation being presented in figures 1 and 2.

The profile located at the southern limit of the VEGA refinery depicted a low resistivity anomaly at depths ranging from 0.5 to 7.0 m, interpreted to be caused by an inflow of industrial waters within the geological formations (Fig. 1).

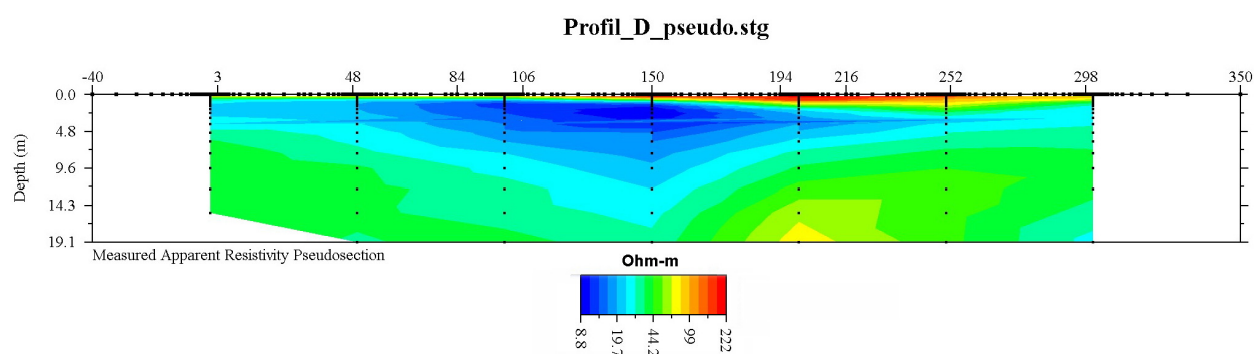


Fig. 1 – Resistivity cross-section in the area of VEGA refinery

The processed data from profile situated at the eastern limit of the PETROBRAZI refinery showed an elongated high resistivity anomaly developed at approximately 5 m depth, interpreted to be caused by the presence of hydrocarbon spills (Fig. 2)

Sectiune rez. reale (model 1D - 8 strate)

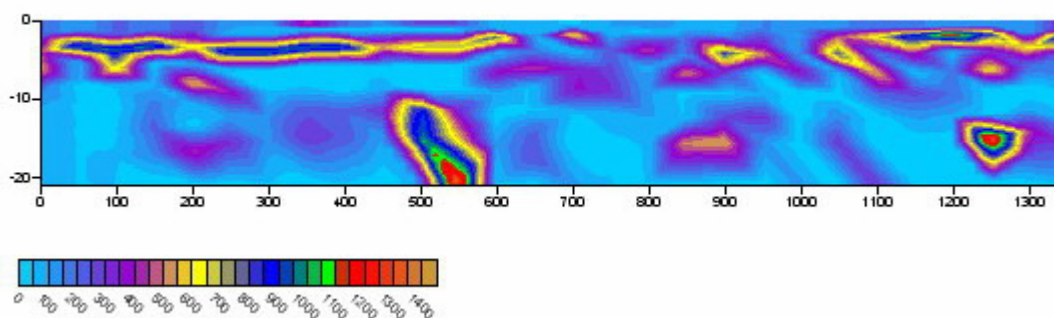


Fig. 2 – Resistivity cross-section in the area of PETROBRAZI refinery

The project results will be used to reduce the vulnerability of the aquifer structures within the studied area and to elaborate an efficient and cost-effective system for the determination of spatial and temporal variations of contamination plumes, in order to define a strategy for diminishing or stopping the effects of environment pollution. In the same time, the hydrogeophysical program will be used for real-time warning of the environment protection agencies on monitored areas, characterized by a high potential for soil and aquifer contamination, with an extremely destructive impact upon people daily life and local economic activities.

RESEARCH ON THE EFFECTIVE UTILISATION OF IRRIGATING WATER FOR GRADING WORKS EXECUTED WITH SPECIALISED MACHINES HAVING LASER AND ELECTRO HYDRAULIC DRIVEN OPERATING PARTS - NUTCL

Teodor Costinel POPESCU, Gheorghe SOVAIALA

Thematic fields:

- Sustainable resource management – Sustainable preservation and management of natural and artificial resources in the technological platform of TP 25 programme
- Clean Water and the European platform TWG 4
- Water in agriculture
- Watered agriculture
- Non-watered agriculture.

The project proposal falls under the thematic field 6.2, ?Sustainable resource management – Sustainable Preservation and Management of natural and artificial resources? since it deals with issues within the following areas:

- a) The project comes with a solution for an effective utilisation of water resources, whether natural or artificial, to be spread across watered and non-watered land. This would be achieved through building an equal growth and development environment for the plants by homogenously spreading the water quantities (rain or irrigation-based) reaching the soil;
- b) The solution means carrying out land grading works to ensure a maximum $\pm 3...5$ cm deviation on the whole surface for the longitudinal gradient of the graded surface – which is maximum 1.5 % (depending on the watering technique) and also to prevent soil degradation;
- c) The “classical” grading technology, currently used countrywide is non-effective for the following reasons: the machines used produce grading with over ± 5 cm deviation from the longitudinal gradient of the graded land surface; grading works need high energy costs, for 4...5 successive cross-over; grading means additional work for the implementation,

monitoring and fine-tuning of the grading works project; poor quality of grading reflected in over ± 5 cm deviations from the longitudinal gradient is a source of secondary degradation of soil: swamping, salinization, erosion; grading works are sometimes performed on improper soil categories and at improper depths, resulting in diminished soil fertility;

d) The grading technology promoted in the project implies the use of a complex, specialized laser controlled equipment able to achieve a two pass-over grading, an initial and a fine-tuning grading, with maximum $\pm 2,5 \dots 3$ cm deviations from the longitudinal gradient while excluding any potential secondary soil degradation. It also means a significant reduction of the monitoring, implementation and fine-tuning of the outreach land grading project;

e) Fewer number of times needed for the navy machines to cross over the graded land diminishes time, manpower and fuel consumption as well as soil compaction ratio;

f) Compared to the machines known to date, the specialized grading equipment shall include the following four modules: a laser emitter module mounted on a telescopic frame in the center of the surface to be graded. It will generate the reference plan for grading with gradient programming options for this plan between $0 \dots 1,5\%$; a laser receptor module mounted on the equipment in the proximity of the operating part. It captures the laser fascicle emitted in an "optimal area" when the ground elevation underneath the equipment reaches the grading elevation, in a "maximum area" when the ground elevation is higher than the grading elevation or in a "minimum area" when the ground elevation is lower than the grading elevation; an electronic monitoring and controlling module mounted on the equipment. It converts and amplifies the received laser information and compares it against a specifically preset grading elevation value, sets the error against the preset value and emits orders to an electro-hydraulic drive system in order to cancel the error; an electro-hydraulic driven system on the operating part of the equipment, controlled by the electronic module.

Results obtained:

In the **first stage** was elaborated the Study for the conceptual definition regarding the necessity for the agrarian terrain leveling with controlled grade, structured on five chapters in which there were treated the following issues:

In the **first chapter** are presented aspects regarding the importance of the main objective of the project – water saving in agriculture. Definitive aspects are highlighted, concerning the qualitative and quantitative durable management of the water resources in agriculture as mentioned in the 2000/60/EC Framework Directive. The idea that the main water consumer will be agriculture, specially irrigations which will expand due to the planetary climatic change and population growth, is developed.

In **chapter 2** are treated aspects facing the need for agrarian terrain leveling under its two forms, capital leveling and exploitation. Land leveling represent a way for water resources saving, by insuring the evenly distribution of water over the entire surface, and a method for reducing the negative effects of the: sloughing generated by puddles formed in low areas; secondary salting in the high areas

In **chapter 3** is presented the range of leveling equipments national and international manufactured and their main technical and functional characteristics. It has been observed that, for these equipments, the actuation of their operating parts it is mainly done hydraulically. From this point of view, the implementation of the electro-hydraulic modular actuating system and the laser command system will be compatible.

In this chapter is developed the idea of finishing leveling of agrarian terrain achieved through one single passing, as a way to reduce the soil settling caused by the classical leveling technology who needs at least 4-6 successive passes.

Chapter 4 deals with the importance and the opportunity of the implementation of the electro-hydraulic modular actuation system and laser command system, with automated operation. This system has the following advantages: eliminates the human errors; enables

the execution of the leveling work simultaneously with more than one leveling equipment of which operating parts will follow a plane parallel with the laser reference plane: leveling precision rising at $\pm 2.5\text{cm}$ over the designed slope, in the range of 250..350 m from the laser emitter.

In **chapter 5** are presented general references over the conceptual foundation of the project's main theme. The main theme of the project will be fully covered in the second stage after the theoretical analysis of the main solutions for the realization of an laser command and control modular equipment for the leveling equipments.

In the **second stage** is elaborated the Theoretical analysis Study of the main solutions regarding the realization of an laser command and control equipment for the leveling equipments which has developed problems like: realization of the electro-hydraulic actuation system for the leveling equipment end the related electronic block. Realization of the laser components positioning systems on the leveling equipment; types of leveling equipments on which the laser command and control system could be implemented; the operation and components list of the laser command and control systems.

Perspectives:

In the future stages of the project will be continued: the configuration of the laser command and control system on two categories of main components, valid for all the hydraulically actuated leveling equipments, and specific in regard to the degrees of freedom of the working parts (cups and blades); developing the option for an leveling equipment and assembling on it of the specific laser command and control system; adjustment of the equipment's hydraulic system with the specific laser command and control system: experimentations in real exploitation conditions of the leveling equipment equipped with laser system; analysis of the quality of the leveling work and of the system functionality.

POLIOXOMETALATES COMPOUNDS WITH OXIDATIVE CATALYTIC ACTIVITY FOR TOP APPLICATIONS

Valer ALMASAN¹, Camelia GROSAN¹, Mihaela LAZAR¹, Monica DAN¹, Alexandru BOTAR², Dan GAVRILESCU³, Mircea BUCUR⁴,

The paper and cellulose industry has very profound impact on the economic and social development of the society. The residual products obtained have a serious impact on the environment. The wastes are polychlorinated aromatic compounds and dioxine, known for their toxicity and low degradability. The *cellulose nonpolluting bleaching processes* which are studied in the framework of this project are catalytic oxidative processes for the *selective oxidation of the lignin*. The catalysts involved in this process are polioxometalates (POM) catalysts or clusters which contain Mo, W, V and other transitional elements. The polioxometalates compounds used in this project must have the ability to be reversibly reduced and oxidized, to have the reduction potential sufficiently positive to be able to oxidize lignine, but in the same time sufficiently negative to be re-oxidized by oxygen.

The project has the following **objectives**:

1. synthesis of new POM combination and clusters based on Mo, W, V and other transitional elements with selective catalytic activity for the lignine oxidation;

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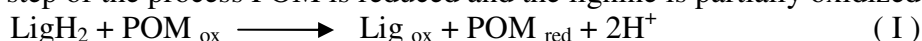
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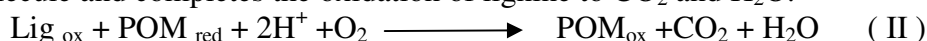
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2. physical and chemical characterization of this compounds, like structure, catalytic activity and selectivity in the lignine oxidation reaction;
3. in-depth studies of bleaching process using our synthesized catalysts; the determination of the bleaching reaction parameters;
4. integral recovery and re usage of the POM used in the bleaching cycle;
5. development of new ecological friendly technologies, at laboratory level for the bleaching of cellulose and other natural fiber using our new synthesized POM;
6. composition establishing of the bleaching POM residual solutions;
7. studies of the cellulose recovery process from different paper wastes using our synthesized POM;
8. brightness and mechanical qualitative analysis of the bleached cellulose pulp using POM as bleaching agent .

The catalytic bleaching process is based on POM property to be easy reduced and re-oxidized by O₂. In the first step of the process POM is reduced and the lignine is partially oxidized.



In the second step the addition of molecular oxygen (O₂) to the system regenerates the original POM molecule and completes the oxidation of lignine to CO₂ and H₂O.



Results

The activities carried on until now were related to: (a) preparation and characterization of POM molecules with Keggin structures suitable to make a selective oxidation of the lignine from cellulose pulp and natural fibres; (b) to establish the proper analytical method for the reactions monitoring; (c) to set the optimum reaction conditions.

Two polioxometalates compounds were synthesized: (NH₄)₅H₄PMo₆V₆O₄₀ x 15H₂O and Na₃H₂PV₂Mo₁₀O₄₀. The compounds were characterized by elemental analysis, UV-VIS and IR spectroscopy. The UV-VIS spectra of the two POM molecules are presented in Figure 1.

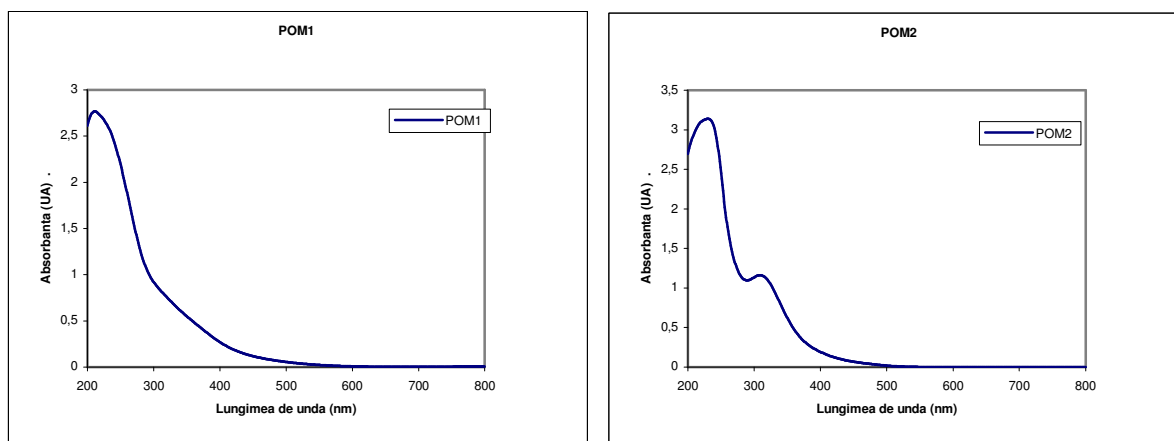


Figure 1 UV-VIS spectra of (NH₄)₅H₄PMo₆V₆O₄₀ x 15H₂O and Na₃H₂PV₂Mo₁₀O₄₀ molecules

The frequencies from IR spectra have been attributed to P-O, Mo-O-Mo, H-O-H bonds.

The catalytic activity of POM compounds was studied in pure lignine oxidation reaction. The concentration of oxidized and reduced forms of POM was monitored by UV-VIS spectroscopy correlated with other analytical chemistry methods. The results show a good catalytic activity of both compounds for lignine oxidation. Approximately 3% of the initial V⁺⁵ concentrations were reduced to V⁺⁴, in good agreement with previously reported results. The catalyst was totally regenerated with O₂ and reused in oxidation process.

The *future activities* on the project will include: testing the lignine selective oxidation capacity of the two synthesized and characterized compounds for wood pulp and natural fibers in order to determine their specific bleaching properties.

STUDIES ON DECOLORIZATION OF SOME DYES SOLUTIONS USING NEW OXIDATIVE, MICROBIOLOGIC AND SORPTIVE PROCESSES FOR REHABILITATION AND RE-USE OF WASTEWATER FROM TEXTILE INDUSTRY

Viorica DULMAN¹, Ion BUNIA², Stefania SURDU³, Anisoara BERTEA⁴

The project aims at the study of some new and efficiency oxidative, microbiologic and sorptive degradation processes using organic polymers for decolorization of some textile dyes solutions as well as the possibility of re-use of the textile wastewaters. In this context, the project is focused on the important issue of pollution with the textile dyes, as, for instance: reactive (resulting from dyeing the cellulose materials), acidic (wool dyeing) and basic (from dyeing polyacrylonitrile) dyes.

The study was carried out at laboratory scale by means of the following decolorization processes:

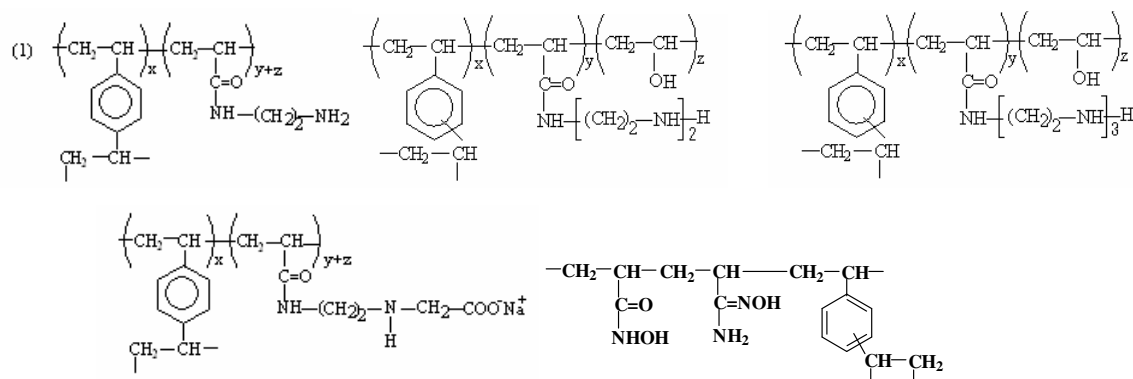
- Chemical-oxidative degradation of the water soluble textile dyes, by means of hydrogen peroxide (H₂O₂) using heterogeneous catalyzers such as functionalized chelating resins with amines and saturated with different metallic ions.
- Physical – sorption of the textile dyes on newly synthesized organic polymers, whose structure is correlated with that of the investigated dyes.
- Microbiological-using microbial strains isolated from activated sludge.

Various chelating acrylic ion exchangers and pyridine strong base anion exchangers were synthesized and characterized.

The chelating resins were of weak base, weak acid and amphoteric structures and they were used for the retention of different metal cations such as Cu(II), Ni(II), Co(II) Fe(II), Fe(III), Mn(II) to perform heterogenous catalyst applied in oxidative degradation processes of some dyes.

The chelating macroporous acrylic ion exchangers containing primary, secondary, tertiary amine groups (weak base ion exchangers), carboxylic (weak acid ion exchangers) and mixture of hydroxamic and amidoxime groups (amphoteric resins) were achieved.

The chemical structures of their active structural units are shown below:



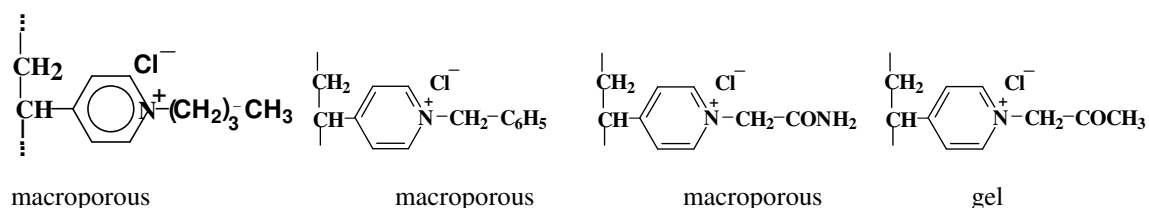
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The pyridine strong base anion exchangers were of gel and macroporous types. These resins were used for the retention of acid dyes (Acid Blue 113-A, Acid Green 9-W and Orange G-G) by sorption process (ion exchange and adsorption). The pyridine strong base anion exchangers have the following chemical structures for their active structural units:



The ion exchangers were characterized by weight and volume ion exchange capacities and the purity of the investigated commercial dyestuffs was determined by two methods.

The capacity of 32 polymeric chelates with Fe(II), Fe(III), Cu(II), Co(II) to catalyse the degradation of three acid dyes in the presence of H₂O₂ was investigated in optimal conditions (pH, temperature, H₂O₂ concentration, dye concentration, amount of catalyst). A great efficiency was observed for two catalysts based on Cu(II) and Fe(II), with total decolorization and degradation of dyes.

The experimental results obtained in optimal conditions (pH, contact time, dye concentration, temperature, sorbent amount) show the great performance of the acrylic copolymers functionalized with EDA and TETA to retain W and G dyes by sorption processes, in both static and dynamic conditions.

The quantitative desorption of these dyes was attained, that suggest the possibility to recover them. Based on successive sorption and desorption processes it was concluded that the sorbent could be re-used for more than 13 times, with maintaining the maximum sorption and desorption capacity.

The decolorization efficiency of seventeen textile dyes, in the presence an adapted microbial consortium, isolated from activated sludge of a textile - water treatment plant, was screened in aerobical biodegradation process. The consortium exhibited over 95% decoloration for Acid Blue 113, Basic Blue 41, Bezactive Orange V – 3R and Red Acid 6A, within 12 hours of cultivation, 89.39% decoloration for Orange G, 70% for Bezactive Violet V-5R and Red Acid V, 50% for Cibacron Rot HE -3B, Reactive B5A, Drimaren Red X-6BN at initial concentration of 20 şi 50 µg/ml, in 24 hours.

Temperature, pH, initial concentration of dyes, presence and concentration of organic and ammonium nitrogen and glucose, in shaking culture, was tested in order to establish the optimal conditions of biodegradation.

The optimal conditions for sorption and degradation will be applied on wastewaters from textile industry. An extent of exhaustion of 80% for acid dyes at different concentrations and liquor ratios was obtained and hence important quantities of dye finish in the effluent, what justifies a decolorization process.

In order to elucidate the mechanisms of decolorization and the impact of the degradation products on waters, several methods will be used for analysis, such as: spectrometric (UV-VIS, IR, FAAS), voltametric (stripping voltametry, cyclic voltametry), thermogravimetric (TG, TGD); the analysis of some endo or exo-enzymes as well as CBO₅ measurements will be addressed.

The proposal scope is well suited for the general interest in terms of reducing the impact generated by anthropogenic activities such (as those from textile industry) and protection as well as maintaining the quality of the natural water resource.

INTEGRATED RESEARCH ON THE INTRACONTINENTAL INTERMEDIATE-DEPTH EARTHQUAKES GENESIS WITHIN VRANCEA ZONE (ACRONYM INDEGEN)

Lucian BEȘUȚIU¹ and INDEGEN team

The project represents an attempt to explain the intermediate-depth seismicity within Vrancea zone through the link between the geodynamic environment (that seems to determine the sinking of the seismic source) and seismic contribution of the thermo-baric accommodation phenomena (following the lithosphere sinking into the upper mantle).

Several top research organizations joined the project in order to overcome research fragmentation in the field: Institute of Geodynamics of the Romanian Academy (IGAR), National Institute for Earth Physics (INCDFP), Geological Institute of Romania (IGR), Technical University of Civil Engineering (UTCB), and University of Bucharest (UB).

PROJECT OBJECTIVES

The INDEGEN project should answer several major questions such as:

- Are there thermo-baric accommodation phenomena able to generate the observed seismicity in Vrancea zone?
- What is the critical mass of lithosphere that should be exposed to higher temperature by sinking into the upper mantle?
- What is the speed limit of sinking in order to avoid gradual heating without (or with minor) associated seismic phenomena?
- Is there any correlation between the sinking of seismic body and horizontal dynamics?

Measurable objectives:

- An improved model for the tectonic and geodynamic framework of Vrancea
- Geothermal models providing constraints to each scenario of geodynamic evolution
- Research on the amount of the seismicity generated by the thermo-baric accommodation
- An improved model for the lithosphere structure within the seismic zone
- Quasi real-time monitoring of the lithosphere dynamics within Vrancea zone
- Considerations on seismic hazard evaluation
- Providing means for increasing public awareness on the seismic hazard: providing support for policy-makers involved in civil protection for appropriate management to mitigate risk
- Developing a pool of highly qualified Romanian scientists in the related field

THE APPROACH

In order to solve the above-mentioned aspects, a complex approach has been designed and applied. The research encompasses several work packages as follows:

WP1. Integrated research on the structural-geodynamic framework (partners IGAR and IGR)

WP2. Modeling thermal structure of the lithosphere (partner IGAR)

WP3. Deciphering lithosphere structure by using simulating models (partner IGAR)

WP4. Subsidence/sedimentation rate studies (partner IGR).

WP5. Study of the structure of the geographic units (partner UNIBUC)

WP6. Studies on the space-time evolution of the seismicity within the geodynamic active zone and WP7. Relationship between focal mechanism and seismic waves propagation (partner INCDFP)

WP8. Geodetic monitoring of the active seismic zone (partner UTCB)

WP9. Non-tidal gravity change monitoring (partners IGAR and IGR)

¹ Institute of Geodynamics of the Romanian Academy

WP10. Monitoring of fluids geochemistry within the crust (partner IGAR)

WP11. Seismic contribution of the temperature accommodation phenomena (IGAR and IGR)

PRELIMINARY RESULTS

1. Main hypotheses on the geodynamic framework of the Vrancea intermediate seismicity zone were critically reviewed. The role played by the W Black Sea opening on the SE Carpathians seismotectonics was emphasized. Comparisons to other world seismic nests were made. The construction of an improved structural model for the seismic zone has started based on geophysical data interpretation.
2. A geothermal model of the East Carpathian collisional event was performed.
3. Subsidence/sedimentation rate studies focused on three deep oil wells located in the bending area of East Carpathians: 6180 Valea Ratei, 5024 Mânzălești, and 5515 Foc Nestins.
4. The analysis of the available geographical information provided a preliminary geomorphotectonic regionalization. The following aspects were approached: (a) limits and description of the geographical units within the bending zone of Carpathians and Sub-Carpathians, the Romanian Plane; (b) imprints of the neotectonic and seismic movements within the topography.
5. Statistical studies on the space-time dynamics of the intermediate depth seismicity and source parameters analysis were performed. Mention should be made to the concentration of seismic activity at three main depths coinciding with asthenosphere location around the seismic body: 90 km, 130 km and 150 km.
6. Geodetic research focused on a feasibility study preparing specific activities for the next stages, when several campaigns of ground and space geodesy (for revealing crust deformation related to seismicity) are foreseen. The first GPS and leveling campaign started.
7. Relative gravity observations at both regional and local scale were performed in order to reveal non-tidal gravity changes across major lithosphere contacts and within Vrancea zone.
8. Systematic collecting and analyzing of water samples have been started.

RESULTS DISSEMINATION

Details on the INDEGEN project design and development may be found at the site <http://www.geodin.ro/~prezentare/Departments/BesutiuIndegen/engleza/Index.htm>.

Preliminary results were also disseminated through oral and poster contributions at several prestigious international conferences as follows:

IGFS-2006 (1st International Symposium of the International Gravity Field Service – Gravity Field of the Earth), 28 August – 1 September 2006, Istanbul, Turkey

“Non-tidal gravity change over the Vrancea active seismic zone, Romania”

2007 AGU Joint Assembly, 22-25 July 2007, Acapulco, Mexico

“Crust to Upper Mantle Echoes of the Black Sea Opening and Seismotectonic Consequences on the NW Inland”

„Temporal variation of seismicity in the particular case of Vrancea (Romania) intermediate-depth earthquakes”

„Seismic source parameters and geodynamical features in the Vrancea region, Romania”

2007 IUGG General Assembly, 2-13 July 2007, Perugia, Italy

„Large scale features of the south-easternmost TTZ as inferred from geophysical data”

“Comparative study concerning intermediate seismicity dynamics within some “seismic nests” of the world”

„Time – dependent seismic hazard assesment on the basis of monitoring seismicity behaviour in Vrancea region, Romania”

Romanian – Turkish Geographical Academic Seminar 5 - 15 June 2007, Antalya, Turkey

“The reflection of the neotectonic movements and seismicity in the relief morphology of the South East Romania”

“Neotectonics, seismicity and slope dynamics in the Bend Subcarpathians”

STUDY OF THE DYNAMIC EXCHANGES OF CARBON BETWEEN THE ATMOSPHERE AND THE TERRESTRIAL BIOSPHERE AND THEIR IMPACT ON THE CLIMAT AND THE ENVIRONMENT

Stela CUNA¹, Cornel CUNA¹, Gabriela BALAS¹, Edina SZILAGYI¹, Alina MAGDAS¹, Valentin MIREL¹, Nicolae Lupsa¹, Calin Baciu², Roxana LAZAR³, Gavril TODERAN⁴

The CARBODIN project provides scientific information critical to reducing uncertainties on greenhouse gases (CO₂ and CH₄) at the local and regional level in some selected sites in Romania. The research focus on the dynamic exchange of these gases between atmosphere and some terrestrial ecosystems from Romania. The knowledge of this dynamic helps us to account for sources and sinks of CO₂ and CH₄ at the selected sites.

The central goal of the project is to provide the scientific needed to inform policies designed to reduce contributions to atmospheric carbon dioxide (CO₂) and methane (CH₄).

The main objectives of CARBODIN are:

1. To provide scientific data and analysis to determine the fate of CO₂ emitted to the atmosphere by combustion of fossil fuels in 2 areas.
2. To understand the rates and mechanisms controlling carbon uptake and release from soil and vegetation in other 3 areas from Romania.
3. The project will develop knowledge of the sources and processes that release other important gases, including carbon monoxide (CO) to the atmosphere.
4. The project will improve our understanding on magnitude location, temporal behavior and causes of the carbon source/sink strenghts of three terrestrial ecosystems which can be used to improve capacity of our country to accomplish the Kyoto protocol (1997) and Montreal protocol (2005).
5. To develop a strong infrastructure that will be able to provide a high level performance for the measurements
6. To increase scientific cooperation among the project participants and to implement a network that will be able to offer integrate services at the local/regional scale connecting with the carbon budget.
7. To increase cooperation with other scientific communities involved in carbon cycle studies.

Following these main objectives, more specifically objectives of the project are:

1. To develop and apply an experimental strategy to quantify the atmospheric carbon budgets in five selected sites and derive local estimates of emissions and sinks
2. Develop and apply the modelling tools required to assess the local and regional carbon budget of some representative areas in Romania (wetlands, urban areas, and forest)
3. To investigate the magnitude of the carbon source/sinks for terrestrial ecosystems (forest and wetland) in respect of species, age, climate, and geographical locations
4. To understand the effect of inter and intra-annual climate variations on the magnitude of carbon exchanges of the terrestrial ecosystems mentioned above
5. To investigate the role of soil and leaves biomass respiration on partition of the ecosystem carbon exchanges
6. To improve and test models of biosphere-atmosphere interaction for assesing the local and regional scale carbon balance of representative areas

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7. To validate ecosystem model of carbon sequestration across a range of climate, species and vegetation structure.

In the first stage we have studied the soil and vegetation CO₂ emissions in few areas: urban area, wetland area, and forest area. To quantify the CO₂ emissions we have analysed the atmospheric CO₂ in the studied areas at different heights: 0.5 m, 1 m, 1.5 m, and 2 m in order to obtain the concentration and isotopic composition of CO₂ from air, and to determine the isotopic signature of **above respiration** from Keeling plots. Also, we have obtained the Keeling plots for the wetland area where we have studied the methane (Fig. 1)

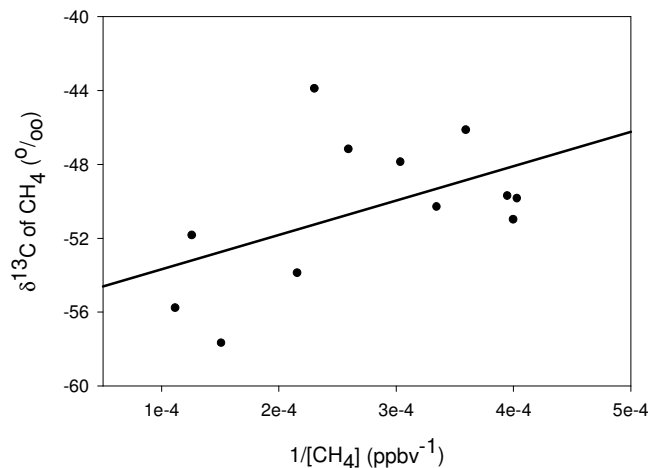


Fig.1 Keeling plot for wetland samples

Also, we have studied the CO₂ effluxes from soil by sampling weekly the CO₂ fluxes and constructing diurnal and monthly variation of CO₂ fluxes. Combining the measurements of $\delta^{13}\text{C}$ from soil with those of CO₂ concentrations from soil, we obtained the Keeling plots for **belowground respiration** and the isotopic signature of the belowground respiration.

We have obtained the variation of the soil respiration (the variation of $\delta^{13}\text{C}$ values and the variation of rate of soil respiration) with environmental factors that were weekly measured: soil temperature, vegetation evolution on soil surface, soil and air humidity, and we have found a very strong variation with these factors. Another aspect that was determined using the $\delta^{13}\text{C}$ values of plant respiration was the variation of these values with the time and place of collected samples.

The CO₂ concentration from air and soil were measured with an infra-red analyzer. To record the CO₂ effluxes from soil, we used a closed dynamic chamber in line with an nondispersive infra-red analyser. To obtain the CO₂ from air samples, we used the cryogenic extraction and purification device built by ourself. The analysis of ¹³C isotopic composition from air, soil and plant leaves were made with a mass spectrometer DELTA V Advantage, designed by Thermo-Finnigan.

The results which we have obtained in this project, and that will be completed with the researches that we will accomplish in the next stages of the project will be useful in the following:

- qualitative description of the sources and sinks of carbon in the studied areas
- quantitative insight into assimilated carbon pathways and carbon cycling processes
- a quantitative estimate of the local/ regional carbon budget where fossil and terrestrial components will be constraints separately

INTEGRATED POLLUTION STUDY USING OPTICAL REMOTE SENSING FOR URBAN PLANETARY BOUNDARY LAYER

Maria ZORAN¹, Sabina STEFAN², Ioana Ionel³, Daniela Zisu⁴, Cecilia Roman⁵, Stela Capra⁶, Doina Nicolae¹

Introduction

TOP project will focus on research involving experiments in intensive measurements campaigns and development of prognosis models as evaluation instrument for vertical, horizontal and temporal distributions of atmospheric pollutant concentrations in urban region of Bucharest.

Objectives

1. Realization of a statistical data base concerning the level and the variability of the urban air pollution (gaseous pollutants and particulates originating from industrial areas and traffic) using remote sensing techniques. The parallel use of a DOAS together with LIDAR scanning will provide higher reliability for detecting and ranging the extreme pollution events in Bucharest.

2. Identification of aerosols major sources by backward air masses trajectories on selected cases - Another important aspect for real situation evaluation of air pollution over Bucharest is related to the significant pollution sources localization. The studies involved in this project will contribute to obtain more objective information by introducing as computing parameter the quantities of aerosols transported from other locations by the winds.

3. Studying physical parameters of planetary boundary layer with Lidar by using aerosols as tracers - Most pollution phenomena take place in the lower atmosphere, low troposphere, called Planetary Boundary Layer (PBL). PBL is usually divided in layers characterized by different scale parameters. Meteorological non-stationary properties in each layer affect pollutants dispersion, turbulence being significant. Among meteorological factors which affect air pollution phenomenon the most important are: the wind, the atmospheric stability, the height of PBL (or mixed layer), the thermal inversion amplitude, the vertical movements and the terrain variations effects (hill, valley, plain etc.). The terrain variations lead to significant local variations in the thermal and the dynamical forcing that can influence the patterns that are formed due to the surface.

Results

The first campaign, effected in Magurele (5 km away from the Bucharest periphery, latitude: 44.35 N and longitude 26.03E), was focus on the **experimental determination** of air level pollution and correlations of the methods, which enable on the one hand the sources' localization (punctual or sparse, local or faraway) and on the other hand forecasting on spatial (transport and diffusion) and temporal (diurnal and season variability) evolution. **The experimental setup** consist on: a **LIDAR system** for remote detection of pollutant aerosols, a **DOAS system** for remote detection of pollutant gases, a **NDIR system** for remote

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detection of IR absorption pollutant aerosols, **ground based remote detection of pollutants** (IR gas analyzer for CO, CO₂, CH₄; PM₁₀, PM_{2.5} particle counters, TSP counters), **a mobile meteorological station** (for pressure, temperature, humidity and solar fluxes monitoring), **mobile lab for air quality control, portable equipments for drawing samples, laboratory equipments for analyzing samples, dedicated software.**

The Figures 1, 2 shown diurnal cycles of PM₁₀ on 10.05.2007 (fig 1) and ozone cycles during 08.05.2007 – 10.05.2007

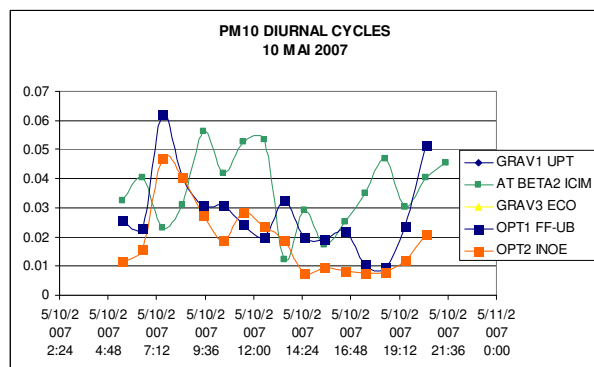


Figure 1: PM₁₀ Diurnal Cycles

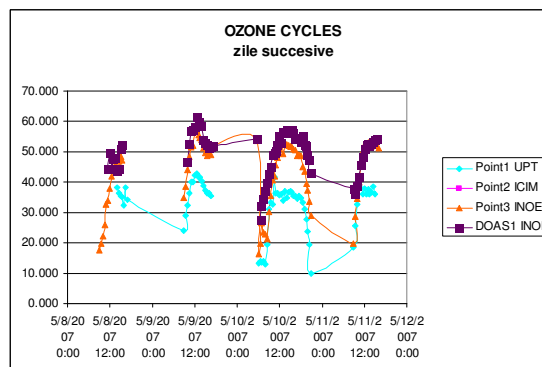


Figure 2: O₃ Diurnal Cycles

By analyzing our experimental results we show the influence of the traffic on hydrocarbons, CO, NO ground based concentrations and also we proved there are no other major pollutant sources in the area.

The perspectives:

- Organization seasonal measurements campaigns using both optical and classical techniques for mapping of main species of air pollutants and comparing the measurements results from the two techniques, of the gaseous pollutants (CO, NO₂, NO_x, SO₂, CH₄, O₃), and PM₁₀ and PM_{2.5}
- Identification of some gaseous pollutants(NH₃, CO₂, VOC) with non-standard methods in Romania, using DOAS technique and alternate methods
- We will demonstrate the advantages of optical techniques: three-dimensions measurements, real-time acquisition and analysis, interconnectivity, high efficiency at low cost
- We will make studies of daily and seasonal variability of physical parameters of PBL, using LIDAR data and we will demonstrate the value of this technique for urban planning and industrial development, including traffic control.

INNOVATIVE COMBINED TECHNOLOGIES FOR IN-SITU PROTECTION AND REMEDIATION OF SOILS POLLUTED WITH HEAVY METALS IN ORDER TO DECREASE THEIR BIOAVAILABILITY

Corneliu BOGATU¹, Smaranda MASU¹

The project tasks are the development of innovative methods for in-situ remediation of soils polluted with metals from mining areas, for soil recovery and reusing in bio-geo-chemical cycles, by taking into account the following processes:

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soil amendment with natural materials, native volcanic tuff pillared with polynuclear salts of trivalent metals, in order to reduce metals bioavailability; metal mobilization by application of electrical fields to soil for metal redistribution, in order to facilitate their adsorption onto pillared volcanic tuff; phytoremediation of soils polluted with metals and amended with pillared tuff, by use different plant species, which have tolerance and bioaccumulation capacity for pollutants from soil. For technologies development, the following objectives must be realized:

-sequential repartition of metals in the soil components, from a mining polluted site; -in-situ treatment parameters establishment through two technologies, using of pillared tuff and electrokinetic treatment; -studies concerning grass plants tolerance at different pollution levels, and kinetic evaluation of metal bioaccumulation in phenophases; -micropilot model for metals redistribution in soil; -determination of the efficiency for soil remediation by using of the combined process: mobilization – adsorption onto pillared volcanic tuff – phytoremediation.

The obtained results are referring to the analysis of metals transport processes into a waste mining deposit, evaluation of treatment processes with supported materials and electrokinetic for soils polluted with heavy metals, an laboratory model for metals mobilization in soils, cultivation of experimental lots with grasslands, in order to establish the influence of volcanic tuff influence onto transport processes of metals from waste mining deposit and their accumulation into plants.

Transport processes for Cu, Zn, Mn and Fe from a waste mining deposit, resulted by copper ore processing at Moldova Noua enterprise in south – west part of Romania, was investigated. Some areas of deposit were covered with non-polluted soil layers, thickness of 5 and 10 cm from deposit neighbourhood, which were cultivated with grass plants like *Festuca arundinacea* and *Hippophae rhamnoides*, in order to evaluate efficiency of metals separation.

Metals concentrations in soil were analysed using of sequential extraction method proposed by European Community Bureau of Reference (BCR). This method allows determination of metals from operationally defined fractions: I- exchangeable fraction, II - fraction adsorbed onto iron and manganese oxyhydroxide surfaces, III - fraction linked by organic matter, IV - fraction linked by mineral networks. Sequential analysis of metals from the horizon 10 – 20 cm showed both concentrations decreasing and changes of their distribution in these fractions, during 1-5 years. Separation efficiencies after five years, due to mining waste covering with soil and grass plants cultivation, had the following yields: Cu – 52 %, Zn – 70 %, Fe – 39,2 %, Mn – 77 %.

For in-situ remediation of soils polluted with heavy metals, two processes were evaluated: using of supported materials and eletrokinetic treatment. Principal processes that takes place between solid phases of supported materials and soil solutions are ionic exchange, adsorption, precipitation and complexation. Synthetic and natural zeolites are used both for remediation of soils polluted with heavy metals and for soil quality improvement, retaining of water, ammonia and pH control. Native volcanic tuff supported with aluminum basic polychloride is applied in different proportions to soils, 0.1- 6 %, in order to block metals and decrease their mobility [1,2].

Factors which influence metals separation, using of chemical reagents for performances improvement of electrokinetic process were analyzed. When an electric field is applied between electrodes placed into soil, ions movement takes place due to electromigration, electroosmosis and electrophoresis processes. The evolution of pH gradient depends on buffering capacity of soil. The rate for ions migration is direct proportional with their mobility, valence, concentration, and electric field intensity [3,4].

In order to develop an electrokinetic method for extracting of heavy metals from the contaminated soils, an experimental laboratory model was made and started up. The main units are: power supply with the ratings of 40V DC and 5A DC; electric board and cable distribution box; set of electrodes for anode; set of electrodes for cathode; semi-permeable vessels for the anode and cathode; cell having about 40 litres capacity, containing soil sample. The conductivity of the circuits between anode and cathode was measured for various influence factors: electrodes type and their arrangements, electrode vessels, soil sample, humidity content of the soil. When the electrodes are placed in the semi-permeable vessels, the current slightly decreases after several hours of operation, because of the slow passivation. This experiment is on the run.

For determination of metals bioaccumulation into plants, experimental lots from waste mining deposit were cultivated with grasslands, as follows: four blank parcels (2 × 5m), cultivated with *Medicago sativa*, *Festuca arundinacea*, *Trifolium repens*, and *Lotus corniculatus*; four parcels treated with native volcanic tuff ($\phi = 1-2$ cm), 700 g/m², and cultivated with the same plants; and, four parcels treated with supported volcanic tuff, 700 g/m², cultivated also with *Medicago sativa*, *Festuca arundinacea*, *Trifolium repens*, and *Lotus corniculatus*. Now, the grasslands growing process takes place.

The results obtained concerning the use of physico-chemical and biological processes for remediation of soils polluted with heavy metals, allows technologies development from laboratory level to their application in polluted areas.

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GEOTECTONIC AND DYNAMIC MODELS OF SEISMOGENE AREAS FROM THE CARPATHIANS AND THEIR FORLAND

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This project presents a comprehensive study of intriguing Vrancea seismogenic zone. The high-seismicity areas involves integration of seismological information from this regions within the geotectonic framework specific to those regions. Information like this are fundamental in order to shape the areas of accumulation of stress generated by earthquakes as well as to update the dynamic models of the lithospheric blocks from these regions. Integrated interpretation of those areas generate the increase of knowledge degree of the areas of high scientific and practical interest (areas of high seismicity). The present project is based on this subject. It focuses on elaboration of geostructural models of seismogene areas using the

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tectonic (regional and local), seismologic (specially the focal mechanism) and crustal deformation (by GPS) information.

The database which will be built is represented by the synthesis of geologic, geophysical, seismological and geodynamic information on the lithospheric structure of the following seismogene areas: Vrancea, Făgăraș-Câmpulung, Danubian area of the Southern Carpathians, Banat, Crișana-Maramureș, Transylvanian Basin, Barlad Depression, Moesian Platform. .

Two sets of data are especially important into this documentation: seismological particularities (localization, fault plane solutions, source parameters) of the earthquakes generated into the respective areas, and the results of seismic investigations for deep crustal studies, based on refraction waves (international profiles from the eastern part of Romania, Oltenia, Transylvanian Basin and the Pannonian Basin, and also on the multiple coverage on near-vertical incidence on long time-span recorded seismograms, up to 20 s, on selected seismic lines from the hydrocarbon exploration activities, mainly from the Carpathian forland.

Coroboration of datasets will allow to generate tectono-dynamic models (regional and local) of the areas of high seismicity and deciphering the dynamic and space-time relationships between tectnic units belonging to these zones.

A special attention will be focused on the geotectonic and dynamic models of the Vrancea seismogene zone, the most important active seismic area in Europe, placed at the Carpathian Bend zone (the approximate boundaries being lat $45,0^{\circ}$ - $46,0^{\circ}$ si long $26,5^{\circ}$ - $27,5^{\circ}$). From the geologic point of view, the area belongs to the Tarcau and Subcarpathian Nappe sysem, as well as to the western flank of the Focsani Depression. The crustal events are less than 5,6 and the intermediate-depth ones are less than $7,8^{\circ}$ on Richter scale. A significant database will be analysed. It is is represented by records in order to relocate the seismic events using updated seismic wave velocity models.

Finally, advanced geotectonic and dynamic models for the seismogene zones and neighbouring areas will offer the stop-press geologic and geotectonic information, as well as the results of integrated seismological data processing.

This integrated database will be integrated into some tectono-dynamic models within the eastern Europe framework. The extension of the interesting elements into the neighbouring countries will be shaped up (areas of high stress accummulation, active faults) and a continental model will be sketched. This model, together with the detailed information from the above-mentioned areas, will allow the advance of knowledge on the mechanism of stress accummulation, and so, of generating seismic events. Such an advanced model, based on the new information and quantitative analysis, is a clear must, especially regarding Vrancea events of high seismicity and persistent character.

THE IMPACT OF THE CLIMATIC CHANGES UPON THE HOLOCEN AND PRESENT DYNAMICS OF THE ALPINE ENVIRONMENT FROM THE ROMANIAN CARPATHIANS. IMPLICATIONS IN THE RISK MANAGEMENT AND LANDSCAPE'S ARRANGEMENT – MEDALP

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The project covers a thematic less broached in the geographic scientific literature of Romanian and submits to the recent concerns of the Alpine Geography in France, Switzerland, Germany, Norway, Poland, Italy, USA and Canada and follows the pattern of

the thematic area of European interest concerning climate changing, and the effects of that on the environment and on the long term management of the landscape. The project proposes two major direction research:

(A) The Holocene-present evolution of the alpine landscape in the Romanian Carpathians

(B) The analysis of the present geomorphologic processes and drawing large scale maps of the geotop and landscape and the geomorphologic risk in order to conserve and manage on a long term.

The main aim is represented by the quantity and quality analysis of the alpine environments in the Romanian Carpathians, in certain characteristic areas, in order to reconstruct the landscape's evolutions in Postglacial (14000 years B.P- present); there will be a very detailed reconstruction of the climatic oscillation for the last four centuries partially documented by several scientists. The topographic and bathymetric measurements joined with radar scanning or field – GPR (Ground Penetrating Radar) and evidence taking (sample gathering in with the bodengreiffer) made in order to determine absolute age, are going to establish how old the deposits (peat, detritus) and the relief that covers the Pleistocene with the climatic and paleobotanical, dendrochronologic and lichenometric) data. Besides the obtaining of these data another aim is represented by the evaluation of the volume of the post-glacial deposits. So, it will be established much more precisely the exact recent (Holocene-present) evolution of the mountains landscape in the Romanian Carpathians, which compared with the environment changes in Tatra, Alps and Balkans, reported in the scientific literature will emphasise the great climatic oscillations their reflection in the geomorphologic and biopedologic associated processes (including extreme phenomena). A special care will be given to the glacial lakes in order to investigate the sediments that lay here, there also be analysed detailed maps of both the lake's relief and sedimentary cover (through isopahs), making use of the acoustic fathom devices (with echo-sounder and chirp – subbottom profiler). The second part of the project deals with the evaluation of the frequency and the intensity of the present manifestation of the geomorphologic processes through sets of specific measurements (topographic and bathymetric lifting, determining the temperature of the streams from periglacial deposits – BTS, watching the movement of certain guide marks, remote sensing and air-photogrammetry devices, dendrochronologic and lichenometric measurements) and will use the resulting data in order to draw morphodynamic and analytic maps, hazard and risk maps.

Project objectives. The project generally aims towards resolutions some essential problems regarding the alpine environment from the Romanian Carpathians, taking into account that the exiting works are relatively few and based mostly upon field observations, maps and relations between the relief and other environment components. The multi-proxy approach, the first of this kind ever made in our country in the study of the main elements of the alpine environment, assures the obtaining of very accurate result, that have eloquent relevance for the postglacial and present evolution of the alpine environment, making possible forecasting the future trends in the evolution. The issues differ from the ones in the Alps or even in High Tatra. The lack of well preserved moraines and the restoration of the soil and vegetation during the Holocene, the filling of the small lakes through eutrophisation, but mostly through the intense denudation of the mountainsides from the cryo-nival layer impose a specific approach. The work devices used are going to allow us a new approach, based on the quantitative elements of the alpine environment's functionality. In this context, the project will pursue **two major research trends**:

A. The postglacial evolution of the alpine environment in the Romanian Carpathians, emphasizing the present evolution; A.1. Sedimentary analysis of the lakeside deposits and of

the peat bog nearby based; sampling; A.2. The dating of cores deposits corresponding to the changing in facies and environment, and analysis of scree and debris-flow deposits and also on the würmian moraines deposits in specialized labs, including methods of dendrochronology and lichenometry; A.3. The reconstruction of the denudation processes from Late Würm to contemporary period; A.4. The reconstruction of the climatic oscillation from the alpine space for the last 400 years through dendroclimatologic devices;

B. The analysis of the present geomorphology processes and a large scale mapping of typical area and geomorphology risk processes, in order to preserve and manage on a long term the resources. B.1. Overlooking the present geomorphology processes; B.2. Investigating the present sedimentary processes in alpine area; B.3. Making detailed bathymetric maps for the glacial lakes; B.4. The analysis of the morphology changes register in the last 40 years in glacial cirque; B.5. Making risk maps of the investigated areas through GIS analysis.

Results. The training period, when the main research areas and points were chosen, was followed by field activities when topographic measurements with the Leica geodesic total station were made and bathymetric probes from Bâlea and Capra lakes were taken and in Bâlea and Valea Doamnei areas from Făgăraș Mountains rock samples were also taken. The samples of postglacial and lacustrine peat-bog silty sedimentary deposits was analyzed by Woods Hole Institute of Oceanography, and then the **morphometric and morphographic particularities** were made. **The digital modeling of the terrain** was elaborated next, based on which other important and with practical utility cartographic materials were developed, e.g. the **map of avalanche risks**. **The specificity of the climate** of the alpine domain in the Romanian Carpathians was also researched. **Dendrochronological researches** on the probes taken from the limit trees (*Larix decidua*, *Pinus cembra*, *Picea abies*) consisted in the checking and inter-dating of individual series of growth, the statistic analysis of the series of growth and the standardizing and production of the dendrochronologic series for Făgăraș Mountains. Preparations for the analysis with modern **geophysical techniques** (electrical tomography, seismic reflection and refraction techniques) of the surficial deposits in alpine areas were initiated.

INFORMATION SYSTEM FOR CONSULTANCY REGARDING TO AGRICULTURAL MANAGEMENT WITHIN NITRATE POLLUTION VULNERABLE ZONES ACCORDING TO NITRATES DIRECTIVE

Mihail DUMITRU¹, Sorin CAMPEANU², Catalina RADU³, Ion CREANGA⁴, Teodor JURCUT⁵

The project has the aim of elaborating an information multi-media system for dissemination, which includes data bases, system decision support, information and research related to way of defining, monitoring and management of vulnerable zones to nitrate pollution from agricultural activities, according to European Nitrates Directive regulations.

This integrated information system addresses especially to the stakeholders located in the vulnerable zones to nitrate pollution; for the presentation will be chosen that's

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technologies that adapted to local conditions will ensure a sustainable management of the environmental resources from the respective areas.

The interface between output data and the way of information of the stakeholders consists of a Power Point Presentation, that include data bases and information adapted to local conditions, management and specific traditions of the different zones that it will be accomplished in the last stage of the project. A comprehensive study will be elaborated, with exemplifications from vulnerable zones to nitrate pollution from agricultural activities which will constitute a presentation material for consultancy agencies. Case studies in areas located within vulnerable zones to nitrates from agricultural activities and within Cris and Arges watershed are carried out. The experience gained through the information transfer to the stakeholders from these areas will determine the extrapolation of these tool at national level in other areas vulnerable to nitrate pollution.

Following the scheduling scheme of the project, the second term of results reporting ended. In this period the activities carried out related to:

- 1) accomplishing the inventory of data basis, expert systems, simulation models and dissemination techniques of available results for consultancy of stakeholders/interested groups within vulnerable zones to nitrate pollution.
- 2) establishment of the environmental stewardship principles that have to be respected when agriculture management plans are accomplished, at farm level, for protection insurance, amelioration and/or conservation of the environment. These principles were established having in mind the benefits and also the risks of using the organic bio-products, especially the animal manure in agricultural management. The acknowledgement of the of an environmental stewardship principles within the stakeholders is obligatory for development of an sustainable and competitive agriculture system that has to protect the environment.
- 3) Characterization of the area vulnerable to nitrate pollution from agricultural activities within arges and Cris watershed. It was concluded that the nitrate concentration exceed the admissible limit of 50 mg/l in some areas.
- 4) Farm level nutrient management plan elaboration using farm nutrient balance estimations. Using AGENDA model, based on nitrogen flow at farm level it was accomplished a management plan proposed in a vulnerable zone to nitrate pollution, located within Arges watershed.
- 5) Storage type selection: factors, characteristics, conditions, for manure storage sizing. It was accomplished a case study in Budeasa, located within Arges county. Using a computerized system, for different condition (animal type and number, type of growing system, etc.), it can evaluate the optimum size of a manure storage.
- 6) Ways of animal manure application on open lots (grazing, pastures).

The results of projects will make the general public and policy-making communities more aware of the importance of conformation and monitoring following the Nitrates Directive. The results of the project will constitute a support for the consultancy concerning the manure management at the local communities level, for the dissemination of information at local conditions from the communes vulnerable to nitrate pollution and for implementation and monitoring of action programmes developed for vulnerable areas.

ECO-TECHNOLOGIES RELATED TO ADVANCED INTEGRATION OF INDUSTRIAL WASTES FOR A SUSTAINABLE DEVELOPMENT

Rachila IEREMIE¹, Elisabeta Pena LEONTE,² Gheorghe BARTIC³, Maria GHEORGHE⁴

This project proposes advanced integration of industrial waste, research being applied to waste resulted in the pulp and paper industry, generator of huge quantity of rejects. At present these rejects create increased environmental pressure due to important quantities involved in both as long-term (up to 40 years) accumulation in the existing landfills and as current generation in industrial processes. On the other hand, rejects present an important valorisation potential in other industrial fields or as secondary energy source. The aim of the project is to investigate, perform and verify techniques and technologies enhancing the added value of these wastes, approaching various research directions to elaborate 4 advanced valorisation technologies (integration into new construction materials, valorisation by composting or/and by fermentation with biomethane generation, energetic valorisation), integrated waste management IT model, an advanced waste integration strategy, as well as 3 waste processing or closure techniques of the existing landfill sites. The estimated period of project is 26 months.

The project activities, grouped into 5 stages, approach the complexity of problems using the following methods: quantification the technological, economical and ecological involvements of the waste management; waste characterisation related to their compatibility with the integration solution; develop alternative solutions and select the optimum one; develop advanced waste integration techniques, technologies and IT management model; dissemination the results and post-monitoring the project.

The project involves a multidisciplinary partnership (7 partners) (high skilled personal from pulp and paper, environmental protection, construction material and informatics – professors, doctors, engineers mathematicians and doctor candidates). The obtaining results will be extremely important to the whole economy due to a very severe decommissioning and closure terms established for the existing landfill sites.

The project objectives in a chronological order of performing are as follows:

1. Integrated analysis of the variety of wastes from the pulp and paper industry for real evaluation the existing situation, as a start point for research;
2. Identification the industrial waste utilisation alternatives through a multi- and interdisciplinary partnership;
3. Elaboration of alternative techniques and technologies for advanced integration of wastes;
4. Practical precompetitive demonstration of techniques and technologies proposed studying the potential implication and effect for a proper selection;
5. Create an integrated management model using IT resources and dissemination the results at inter-sectorian level;
6. Post-project activities (create post-project action capabilities).

Up to this moment the following two stages have been performed:

Stage I: Study of the approaching directions and quantification technological, economical and ecological aspects of wastes resulted in the pulp and paper industry:

- Quantification technological, economical and ecological aspects of wastes resulted in the pulp and paper industry

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- Identification essential elements for the integrated management of wastes
- Setting research directions for:
 - valorisation inorganic and organic components of waste in the construction material industry: as energetic source for ceramic products, creation of porous brick-lined masonry structures, composite material with inorganic sludge
 - biotechnological valorisation of the organic components
 - valorisation of the organic components: agro-fibre composite, combustible pellet, combustible fluff, cement from deinking sludge, thermal treatment (incineration, pyrolysis and gasification, sludge drying).

Stage II: Research for setting technical/technological conditions and elaborate preliminary solutions

The following activities have been performed:

- Characterisation of wastes related to the compatibility with the specific requirements of the approached research directions
- Setting the compatibility requirements of wastes with the studied advance integration directions
- Technical/technological management conditions of wastes at the generation, transport and processing stages in order to obtain proper characteristics for the studied advance integration directions
- Preliminary solutions for the studied advanced integration directions

During the next stages of the project the following researches are to be performed:

- *Detailed research study of the alternative solutions*
- Ecological techniques/technologies for the advanced integration of wastes and the implementation strategy of the integrated management in the pulp and paper industry
- Definition the portfolio of the ecological waste management techniques/technologies in the pulp and paper industry – valorisation/controlled landfilling/landfill closure

EARLY WARNING PILOT SYSTEM FOR HYDRO ELECTRICAL PLANT. CASE STUDY - VIDRARU

Ovidiu VASILIU¹, Constantin IONESCU²

The project presents a pilot system for seismic warning to be used in Hydro Electric Plants and to apply the research results in VIDRARU.

The project objectives are about resolving the issue of hydro electrical plants, connecting them to the national seismic warning system in case of major earthquakes.

At the present time the hydro electrical plants are not equipped with prewarning seismic systems and this is why our project is so usefully.

Creating the possibility of interconnecting to the national warning network will develop an entire system of strategies which are applicable by scientists from hydro electrical plants in order to minimise the damages in case of a major earthquake.

Aquired result so far is a study which contain:

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- international tendencies of grand accumulation barrages from Hydro Electric Plants seismic warning systems improvements;

- technical solutions proposed for the local seismic alarm systems and their interconnecting with national systems of seismic alarm;

- identification of the potentially seismic alarm systems beneficiaries from Romania and economic efficiency as well as costs evaluation;

- deterioration effects of the accumulation barrage over environment and people in major seisms cases.

In next stage our project will submit:

- project for interconnecting local seismic supervision network to the national seismic alarm system;

- project for hydro energetic systems adjustment disposals to the seismic alarm system;

- program for detecting and evaluation of the seismic events for warning;

- project for instruments able to receive the seismic warning signals delivered through the networks to the national seismic warning system and adjustment for Hydro Electric Plants used systems;

- experimental models for communication systems with the national seismic warning system, instruments for adjustment in the Hydro Electric Plant system, communication software with the national seismic network.

- testing reports for the experimental model of the warning system in Vidraru Hydro Electric Plant;

- system referential;

- presentation handbook;

- scientific papers published in specialised national and international reviews;

- scientific symposium with information diffusion on a large scale;

- methods of using and maintaining the seismic warning pilot system.

The spreading out of these results is presumed to take place in the final stages of the project for informing as accurate as possible the potential beneficiaries.

Through the promoted objectives, our study is included in the thematic area of PC7 in 2007 - 2013 period, particularly through issues of informatics technologies development as response to societal challenges, environment and long lasting development, decreasing vulnerability and control natural hazards and industrial accidents consequences.

This project is included in priority domains of integrated technological platforms developed at european level, where embedded systems are promoted.

For more informations please visit www.proctel.ro.

METHODS AND POSSIBILITIES USED TO DECREASE ENERGY CONSUMPTION DURING PETROLEUM & GAS DRILLING OPERATIONS

dr. ing. Grigore Tatu - IPCUP Ploiesti

Project no. 745/2006 “**Methods And Possibilities Used To Decrease Energy Consumption During Petroleum & Gas Drilling Operations**” has been developed by a partnership: IPCUP Ploiesti (CO); Petroleum-Gas University Ploiesti (P1) and ICPE Bucharest (P2). The project aims at identification of methods and possibilities in order to develop technologies and adequate technical systems to reduce energy consumption during drilling operations at petroleum and gas well sites.

The project aims at creating optional feasibility situations against efficiency and energy consumption during the drilling and production operations, for both the conventional and unconventional drilling technologies in order to allow for simplification of well construction, prevention and management of difficulties and complications occurred during the drilling operations in complex geological areas and decrease in the volume of displaced weks, respectively.

The studies developed in stages 182 hose underlined the premises in order to achieve the project objectives and also established the existence of a significant potential of the drilling, research and production activities for the next 15 to 25 years, with high recommendations to develop solutions, as follows:

- optional solutions in engineering activities for well drilling activities, for the conventional drilling technologies in order to increase drilling efficiency and decrease energy consumption during well drilling activities (simplifying the well construction) decreasing well bore diameter, optimizing the drilling features and drilling bits programs as well as drilling fluids program, optional choice for the drilling equipment type);
- drilling technological solutions and adequate technical systems (conventional, partly conventional and non-conventional) such as: drilling with a reduced diameter of the well bore, drilling technologies using the coiled tubing, drilling with casing, drilling with flow amplifier, drilling with submerged hydraulic/electric motors, smart drilling technologies, protective and compensatory technical systems for electrical drilling equipment powered from the network etc.

Both conventional and non-conventional optimal solutions, applicable with adequate technical systems (conventional, partly conventional and non-conventional) present a large potential to more efficient well drilling activities (sometimes more than 50%) and also a significant potential in decreasing the drilling costs (many times more than 25% to 30%).

The optional engineering solutions present a certain maximum level of feasibility while the drilling solutions and their adequate systems present a certain relative feasibility which is influenced by the economic availabilities (scientific and technical feasibility are a certainty).

There are certain implementation perspectives in oil and gas well drilling practice provided that the oil and gas deposits lease holders as well as the organizations in charge with oil and gas management will accept and apply optional engineering solutions while adequate conditions for engineering development and implementation of non-conventional solutions shall be provided.

NATIONAL STANDARDS FOR LANDSLIDE HAZARD MAPPING TO IMPLEMENT ON LOCAL LEVEL. STUDY CASE-HOREZU-COSTESTI AREA

Eugeniu Marchidanu¹, Dorin DORDEA², Radu STĂNESCU¹, Ioan CASAPU², Gheorghe DIMACHE³

The project presents a multidisciplinary investigation (*geological mapping, hydrogeological mapping, geotechnical mapping, short geomechanical drilling in zones with active or imminent landslide phenomena, electrical vertical sounding, inclinometrical*

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measurement, complex geotechnical analyses on in situ or core collected samples, physical - chemical analyses on rocks and underground water, systematic photogeological interpretation, database construction and GIS data processing, 3D modeling of the landslide affected zones detailed structure and elaboration of syntheses/proposals for the utilization of the results in correlation with the local authorities projects/potential).

The investigation concerns landslide affected area (Horezu-Costesti) which covers the whole variety of Romania landslide problems (*superficial landslide, deep landslide, plastic landslide, landslide on the basement, landslide through the basement*) and it aims to determine the *causes, the correlation between the deformations, the necessary amount of studies, research and calculation, prevention, control and monitoring solutions and measures*. In case of atypical situations (pollution indirect effects), specific investigations will be undertaken regarding *the secondary environmental impact*, the associated monitoring included. The project generates a model (also implying legislative modifications) regarding *the recording, the classification (typology and amplitude), GIS cartography solutions, monitoring, prevention and control solutions*.

The practical studies aim to rapidly and efficiently evaluate the **landslides spatial characteristics** (*the dismantling surface, the sliding surface, the landslide foot, the sliding accumulator, the landslide basis, the sliding mass, the transversal and longitudinal cracks, the old and predictable sliding trajectories*), **the security factor (the stability coefficient)**, **the landslide evolution orientation** (*delapsive, detrusive*), **the sliding surface position** (*consequent, asequent*), **the movement type** (*rotational, translational*), **the landslide phases, speed, periodicity and age** and **the definitional/generating factors** (*geological, natural mechanical and geomechanical, anthropogenic, hydrological, hydrometeorological and climatic, seismic, biotic*).

In accordance with the Romanian legislation (**Law 575/2001, HG 447/2003**) of natural hazards (flooding, landslides and earthquakes) the project present the map of the landslide potentiality built by vectorial layers (in STEREO '70 projection format) of the next factors:

- litological (Ka),
- morphological (Kb),
- tectonical (Kc),
- hydro-climatical (Kd),
- hydrogeological (Ke),
- seismic (Kf),
- forestal (Kg),
- anthropical (Kh), procesed in the following mathematical relation:

$$K(m) = \sqrt{\frac{K(a) \times K(b)}{6}} \times [K(c) + K(d) + K(e) + K(f) + K(g) + K(h)]$$

The project *Multidisciplinary research to elaborate a national standard concerning landslides mapping, zoning of the landslides hazards and implementation of the obtained data on national and local level* intends to obtain a set of acquired data, records and processed information regarding landslide phenomena that affects the earth's surface; the programmed works will be carried on according to a coherent schedule and will include the following **categories of activities**: *geological mapping (1:25.000), hydrogeological mapping, geotechnical mapping, geotechnical drilling, inclinometrical measurements, geological photointerpretation, vertical electrical sounding, geotechnical analyses, physico-chemical analyses on rock and underground water samples, data processing and integrated interpretation*.

The elaboration and distribution of the sounding questionnaires will be focused on:

- How comprehensive is the volume of information on the landslides?

- How accessible and enlightening are the presented data?
- How compatible are the data (especially the cartographic ones) with the local development plans (urban, forestry, agricultural, electricity, gas and water supply, etc.)?
- How much confidence does the proposed model benefit of?
- What chances have the proposed model for the landslides investigation, their prevention methods and their negative effects control, to be adopted?
- What chances have the proposed model to be applied, in the context of further commercial contracts for practical solutions?

The entire database, the graphical materials (GIS maps), the conclusions and proposals elaborated as a result of the detailed activities and, especially, the observations regarding the potential of implementation, at local and national level, of the generated models.

Taking into account the premises of a consistent program of data acquisition, processing and interpretation, after the completion of the program works in the target landslide affected Horezu-Costești perimeter (70-90 km²), the following products are delivered:

- detailed *geological map* (sc.1:25.000), with geotechnical elements,
- *hydrogeological map* (sc.1:25.000), with models of the freatic level and of the superficial aquifers, potentially influencing the terrain stability,
- *geotechnical map*, with detailed description of the landslides spatial and dynamic features,
- *drilling vertical cross-sections* through the landslides sectors potentially unstable areas,
- *inclinometrical data sets* from all the geotechnical drillings,
- detailed *photogeological map* (sc.1:25.000) of the entire area,
- *geological-technical cross-sections* showing the vertical development of the structures intersecting the landslides direction,
- *geophysical cross-sections* with the representation of the physical characteristics and the fields generated by the rock masses composing the stationary or sliding structures,
- complete *sets of geotechnical analyses* for all the recorded landslides and adjacent sectors,
- complete *sets of physico-chemical analyses* on rocks and underground water samples from the landslides sectors,
- *complex databases*, including all the acquired numerical and vectorial data regarding the space-time situation of the earth's surface in the target areas, in different representative context: geological, structural, hydrogeological and hydrological, morphological, geophysical, physico-chemical, physico-mechanical, topographical; the data will be organized in a manner allowing rapid activation and as simple as possible,
- *sounding questionnaires* for the potential local and national users of the data sets, including questions regarding: the relevance of the survey for the respective area, the applicability of the recommendations and zoning to the local development plans, the data accuracy, the possibility to improve the acquired and processed data, other suggestions.

RESEARCH REGARDING A NATIONAL RADON MAPPING (INDOOR AND IN DIFFERENT ENVIRONMENTAL FACTORS) FOR THE POPULATION PROTECTION IN CONFORMITY WITH INTERNATIONAL AND EU STANDARD REQUIREMENTS

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The project presents : A scientific approach of an Romanian Radon mapping , in conformity with WHO, European and International Standard requirements in field of population protection. Radon, which is a natural radioactive isotope, enriched in concentration in-door, which, through inhalation, produced pulmonary cancer. The daughters of Radon are solid, alpha desintegration isotopes which affects the human tissues. Like other environmental pollutants, there is some uncertainty about the magnitude of radon health risks. However, we know more about radon risks than risks from most other cancer-causing substances. This is because estimates of radon risks are based on studies of cancer in humans (underground miners).

Radon gas decays into radioactive particles that can get trapped in the lungs when you breathe. As they break down further, these particles release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of your lifetime. Not everyone exposed to elevated levels of radon will develop lung cancer. And the amount of time between exposure and the onset of the disease may be many years.

There is necessary to build a Radon mapping program to cover the Romanian area for in-door and exhalation from soil measurements. To take appropriate protection action for population in corresponding zone with big concentration of Radon there are necessary to have a map for Radon risk for indoor Radon and for environmental including seismic falls.

The main objectives of this project are:

- Implementation of an scientific quality assurance program for measurements of Radon indoor and soil exhalation;
- Generation of a program for measurements, acquisition of data;
- Development of new instrumentation and methods for Radon measurements;
- Correlation of data with geological units and soil maps for estimation of a transfer factor;
- Data base for Radon mapping;
- Preparation of proposals for a legislative initiative for an *action level* and public communication program based on the results of measurements.

In the first Etape of the project we are performed a study above the historical data regarding Radon measurements in Romania. In frame of a second etape we have to implement a set of Quality Assurance system for Radon measurements and to present the results of research in frame of developing new methods of in real time detection of Radon.

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GEOCHEMICAL ATLAS OF HEAVY METALS FROM THE SOILS OF THE IAȘI CITY AND SURROUNDINGS

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Emanoil GANDRABURA¹, Ciprian POPA², Eugen TEODORESCU-SOARE³,
Mihaela LUNGU⁴, Haino Uwe KASPER⁵, Oana STAN¹, Dan AȘTEFANEI¹ and
Cristian PATRICHE⁶

Objectives

The project presents a systematic investigation concerning the content and distribution of Zn, Cu, Fe, Mn, Pb, Ni, Cr, Co and Cd, heavy metals commonly found in the urban soils due to anthropogenic activities; Hg, Mo, As, Sn and Ba will also be considered depending on the quality of the analytical instruments.

The main objectives are:

- analysis of soil heavy metal concentrations (0-0,25 m horizon) establishing their concentration dispersion degree and geochemical evolution within the Iași City and surrounding areas, as a consequence of past and present-day anthropogenic activities;
- establishment of izoconcentration curves for several chemical elements (as shown in Fig.1);
- prognosis of heavy metal migration within soil and other environmental factors.

This will serve to the soil quality assessment and contamination level prognosis, including the identification of the anthropogenic polluting sources in the Iași City area.

The proposed perimeter is a square of approximate 16x16 km², which encloses the urban Iași City and surroundings.

The soil cover in the studied areas consists of the following types: Mollic Fluvisols, Gleyic Fluvisols, Stagnic Fluvisols, Calcic Phaeozems, Chernozems, Calcic Chernozems, Vermic Chernozems, Eutric Regosols, Mollic Technosols, Siltic-Clayic Tehnosols, Horticultural Anthrosols and Eutric Anthrosols (WRB–SR-2006).

Results

Topsoil samples were collected on a grid of 500 m, from a depth of 0-25 cm, with a 25 cm long hand sampler. So far, the study was concentrated on a number of 300 samples from the agricultural soils and forests covering the NE and SE areas of the survey perimeter. The samples weighing between 1.5 and 2.5 kg were dried and sieved to < 1 mm fraction and then randomized and analyzed by Atomic Absorption Spectroscopy (AAS). pH was also determined by using a Corning M-555 pH/Ion Meter. External check was performed on 18 samples (10%) by X-Ray Fluorescence Spectroscopy (XRF) at the University of Wien, Austria and by AAS at the University of Katowice, Poland.

The heavy metals contents of the samples is presented briefly in Table 1:

- they range between the normal values for soils: Zn, Cu, Fe, Mn, Pb, Cd, Co;
- in some cases, they surpass the limit of intervention: Cr and Cu;
- in all cases, they surpass the limit of intervention: Ni.

Significant positive correlations have been determined for the following chemical elements pairs: Zn-Cu, Zn-Cd; Cu-Pb, Cu-Cd; Fe-Mn, Fe-Co; Pb-Ni, Pb-Cr; Co-Cr; Ni-Cr and significant negative correlations for Cu-Co and Cd-Co. The soil pH varies between moderately acid and strongly alkaline.

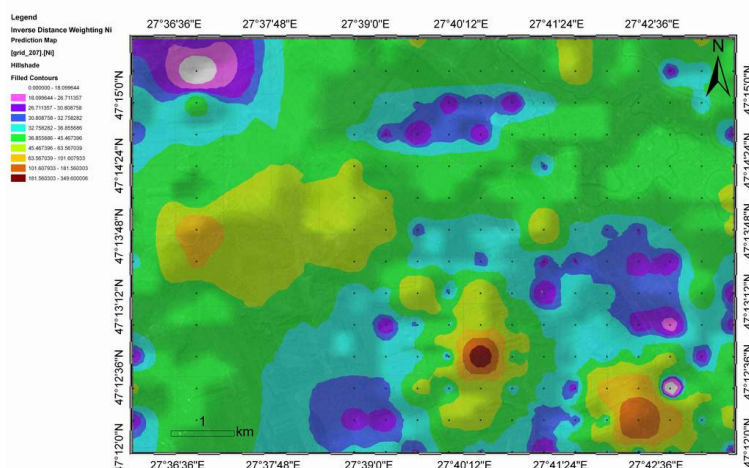


Fig. 1. Izoconcentration curve for Ni in the NE area of Iasi city

Table 1. Qualitative parameters of Iasi soils and surroundings (ppm)

Element	Range interval		Average	Normal values*
	Minimum value	Maximum value		
Zn	40.1	1620.3	86.446	100
Cu	11.6	308.3	40.227	20
Fe	7118	32586	19282,460	35000
Mn	50	1669	631.375	900
Pb	4.5	209.8	18.503	20
Cd	0,08	2.368	0.447	1
Co	5.1	14.3	9.336	15
Ni	13.5	349.6	39.785	20
Cr	6.6	591.6	28.589	30

*As of Romanian legislation

Heavy metal contents is contrasting, from normal to high values even in the same profile. The current work has established a possible anthropogenic geochemical Ni, Cu anomalies for the entire preliminary research area and a localized one for Cr and Pb. The possible causes of the anomalies could be: plastic industry, steel works, refractory bricks factories, traffic, coal combustion, waste disposal and incineration, fertilisers, insecticide and genogenic dust.

Expectations:

1. the establishment of the the heavy metal concentration level by comparison to the soil quality norms and standards operating on the European Union territory;
2. the identification of quality inconsistent areas;
3. the identification of sources and geochemical evolution of heavy metal concentrations in soils belonging to Iași City and surrounding areas.

The geochemical atlas of heavy soils from the Iași City and the surrounding areas will allow to emphasise the potential alert or intervention thresholds of the mentioned pollutant agents concentration in the soils of sensitive use (soils belonging to residential and leisure areas, agriculture fields, protected areas or restricted sanitary perimeters) and the authorities intervention in controlling the remedy and removal or diminution of the pollution sources.

ABSOLUTE AGES BY NUCLEAR METHODS AND APPLICATIONS IN ARCHAEOLOGY, GEOLOGY AND ENVIRONMENT

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OBJECTIVES:

The main objective of this project is the acquisition of a modern equipment for TL/OSL (TermoLuminiscence and Optical Stimulated Luminiscence) dating and the building of an interdisciplinary team of physicists, geologist, chemists, and historians, team capable of integrating the research in the European scientific interests.

A second objective, closely related to the first one, is represented by the development of laboratory techniques (physical and chemical methods) for preparation of quartz and feldspar samples in order to measure the archaeological or geological dose. Moreover, a correct dating technique, with reasonable error bars, requires an improvement of the existing procedures of the annual doses, which includes precise measurements of U, Th, and K content of the samples and of the surrounding soil. Such measurements are useful also for radioactive pollution problems or for alternative dating methods for the U and Th series.

The scientific objectives are of three categories:

- Dating studies of archaeological samples (ceramics, bricks, etc.), first of all for materials of interest for the two History institutes involved in the project. Both of them have archaeological sites opened, and, in addition, the Systemic Archaeology Institute from the University of Alba Iulia participates in the archaeological approval of the project of the Oradea-Brasov highway, which offers the possibility of dating of the recovered material. The method to be developed will allow dating of the materials from all ages: medieval, old, Neolithic,

- The starting of TL/OSL dating measurements on loess from south of Dobrogea and on loess and paleo-loess profiles from Mostistes (south-east of Bucharest, Danube fields).

The loess deposits in China, Central Asia, Europe and USA provide records of the past climate, thus allowing the reconstruction of long-term temperature climatic fluctuations. The use of the age estimates obtained with the TL method has allowed the inter-regional correlation of the sequences of Loess deposits. The further development of the optical excitation method (OSL) has led to a rapid increase in the number of studies devoted to the question of the Loess deposits age determination. Such projects based on the OSL method are being currently pursued practically everywhere in the world. We note that a benefit of this collaboration is that she will acquire the necessary experience for a rapid implementation of TL/OSL methods at our laboratory.

- Future approach of issues concerning the retrospective exposure to radiations and the quality control of irradiated food. The reconstruction of the radiation dose may be achieved by thermoluminiscence measurements of the minerals from the environment (such as bricks, tills) used for buildings. Two other very useful materials in this context are the porcelain used in the bathrooms and the ceramic insulators of the power lines. The OSL method is efficient in these cases, and the experimental set-up for such measurements on core extracted from bricks or porcelain has been developed since 1996, and a large number of such measurements have

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been performed by I.K. Bailiff et al (I. K. Bailiff, et al., Health Physics, 86, 25-41, 2004; L. Heide, S. Shalom, Giosku, LED 2005 – 11-th International Conference on Luminescence and EPR Dating, Cologne, July 24 – 29, 2005, Book of abstr. pg. 84).

OBTAINED RESULTS:

- In the first year – 2006 (Etapa I) were collected and measured samples of Roman and Neolithic pottery implying all project participants. For sample collecting were implied two institutes (MUZEUL NAȚIONAL DE ISTORIE A TRANSILVANIEI-CLUJ, UNIVERSITATEA 1 DECEMBRIE -ALBA) and for analysis “Sucursala Cercetări Nucleare Pitești”. INCDTIM – CLUJ and GEOECOMAR provided documentation studies about annual dose determination and loess samples gathering.
- Two PhD students made research stage in Dating laboratory of Gent University, measuring Romanian ceramics and China loess.
- It was published the paper „Preliminary dating results for ancient ceramics from Romania by means of thermoluminescence (C. Cosma, V. Benea, Alida Timar, D. Barbos, C. Paunoiu) in ISI journal Radiation Measurements, 41, 987-990, 2006
- An oral presentaion in December 2006 at local Symposium organised by History National Museum of Transylvania was sustained.
- UNIVERSITATEA 1 DECEMBRIE –ALBA and INCDTIM – CLUJ purchased devices and working materials necessary to project progress.
- In the second year (2007- Etapa II) – until now were continued, only by UBB – Cluj, which is lonely implied in the project during 2007 the studies about ceramics and loess dating and it was ordered a Riso TL/OSL dating installation which will arrive in December 2007 in our laboratory.
- For annual dose determination it was updated a gamma-spectrometry method to measure U, Th and K concentration. A Monte Carlo method was performed for quantity analysis, also reference materials for AEIA were purchased.
- Devices for loess samples analysis by TL/OSL method were produced
- A poster presentation at 9th International Conference “Methods of Absolute Chronology” 25-27th April 2007, Gliwice, Poland of the paper “Luminescence dating of Neolithic ceramics from Romania” (Benea Vasile, Vandenberghe D., Van den Haute P., Cosma C., Timar A., Gligor M. and Florescu C.). This paper was accepted to publication in ISI journal *Archeometria* during 2007.
- At international Whorkshop IX-ESIR (EUROPEAN SOCIETY FOR ISOTOPE RESEARCH), in Cluj-Napoca will be presented an oral work: “Estimation of environmental radionuclide concentration in soils, a comparison of methods for the annual radiation dose determination in luminescence dating” (Alida Timar, Constantin Cosma, Benea Vasile, Robert Begy Viktor Jobbagy, Gabor Szeiler, Dumitru Barbos, Dan Fulea).

PERSPECTIVES 2007:

- Collecting and preparing the samples (loess and ceramics) for dating after device receiving.
- Laboratory for samples preparing will be updated in the next months.
- Stage in the Gent laboratory (PhD) and the first Romanian loess dating – autumn 2007
- A PhD thesis sustaining in December 2007 (Benea Vasile)
- Receveing and first tests with our installation (Riso- 20 –TL/OSL)

RESEARCH PROJECT ON HYDROGEN ENERGY TECHNOLOGIES BASED ON THE RENEWABLE ENERGY SOURCES AVAILABLE IN THE DOBROGEA REGION

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The aim of the project is to evaluate the potential renewable energy sources in the Dobrogea Region. The main interest of the project will consist on the evaluating of the following sources: biomass, wind and solar energy. The major outcome of the project will consist on the development of a research tool for the evaluation of the technologies for the conversion of these energy sources into hydrogen production that can be further used as a future energy vector in an alternative energy system concept for the Dobrogea region.

The project has a complex structure and it is implemented by a group of research teams. The main goal of the project consists on the development of some key competencies in order to create competitive advantages for the partners in the European projects, like: original technologies for the accelerated production of biomass based on the purification of the sewage and Danube waters; innovative technologies for hydrogen production at low costs and in large amounts; advanced engineering methods for the development of the supply systems using alternative fuels.

Original processes for the hydrogen production will be evaluated using catalytic properties of the solid or melted state metals and alloys, specially the hydrogen production by the atomic disintegration of the gases formed in eutectic metal tanks, by the catalytic reformation of the resulted ethanol from the biomass fermentation or gasification and the improvement of the existing technologies (catalytic reforming of hydrocarbons) for reducing the hydrogen production costs, transition to the usage of the new renewable sources (fast growing biomass on the sewage water in the process of purification or in the plants growing in the Danube Delta area).

In order to increase the raw material supply for the hydrogen production, research studies will be carried out for the accelerated growth of the aquatic plant biomass, including algae, in the Constanta County effluents, by using the existing pollutants and by biological purification of these effluents. At the same time, it is necessary to study the possibility to use the collected pollutants by the Danube waters from the riparian countries in order to increase the biomass growth of the Danube Delta plants. Both kind of biomass will be used for the production of biogas by anaerobic fermentation, production of syngas by gasification and production of hydrogen by pyrolysis. A share of the produced biogas and syngas will be converted in hydrogen through specific processes.

The research objectives of the project are as follows:

1. The evaluation of the biomass, wind energy and solar energy potential in the Dobrogea region. This objective aims to correlate and validate some present disparate and often contradictory data. The objective will take the shape of some reports that would be available for the rationale of the future projects either at a national level or for the FP7. These reports will be required also for the initiation of future investments in the area.
2. The definition of the energy technologies for hydrogen production and the evaluation of their efficiency, performances and environmental impact. In the HyRes project we aim to evaluate the existing solutions for hydrogen production underlining the existing potential. In this way, it is intended to be developed the competence of the project partners for future international cooperation and to be defined some original innovative solutions to increase the Romanian research field image on the European ground.

3. The development of the concept for an alternative energy system for the Dobrogea region connected to the European strategy in this field. There are already known some actions at the European level that have encouraged some regions to become promoters of the alternative energy systems, like Iceland, the Azore Islands, Malta, Lombardia Region, Venice region. These actions are based on a compelling scientific research and based on which it was further developed a credible and feasible concept from the economical point of view. The main objective of the HyRes project is the definition of such a concept for a special particular region like the case of Dobrogea region.
4. The definition of implementation directions. The project aims to establish a roadmap for the implementation of an alternative energy system in the Dobrogea region that could be correlated to the European strategy but also to the national strategy related to this topic, and to evaluate the implementation mechanisms.

The results of the first faze of the project consisted on the evaluation of the biomass potential that could be processed at industrial scale in the Dobrogea region. This study includes the followings aspects: the evaluation of the biomass potential in the Danube Delta; the evaluation of the biomass potential in the fresh water lakes; the evaluation of the biomass potential in the purification equipment in the Constanta City; the evaluation of the biomass potential resulted from the agricultural activities; the evaluation of biomass potential resulted from the activities on the Danube course.

In the current stage of the project it was designed a testing stand in order to assure the requirements for the research activities. The stand shall provide the required conditions for experimental investigations on the following processing technologies: anaerobic digestion of biomass, gasification of biomass, pyrolysis of biomass, reforming unit, gas clean-up unit.

The concept of alternative energy system for the integration of alternative energy sources and the implementation strategy represent the most important output of this project and it will become a very useful tool for regional planning.

MODERN CONCEPTS WITH SPECIFIQUE EUROPEAN ROOLS REGARDING THE NOICE OF THE SURFACE TRANSPORT GREENING

Mariana ARGHIR¹, Maria MIRCEA², Istvan KOVACS²,
Florin BLAGA³, Cristina BORZAN⁴

1. INTRODUCTION

The „**Modern Concepts with Specifique European Rools Regarding the Noice of the Surface Transport Greening**” theme is part of Module I – Complex Research and Development Projects, is a huge project that covers a large space (the city of Cluj-Napoca, the surrounding establishments) and a long time (we are willing to extend the research over the entire Romania) and will be solved with the help of researchers from universities (three universities) and a specialized research institute in automation and measurements.

As part of the research, the Romanian laws connected to the field will be study with respect to the laws existing in the European Union as the aderation of Romania to the EU is conditioned by the environmental factors improvement.

The proposed theme follows Resolution no.321 of the Romanian Government regarding the ambiantal noise evaluation and management. The research proposal tries to

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extend the Resolution no.321, with the help of computer technologies by designing and developing a software application that would support the evaluation of noise pollution. The project comes to this decision, and contains two different parts: first is for the evaluators teaching and the second is for the evaluation itself. The Romanian proposal solve this problem using an observer, handling registration, but this way is not in top, that means it is necessary to automate this process, and this is the due of this project. The package of computational programs has a destination with the people who work in this field; they are local authorities, national authorities, environment inspectors and police inspectors. As we know, in Romania and anywhere in the world, the “noise map” uses the direct observations, without any automations process. The proposal project contains the “noise map” with automations process for the surface transport. Specialists, local authorities, national authorities as well as environment evaluation agencies will use the software application. At the final stage of the project, the members of the research team (the four institutions) will publish the obtained results and will teach the users how to solve the major theme – noise pollution – of which Romania is directly responsible with respect to the European Union.

An important remark that must be taken into account is that humans perceive sounds and noise and even animals by an important sense, the hearing, for which if no protection is provided by the society will make the individual to protect himself by leaving the noisy environment. As the human body has no special organs for perceiving directly the vibrations, the disease they produce, for example the disease of white fingers can measure the effect directly. As almost no measures of protection of the individuals are taken against the vibrations, the current project will develop a study of the possible negative effects of vibrations on humans.

2. OBJECTIVES

General Objectives are:

- sound pollution factors analysis, according to the Romanian Laws and the potential solutions with local resources that can be used to align at the European requests for ambiantal environment and population protection;
- time and space measurements for the sound pollution factor;
- purchasing, organizing and management of databases specific to the sound polluter;
- sound-vibration model and signaling the dangers of vibrations over the human body as humans have no adequate sense of protection against vibrations;
- setting-up a laboratory for measurements and analysis of the sound polluter;
- elaboration of the methodologies of adaptation for devices specific to environmental factors in order to obtain he effect of the sound polluter;
- development of software applications for the sound polluter instruction;
- development of software applications for the sound polluter evaluation;
- information dissemination by brochures, web pages and communications at scientific conferences;
- writing courses for simple users, official users like local or national authorities or environment evaluation agencies;
- workshop organizations in the county of Cluj and in the limitrophe counties: Bihor, Salaj, Bistrita-Nasaud;

Measurable objectives:

Some of the measurable objectives obtained by this project implementation are:

- the noise map for a part of Cluj-Napoca city as an exercise to check the proposed methodology;
- software developed in order to instruct the sound polluter;

- creation of a pilot laboratory for observing the environmental factors, their study and establishing the possibility of prevention of pollution as well as the diminution of the sound pollution;

3. RESULTS

In this field the immediately results are:

- the study of the national and international Laws and Standards of the noise and vibrations fields (474 Romanian standards, 2 Romanian HG, 52 European Laws) and them accordance;
- creation of a pilot laboratory for observing the environmental factors, their study and establishing the possibility of prevention of pollution as well as the diminution of the sound pollution, having all the devices and laboratory measurement apparatus using the project financial resources;
- organizing the international conference named ADEMS'07 , between 7th and 8th June 2007 with a special section "Sounds and Vibrations" where the members inside the project realized 15 scientific papers publish in the revue ACTA TECHNICA NAPOCENSIS ISSN 1221 – 5872, Editor Prof. Dr. Ing. Mariana ARGHIR;
- elaboration of the methodologies of adaptation for devices specific to environmental factors in order to obtain he effect of the sound polluter;
- measurements of the sounds and vibrations on the choosing point in the Oradea locations.

INCREASING THE EFFICIENCY OF THE PHOTOVOLTAIC CONVERSION OF THE INDIVIDUAL PANELS BY USING TRACKING SYSTEMS

Ion VISA, Anca DUTA¹, Vistrian MATIES², Nicolae OLARIU³, Radu DAMIAN⁴,
Dan Ilie TEODOREANU⁵, Alexandru SIRETEANU⁶, Ioan TOTU⁷

The MECSOL PV project aims to design and develop novel tracking systems for individual PV panels and to formulate new solutions for integrating in the built environment for increasing the solar to electrical energy conversion. The first step of the project performed a comparative analysis of the problems and solutions related to the tracking systems of the PV modules, based on mechatronic systems an on memory shape alloys. The second step, finished in the end of June, targeted the selection, development, optimization of the virtual prototypes of the tracking systems. During this step there was also identified, developed and optimized the electrical connectivity solution of the systems including tracked PV panels. The optimized tracking movement correlates the incidence angle with the direct radiation, normal on the panel, for maximizing the product between radiation and the cosinus of the incidence angle. A unitary model of the solar angles was developed, correlated with the representative types of LCDO of the PV panels including: the incidence angle sun-panel model as correlation with the LCDO types previously defined; the model of the incident solar

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radiation, falling on fixed and tracked PV panels; the analysis of the effect when reducing the angle orientation and the action step, on the incident radiation perpendicularly to the panel.

As result of the multi-criteria analysis, a feasible solution could be formulated: using manufactured actuators, produced by experienced companies; in the market there are now to main types of actuators: linear, with helix couples and rotating actuators, of different types: precession, cycloid, harmonic, etc.). The linear actuators offer, in this application, a higher technical and economical efficiency when/if reducing the angle domain. Nine conceptual mechatronic solutions were selected, representing the basis of the constructive design and for virtual prototyping, numerical simulation and dynamic optimization.

There were identified the main constructive modules of the tracking kinematic chains, the efforts were identified and the materials were selected; the pre-dimensioning step targeted the parts with maximum load, the linear actuators and the development of the geometric synthesis of the actuators; there were also checked the joints between the actuators and the structure of the open kinematic tracking chain. There were considered two representative mechanisms: tracking, bi-mobile systems of pseudo-equatorial type and one of bi-mobile, azimuth type. The constructive design lead to concrete solutions for the structure strength, for the structure elements attached to the PV panels, for the elements linked with the main rotation axis and for the support. The system resulted was virtually prototyped, simulated and analysed using FEM; the modification resulted after the numerical simulations were operated in the assembly design. The software developed using LabView, allows the modelling and simulation of a control algorithm for the movement of the tracking mechanisms of the individual PV panels. Different types of responses to the control system were analysed.

Using the ADAMS software (based on the Multybody System, MBS, method) the virtual prototype was developed applying, on the bodies, the geometric and kinematic constrains and the external system of forces. In the case of the joints in the kinematic chain, for the daily motion, a strong increase of the reactions is registered, caused by the sudden rotation of the actuator in a very short period of time. Excepting this interval, a relatively slow variation is obtained. The identified problem will be subject of the dynamic optimization of the tracking system. The maximum energy consumption is associated with the continuous back-movement of the tracking system, at the end of the day. Excepting this period, increased energy consumption appears during the overlapping of the two rotations, in a period of about one minute. Based on the analysis of the diagrams, one can conclude on the possibility of an exact control of the tracking movements, with short transition periods, insuring the system stability.

The virtual prototyping platform of the tracking systems includes three software products: CAD, MBS and FEA and one PDM (Product Data Management) software module, for data management. Using the virtual prototyping platform, the digital prototype was developed and the mechanical tracking system was optimized, by modifying specific (mainly geometric) properties. As example the pseudo-equatorial system was considered. The optimization of the dynamic behaviour objective is the reduction in the energy consumption of the actuators' motors along with the reduction of the reactions in the mechanisms joints.

Two new versions, at the level of functional design, were developed using memory shape alloys.

For the systems with tracked PV panels, there were modeled the electrical losses, especially considering the panels interconnection, demonstrating the option for paralel connection. Advanced modelling proved the need to consider the Joule effect and the optimized solution for reducing it is to develop serial connection of PV blocks, paralelly connected. The studies prove the superiority, of the off-grid coupling, admitting both, DC and AC consumers.

The constructive solution for 14 panels was developed, considering 11 tracked and 3 fixed panels (references, fixed at three different angles). Four different interconnection situations were analysed and the optimized solution was identified, with nominal voltage of 24V, in the

rechargeable battery. The photovoltaic response was modelled for a system with tracked panel, analysing the variation of the fill factor (FF) proving a strong influence during winter and cloudy days. Using the N Sol software a simulation of a 1KWp PV system with tracked panels was done and the average active surface was estimated for different PV materials.

In the next steps, the project's activities aim to develop the demonstration systems; therefore, the detailed design will be developed, and the real prototypes will be assembled by the industrial partner. A special attention will be given to the solutions for integrating in the built environment. The 11 prototypes will be installed and tested in the real environment under monitoring the electrical response. Based on the results, optimisation studies will be performed, targeting a maximum energy efficiency, considering the energy gain (tracking) and the energy consumption (tracking movements).

The project is launching a summer school (August 2007, Agigea) for young Ph.D. students and complementary education and training programmes were developed: the new Diploma programme Engineering of Renewable Energy Systems (starting with October 2007), M.Sc. new modules and Ph.D programmes (so far three). Dissemination was performed in major scientific events (26 papers published in international conference proceedings, among them 6 in ISI proceedings) and 20 papers published in IDB journals. So far two proposals for international projects were launched (1 FP7) and five meetings with international future partners were organized.

EQUIPMENT OF HIGH ENERGETICS EFFICIENCY FOR UNDERGROUND STORING OF NATURAL GASES IN AREA WITH HARDENES FEEDING WITH GASES

Ing.Marian Nitulescu INCDT-COMOTI

OBJECTIV

Proposal of project "Equipment of high energetic efficiency for underground storing of natural gases in area with hardest feeding with gases" have final objective the realization efficient equipment for underground storing of natural gases. This project respond to acute necessities – growing of storing capability and safety feeding with natural gases – development in Romania of design and realization of turbo machines respond to necessity of Romanian industry for integration in industrial structures with high level of performance (U.E.). This project is based on knowledge from international projects and he helps us to realize a new concept of design, dimensional control and mechanical realization of centrifugal rotors.

In start of project pass from initial phase – theoretical analysis of technologic process of store and research of gas dynamics of stage of compressor – to elaboration of reference material, realization, experimentation, making of modification for growing of product quality. In final stage, the product needs answering to all conditions of storing station.

Project objectives (new concept of design, new technology, and new product) grow capabilities of Romanian Research-Development-Innovation (RDI) system to accumulate knowledge, results and experience in scientific and technical field and to transfer to economic field. These projects realize a concentration and capitalization optimum of scientific and technologic potential. New research network integrate institutions of Research-Development from whished field and grow capability of Romania to provide competitive partners in scientific and technical co-operation programs and in international technical alliance. This

project is conformable with priorities of CEEX program because realize an growing of quality and performances in Research-Development activities through:

- the growth of level of compatibility and competition needful for integration in European area of research

concrete preparation for participation at next RTD Frame Project 7 of E.U

ACTUAL STAGE OF THE PROJECT

In stage A I.1 and A I.2 was necessary an analysis of current situation of storing natural gases in underground storehouse correlated with identification of technological process for storing of natural gases in underground storehouse and presentation of research in gas dynamics of centrifugal compressor stages for optimizing this compressor for high pressure. Because this equipment work in explosive atmosphere is necessary an analysis and recommendations for conditions and standards used for design, realization and working.

The stage A II.1 will provide documentation for optimal constructive and functional solution for equipment, and for impeller realization (functional model)

TECHNICAL, SOCIAL AND ECONOMIC IMPACT

Technical and economic impact:

- new activities for company in compressor field
- reduction of energetic consumption for 1000 Nm³ natural gases store
- the value of the investment is liquidate in short time because low price of equipment and energetic efficiency
- the reduction of financial effort by equipments with high efficiency in country

The realization of this project facilitates the alignment of Romania with scientific and technical requirement of E.U.

Social impact:

- the realization of the project maintain jobs for personnel with high qualification in research and development
- politics of implication of young graduate in research development activities
- growing of safety for feeding with natural gases
- growing of safety for operating personnel
- growing of jobs in company involved in the realization of the project

ADVANCED TECHNOLOGIES FOR MANAGEMENT AND MONITORING OF NATURAL RESOURCES EXPLOITATIONS HAVING HIGH RISK TO GENERATE NATURAL DISASTERS

Ștefan Popescu, Eftimie Nițescu, Maria Radoane, Carmen Maftai, Nicolae Iosub

The project presents a mixed system for Advanced Technologies for Management and Monitoring of Resources Exploitations (TAMMER), designed to create conditions for both a) sustainable development of the economy based on exploiting and processing natural surface resources (particularly gravel pits) and b) real and efficient environment protection in the operating zone (particularly in the river bed).

The TAMMER system represents a real engineering use for high technologies from communications like GPS (Global Position System) and informatics like GIS (Geographic Informational System), and the implementation in practice suppose the fulfil of three objectives:

1° Technological transfer and adoption of GPS and GIS techniques for monitoring and management for gravel pits exploitations, definitions for monitoring criteria and for structural and functional system of TAMMER.

2° Realisation of a complex system which must assure in real time the environment monitoring in the operating zone of the gravel pits and in the same time, the management of their economical activity.

3° Implementation of a Regional Pilot Center (N-E of Romania) for management and monitoring for exploitations of natural resources (particularly gravel pits).

The analyses and interpretation of the former studies (developed by the our team of researches and other specialists in the field), concerning to the problem of the mineral aggregates from the river's bed, and regarding the legislation in the Water Resources Management, have permitted the following results:

1. Scientific and technical substantiation of the monitoring parameters (from TAMMER system).

2. Identification for two representative gravel pits (Preotești and Miroslăvești), from the hydrographic basin of Siret river (the biggest producer of mineral aggregates from Romania), for which the research team obtained approvals to develop experimental researches concerning the project objectives and activities, from both parts: Economical agents (SC ALDP SA, Iași and SC CONBETON SA, Iași) and Contracting authority namely "Romanian Waters" National Agency (RWNA).

Researches developed in the first stage have been finished trough:

3. Elaboration the structural sketch (from three subsystems: for river bad monitoring, for gravel pit's monitoring and for pit's management), establishing of functional characteristics for TAMMER system and specification of real conditions to adopt GPS and GIS techniques in this system.

In the second stage the research team have obtained the following results:

4. GPS survey and making numerical topographical planes and 3D models for the site of the two gravel pits (Preotești and Miroslăvești) – both for the initial situation (January 2007) and for the actually situation (June 2007).

5. Establishing mathematical and numerical models for the river bad's sector, which is influenced by the gravel pit's operating, on purpose to numerically simulation of liquid flowing and alluvial runoff, in representative scenarios (for minimum, average and maximum discharges).

6. Development of the subsystem for river bad's monitoring, both hard and soft, and initializing for an informatic data base (DB), necessary to design the thematic charts for interested parts (RWNA and Protection of Environmental Agency).

7. Elaboration the functional sketch for gravel pit's management on purpose to create conditions for sustainable development and elimination/minimization of negative effects which are induced by pit's operating.

These research results were disseminated as follows: a) 2 registered requests for Romanian Patent; b) participation to Patent exhibition "Ecoinvent 2007" from Iași; c) participation with a paper to International Conference "Water Management IV, May 2007" from Kos, Greece; d) 1 scientific book in a CNCSIS recognized publishing house; e) 16 published papers.

Later researches will be concentrated on the elaboration of subsystems for gravel pit's monitoring and for pit's management; final expected result there is creation of a Regional Center – Nord-East for monitoring and management of all large gravel pits from hydrographic basin of Siret river.

As well as expected research results will be disseminated by participating with articles at national and international conferences related to environment and economic sustainable development; moreover project's theme will also become the subject of a doctor's degree thesis.

THE IMPACT OF THE HYDRO-CLIMATIC, SOIL AND GEOMORPHOLOGIC RISKS ON THE ENVIRONMENT OF THE BARLAD BASIN

Constantin RUSU¹, Ionuț VASILINIUC¹, Iulian-Cătălin STÂNGĂ¹, Lilian NIACȘU¹, Adrian URSU¹, Ionuț MINEA¹

Our project implies the modern and systemic approach of the problem of the natural hydrologic, climatic, geomorphologic and soil risks, of their impact on the environmental quality and of their role in territorial management, with the purpose of the sustainable development of the human communities from Barlad basin. In this view, certain activities are imposed, such as: the qualitative and quantitative analysis of the present state and dynamics of the potentially negative impact processes and phenomena on the environment (implicitly on the human society); the identification of the areas of high vulnerability degree through the probabilistic analysis of the natural hazards taken into account; field surveys; laboratory analysis and the exploitation of the modern research techniques (GIS and remote sensing). On the other side, the project implicitly offers the scientific basis, the analysis and implementation possibilities of the research results, through the collaboration with the public authorities from the local, regional (county) and central level.

The accentuated dynamics of the slope processes (sheet, rill and gully erosion, mass wasting) is reflected in the continuous diminution and degradation of the soil resources, especially in the conditions of the largely inadequate use of the agricultural terrains, the destruction of communication infrastructure and even of the human settlements (mainly rural), contributing to the riverbed aggrading and accelerated clogging of the water reservoirs, with impact on the flood wave propagation. From this point of view Barlad basin represents an area of a high vulnerability degree, and the research is imposed as a necessity for the elaboration of new solutions for the optimum valorification of the natural resources, and of territorial management schemes for the conservation of environmental quality and for the sustainable development of the human communities from the area.

The hydro-climatic risk phenomena are quite frequent in a region where the variations amplitudes of the climatic elements are very large, and the frequency and intensity of the meteorological impact phenomena with potentially negative impact are also high. The thermal extremes, the early autumn and late spring frosts, the excess precipitation quantities (excess periods or torrential rainfall) and their impact in the erozional processes acceleration and flood occurrence, the drought and rainless periods, the frequency and intensity of hail, glazed frost and their impact on the socio-economical activities are well defined study directions. At the same time we will study the impact of the occurrence of complex hydrologic phenomena with a high risk degree, that mainly regard flooding and inundations, as well as the variation of the underground water reserves.

From a social and human aspect are taken into account and the problems of the vulnerability of the man-made structures (rural and urban habitats, population, agricultural structures, industrial units, communication networks), in the purpose of realizing prevention plans of the risks induced by the manifestation of the natural hazards (hydrologic, climatic, geomorphologic, soil-related).

Till the present moment have been realized the activities mentioned in the proposed plan, some being finalized and others deployed, the results of our research being included in the two reports (December 2006 and June 2007).

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Thus, the first stage of the project, the training one, that implied the reunion of the partners and the establishing of the project strategies, as well as the documentation and completion of the material base needed, has already ended. At the moment the project is in the stage of the intermediary completion of the 2nd and 3rd stages. Thus, from the activities of the 2nd stage, the creation of the database, have already been completed almost 75% of the activities (scanning, geographically referencing and vectoring the geologic, topographic and soil cartographic database; the insertion of the satellite images and aerial photos; the completion of the hydrologic and climatic database and their import in GIS). From the activities of the 3rd stage have been completed almost 80%: the preliminary analysis for the identification of the areas susceptible to natural risks occurrence, with a high vulnerability degree of the anthropic structures and the completion of the database; the mapping of sample perimeters affected by slope processes and the realization of management schemes for these; the survey and mapping of areas of high flooding risk along Barlad River and its tributaries. We have also conducted soil survey and soil profiles for the identification of the perimeters with special soil cover degradation processes, taking samples that have been sent to the laboratory.

Although not scheduled for this stage, we have also realized a part of the activities of the 4th stage, which include laboratory analysis of the samples collected and the data informatics integration. Thus, the largest part of the samples collected has already been analyzed from a physico-mechanical and chemical viewpoint. At the same time we have completed the Digital Elevation Model at the 1:50000 scale, and almost 50% of the steps needed for the 1:25000 scaled DEM. Having already created several thematic layers (contour, relief fragmentation depth and density, slope and slope orientation, vegetation, soil and hydrology maps), we were able to proceed to the multilayer analysis of risk aspects (for example real situation simulations of the flooding and inundation effects), the probabilistic analysis (risk phenomena occurrence probability, soil erosion resistance, slopes resistance to landslides, lithology resistance to erosion), prognosis models (the occurrence possibility of climatic and hydrologic risk phenomena, estimations of soil cover erosion and of the humus stock evolution).

In conclusion, the analysis of the natural risks from Barlad basin has begun in the forecasted limits. We have begun the analysis of the primary data, which have as objective the selection of the methods that give the best and realest results. All the data referring to the geographical factors and processes obtained in this stage will be related to the human aspects, so as to evidence the real impact on the human communities. Also, the started database begun to be used, through the application of statistical methods, mainly in the case of the more complete soil database, but later enlarged with the climatic and hydrologic elements.

An important result till now is the establishing of the sample perimeters, on which the further research will be detailed. These have been chosen after the identification of the natural hazards and implicitly of the high vulnerability areas.

In the case of some of the analyzed phenomena, the causal and relational explanation of the risk processes through the realization and validation of practical models has already been done. This aspect will later be valued in the analysis of the natural and anthropic system dynamics, for the realization of prognosis and evolution scenarios of the risk processes and phenomena. For the near future, our purpose regards the beginning of the implementation and the results dissemination, some of the connections with the local and regional authorities being already established.

METHOD AND INSTALATION FOR CHLORINE PRODUCTION AND UTILIZATION TO POTABLE WATER CLORINATION IN POINTS ALONG THE WATER PIPE

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The project presents a method and a technology for electrochemically generating chlorine from a salty solution (eventually sea water) and for chlorination of potable water by injecting the obtained chlorine directly into the potable water pipe. The electrochemical obtaining of the chlorine in situ from the salty solution is a clean method (easy to automatize) that eliminates the transport and stocking of the chlorine gas. It also ensures the necessary quantity of chlorine for keeping the remaining chlorine level in the water at the legal level (big enough to keep the microorganisms from multiplying, but small enough to be easily tolerated by the human body). This way, the initial excessive chlorination is eliminated and the chlorine level in the potable water pipes is kept. Therefore, the project will make an important difference in the durable management of one of the most important resources – THE POTABLE WATER.

In order to develop the method and the technology that makes the object of this project the following major problems must be answered:

- the fabrication of a reactor that can electrochemical generate in situ the chlorine into a salty solution
- producing DSA to equip the reactor
- making an injection system of the chlorine generated in situ into the pipe that is under pressure
- the automatization of the whole process so that the chlorine quantity that is generated is the necessary one
- making a system that can detect and measure the chlorine concentration in the water (they are necessary in order to automatically conduct the process) and in the air (necessary in order to detect any possible problems) equipped with selective sensors
- establish some methods of analyzing the chlorine and the chlorinated substances for the process control and for measuring the method efficiency
- elaboration of patents, scientific papers, articles
- organizing some workshops and conferences in order to promote the results of the project

A representative network has been constituted at national level. It consists of 6 partners (3 institutes, 2 universities, 1 AR) from Timișoara, Cluj-Napoca, Brașov and București. In order to fulfil the objective of this project, the partners are going to develop a multidisciplinary research activity of big complexity that is going to increase the quality and performance level of the involved institutions as well as the partnership between them. It will also develop the structure for research and development in the fields covered by the project. The data bases used by the partners are going to be developed and integrated into a big network that will become a reference for the specific domains of the project.

The project's theme is from the thematic fields of PC 7 (fields 6-62, 11, 2-2.1) and the network developed is compatible with the technological platforms used at European level (PT 25). Because of this and because of the project's results, the network's chances to access external funds are increased, especially for future projects in PC 7.

The present project implies the development of fundamental and applicative research activities, as well as of some support activities during a period of 24 months (1 June 2006 –

15 September 2008). The project is going to conclude with the presenting and demonstration of the functionality and use of the functional model.

The project is finished with the presentation and demonstration of the use and functionality of the method and of the functional model developed. So, the main result of the project is going to be a new method and a new installation for chlorine producing and the chlorination of water, which is a premiere world wide.

The project will have some secondary results:

- The existence of a strong network of R-D (research-development) in this field, represented by 3 R-D institutes (one of them being a national one), 2 state universities and a specialized company, located in 4 of the biggest towns in Romania. This network can be developed later at zone level, region level or European level by including other partners and by integrating into the European technological platform: PT25 Water supply and sanitation.
- Through the large area of this network, the partnership in problems of R-D is going to increase
- The very different fields covered by the project imply the development of the multidisciplinary research
- The research-development materials owned by the partners are already considerable and are going to increase and to be renewed and completed where it is necessary
- The results obtained are going to be used on a large scale, both at national level and international level

Once the functionality and use of the new method is demonstrated, there are new possibilities of partnerships with other R-D entities as well as with companies interested in applying the results, especially that the method can be easily implemented on the drink water network already existent. The structure of the project implies the use of the intermediary results of each stage in the next stage so that each stage is the basis for the next one. The spreading of the results of each stage is going to be done through papers and articles in national and international magazines, through participations at different scientific seminars, by organizing different symposiums and by promoting the results. At the end of each stage there is a plan of identifying and giving copyrights. This activity is going to take place according to the stipulations of the contract that is going to be signed between the partners, according to the law, in case the financing for this project is obtained.

FUEL CELL SYSTEM FOR DIRECT BIO-ALCOHOL ELECTRO- OXIDATION

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PEMFC (Polymer Electrolyte Membrane Fuel Cells) technology uses hydrogen which is produced predominantly from natural gas. Hydrogen as a fuel has several limitations in storage and in transportation. An ideal fuel for Fuel Cells (FC) is a liquid (at ambient conditions) and importantly one that can be used directly in the FC without transformation to hydrogen, thereby giving much simpler system logistics. *The strategic goal* of the project is

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the development of a Fuel Cell (FC) that uses bio-alcohols as fuel, which is original field for fuel cells research. This concept uses bio-alcohols (methanol / ethanol) as fuel and does not need a pre-reformer. For this target is requiring new research into several aspects of the fuel cell materials (catalysts, membranes) and electrochemistry and in particular ethanol and methanol electro-oxidation. The project provides an excellent opportunity to establish a fuel cell technological understanding and improving the materials base, which for the long term future of mankind is sustainable. The subject is highly innovative in its approach to fuel cell design and operation and requires multidisciplinary approach combining skills in materials science, catalysis, chemistry (polymer and physical and electrochemistry), fuel cell science and engineering, carbon materials and physics. The final aim of the proposal is to enhance the state-of-the-art in the area of FC technology especially those fuelled by bio-fuels, and giving new technical solutions, developing new highly performing and low costing materials, which can have a great impact over the fuel cell technology, both at the scientific, economical and social level. The proposal, by its established objectives, is answering either to both the socio – economic, technical and policy objectives of the FP7 programme and S&T objectives of CEEEX such as *FP7 priority – 6.1. Sustainable Energy Systems*.

The present research is focused on identification of a more practical and sustainable fuel and improved catalysis, in terms of tolerance to poisonous species, durability and enhanced activity; improved performing membranes and demonstration of practical fuel cell solutions to a range of energy consumers

In this stage of the project the elaboration and characterization of some functional models of anodes for BioDAFC systems was the main objective. Synthesis and characterization of functional materials for anode used in BioDAFC design was reported as follow:

- Polymer composite membrane such as Nafion / SiO_2 / ZrO_2 / Al_2O_3 as BioDAFC membrane; The resulted composite membranes were characterised using X- ray diffraction (XRD), infrared spectroscopy (FTIR), thermal analysis (DTA and TGA), conductivity measurements and water uptake of the membrane
- Mono- and bimetallic colloids with Pt and transitional metal such as Pt/C, PtRu/C, FeCr/C, CuSn/C and FeCr/C; The resulted materials were characterised by X- ray diffraction (XRD), adsorption isotherm, scanning electron microscopy (SEM) and transmission electron microscopy (TEM)
- Gas diffusion electrode with different catalyst such as Pt/C (C- Vulcan XC72), PtPd/C (C- Vulcan XC72), Pt/MWNT (MWNT-activated multiwall carbon nanotubes), PtPd/MWNT sand Pt/CA (CA-carbon aerogel). The new catalysts were characterised using EDX analysis, scanning electron microscopy (SEM) and cyclic voltammetry.
- C, SiO_2 , ZrO_2 , Al_2O_3 nanomaterials with aerogel structure; the obtained aerogels were characterised using X- ray diffraction (XRD), adsorption isotherm, BET surface area analyzer, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and atomic force microscopy (AFM)
- Functional models of elastomer sealing with good thermal resistance at 250°C; the behaviour of elastomer were tested and verified at room temperature and 250°C.

All these research results were published in different scientific events (congress, conferences, workshops, symposia, etc) as oral and poster communications and will be published as articles in different scientific journals with international quotation.

In the next stages of the project will be elaborated and characterize some functional materials as cathode materials in BioDAFC. The dissemination of the research results will be also carried on. Finally, the project aims to present and to demonstrate the functionality of these materials for BioDAFC design.

RESEARCHES RELATED TO FUELS AND RAW MATERIALS OBTAINING FROM RENEWABLE SOURCES

Violeta POPESCU¹

Plastic materials (PM) have high chemical stability. This is why, after their life cycle ended, problems related to environment appear. Economical issues limit the application of recycling methods for plastic materials in our country, since the devices need important investments. For this reason a good knowledge of recycling methods is necessary in order to elaborate a strategy for PM recycling. This strategy should take into consideration the local industry specificity and the recycling methods should assure a sustainable development. In view of that, the recycling methods applied for the obtaining of raw materials for petrochemical industry, monomers, gaseous, liquid or solid fuels are preferred to methods implying the incineration of plastic waste. Mechanical recycling could be applied only on rigorously sorted waste. This is the reason why, in our country, we consider appropriate the application of recycling methods less sensitive to the quality and composition of plastic waste. These methods gathered together under the generic name of chemical recycling, involve controlled pyrolysis. Chemical recycling could be applied for sorted, mixed, industrial or municipal PM waste. Pyrolysis is realized in the presence of catalysts which have the role to increase the efficiency in useful products, to achieve the dehydrochlorination of pyrolysis products, in the case of waste containing polyvinyl chloride and to convert the potential toxic compounds in useful products. This project resolves to elaborate a modern laboratory scale technology for chemical recycling of municipal plastic waste, the necessary thermal energy being assured by microwaves or by the combustion of gaseous pyrolysis products. After pyrolysis gaseous, liquid, solid fuels, or monomers are obtained. The composition of pyrolysis products depends on the pyrolysis conditions and on the composition of plastic waste. Also the team intends to initiate research related to the recycling of multilayered and organic matrix composites recovering both reinforcing materials, aluminium foils (from package from food industry), and organic matrix as fuel.

Project objectives

Scientific objectives

1. Elaboration of a theoretical study related to the pyrolysis of plastic materials (MP), Organic Matrix Composite (OMC) and of Waste Electronic Equipment (WEEE).
2. Average composition determination for municipal waste from Cluj-Napoca
3. Updating of the data basis related to environment legislation, standards for the characterization of pyrolysis products.
4. Realization of new pyrolysis installations and updating of existing ones.
5. Laboratory research regarding MP waste pyrolysis.
6. Laboratory research regarding CMO waste pyrolysis in view of recovering reinforcing materials and utilization of organic phase.
7. Laboratory research regarding WEEE waste pyrolysis to the aim of recovering metal phase and utilization of organic phase.
8. Pyrolysis of PVC containing waste.
9. Elaboration of solutions for the treatment of pyrolysis oils in view of eliminating toxic and corrosive compounds in order to fulfill standard demands for use.
10. Laboratory research regarding the environmental impact of the proposed method and reduction of this impact.

Managerial objectives

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Organization of a scientific cluster in the field of MP and CMO recycling.
Improving the research material basis of the consortium
Participation in exchange of experiences and results dissemination
Increase of scientific excellence and visibility of the consortium

Results

The main solution related to plastic material, organic matrix composites and Waste Electrical and Electronic Equipment (WEEE) recycling are established.

In the case of well sorted thermoplastic materials mechanical recycling is the best option. Mechanical recycling can be applied with good results to polyethylene terephthalate (PET), polystyrene (PS) and polymethyl methacrylate (PMMA). The properties of recycled materials worsen during recycling. That is the reason to find other than original applications for recycled materials.

In the particular case of PMMA if a feedstock recycling method that involves thermal degradation of PMMA is applied, a high yield in methyl methacrylate MMA can be achieved. The recycled PMMA obtained by this method have the same properties as the virgin one.

In the case of PS the yield in styrene is smaller than in the case of PMMA. The reaction products are hard and expensive to separate. That is the reason for choosing mechanical method for PS wastes.

Polyolefines forms during thermal degradation a complex mixture of hydrocarbons. That mixture of hydrocarbons can be used as fuels.

Perspectives

Methods for mixed plastic waste, organic matrix composites and WEEE waste will be studied, in order to obtain fuels or raw materials.

STUDY OF GENETIC VARIABILITY OF THE MAIN FOREST SPECIES IN ORDER TO ESTABLISH THE TESTED SEED SOURCES AND COMPLY WITH THE E.U. NORMS

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Genetic diversity represents the basic level for biodiversity preservation, in general and for forest genetic resources, in particular. Individuals and respectively, trees populations are the carriers of genetic information for a particular species and the existence of genetic variability establishes the permanence of forest ecosystems. This is why the main objective for the biodiversity and forest genetic resources preservation is the appraisal of the intra-specific genetic diversity.

The project studies the inter - population genetic variability of the 7 important species for our forestry and our economy: Norway spruce, Silver fir, larch, beech, oak, sessile – oak and ash, in order to establish the most valuable seeds sources - tested seeds sources. Today it is unanimous recognized that forest regeneration's success depends on the using of a forest reproductive material with high genetic potential.

The specific objectives of the project refer to: the study of the inter-population genetic variability of the main characters of forest and economic interest, the study of the phenotype correlations between the studied characters and between them and the geographic gradients of origin, the examination of genotype interaction x environment and of performance stability, the evaluation of genetic inter-population variability with the help of molecular markers.

The tested material are representative and comprehensive and includes a total number of 409 geographical provenances of which 169 from Romania and 240 from 13 European countries, covering most of the natural range for these species. These provenances are tested in 50 multistational comparative trials on long-term, set up on modern experimental technique.

Researches carried on in the firsts two stages show a great interpopulational genetic variability for the most studied traits of the studied species (Norway spruce, Silver fir and beech). Genetic variation is both clinal and ecotype and depends on examined character. Significant correlations were found between the studied characters and between them and the provenances geographic gradients of origin: latitude, longitude and altitude.

The researches results proved the superiority of the Norway spruce provenances that are from the North of the Eastern Carpathians and some Romanian Silver fir provenances: Avrig, Cozia, Moinești, Strambu Baiut, s.a. The wood output that can be obtained by selection of the most valuable local populations is between: 8 – 55% for Norway spruce and 33 – 55% for Silver fir. The most valuable populations regarding the growth, quality and adaptive performances, will be appointed tested seed stands and will be use for afforestation in tested regions of provenance.

In this regard the project is according with the objectives and actions of the Romanian long term forest strategy, with special reference to: the increasing of timber production simultaneous with amplifying the protection and social forest functions; the assurance of stability and increasing the forest ecosystems functional efficiencies; the preservation of forest ecosystems biodiversity and adoption of the adequate institutional framework.

Keywords: forest species, interpopulational genetic variability, phenotypic correlations, stability, tested seed sources.

STUDIES AND EVALUATIONS ABOUT RECOVERY OF TRANSITIONAL METALS FROM SPENT CATALYSTS

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The project proposes the improvement of processing methods of wastes and extraction of transitional metals from these ones as well as establishing new performance technologies in this way.

Development of auto industry, of technologies for reduction of the primary and secondary pollutants resulted from benzenes and gas-oils imposed a permanent competition. In parallel technologies of precious metals recoveries from spent catalysts were developed.

The significant results will be applied in the activity of microproduction of the involved research-development, to the beneficiary (respectively the wastes provider) or centralized by creating one single unit of processing at national level (the optimal way). On international plan, there are important efforts for recovery of precious metals from spent auto catalysts and industrial catalysts from pyrometallurgical processes and transport in gaseous phase. Large quantities of spent nickel catalysts are available from fertilizer, petrochemical, vegetable oil and other industries. Disposal of spent catalyst is a problem as it falls under

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⁴ UPIT

category of hazardous industrial waste. The recovery of metals from these catalysts is an important economic aspect as most of these catalysts are supported catalyst usually with alumina / silica with varying percent of industrially important element nickel, in the reference catalysts alone; nickel concentration varies from 2.5-20%.

Metals like Rh, Pt, Pd, Ni, Cu, Co etc., are widely used as a catalyst in chemical and petrochemical industries. They are generally supported on porous materials like alumina and silica through precipitation or impregnation processes. After periodical use of the catalysts, due to poisoning effect of foreign material and impurities, which deposit on the surface of the catalyst, they will become inactive. In such cases, fresh catalysts have to be substituted and the spent catalyst will be discarded as waste material.

Disposal of such catalyst materials, which contains appreciable amounts of heavy metals, is environmentally hazardous. Therefore, a suitable and economically viable method is required for recovery of metals at the same time method should not pose the risk of environmental hazards.

Our research activity is concentrated upon the characterization of spent catalysts from industrial processes and elaboration of new methods for recovery and purification of metals from these catalysts, the whole process being simple, economic and with minimum implications of pollution. The studies will improve the yield of metals extraction from wastes, elaboration of efficient methods for separation, as well as establishing high purifying processes.

Principal objectives of MERCATU project are:

- 1) Evaluation of environment impact of spent catalysts resulted from industrial processes
- 2) Development of new technologies at European standards by using unpollutant recovery and purification methods for metals from spent catalysts, with minimum impact for the environment
- 3) Optimization of the efficiency of metals recovery and purification
- 4) Modelling and characterization of purified metals and unpollutant catalytic wastes
- 5) Dissemination of results at special conferences, article publishing and elaboration of technical specification for patents.

It is expected to obtain new and improved materials. The obtained results will be patented, intellectual property being divided between the members of the Consortium, according with each contribution.

The complexity and importance of the proposed activities and, also, the excellence in the field of each partner, are coming to sustain this project, which fits perfectly in the European, and national program objectives.

MERCATU project presumes the uses of new preparation and analyzing methods, which are very well defined by all members of the Consortium, these ones having strong theoretical and practical knowledge.

One of the principal advantages of the Consortium lies in the instrumental and human potential of the team, able to establish a strategy regarding the necessity of recovery of poisoned catalysts methods development.

As for the disadvantages of metals recovery from spent catalysts, they lies in the fact that the known processes are not applied at industrial scale. Also, the purification costs are high, that is why it must find the process that is Low-Cost.

The risk in finalizing the proposed objectives is due to its financial and humane nature. The financial risk is considered being a commonly and unfitted treasuring of necessary funds, primarily for experimental systems development and testing progress. The humane risk is due to the possible fluctuation of the personnel involved in the approached research theme.

At the end of the project, a better material base will be developed and there will be accumulated new technical knowledge in the metals and catalysts preparation domain, this fact leading to new work places creations for young people wishing to improve in certain scientific media.

INTEGRATED SOFTWARE TECHNOLOGY BASED ON GIS AND NUMERICAL ANALYSIS PROGRAMS, WITH APPLICATION IN IMPROVING THE SAFETY OF AGRICULTURAL AND INDUSTRIAL EXPLOITATION, BY PREVENTING AND ESTABLISHING THE RESPONSE WAY IN CASE OF ENVIRONMENT ACCIDENTS AND MONITORING THE POLLUTION FACTORS FROM INDUSTRY AND AGRICULTURE

Petru CÂRDEI

The project CEEEX 764/09.10.2006, is developed in the collaboration: INMA Bucharest, project leader, ICPA Bucharest, USAMV Bucharest and IPCUP Ploiesti.

The specific objective of this project consist in application of the best software, methods and technologies of monitoring and simulating of some ecological accidents with industrial or agricultural origins. All these methods which result in this way are included in a methodology which can be used for riposte at the environment safety problems which can appears in Romania or in other areas. For the reach of the purpose – creating of the methodology we used GIS and structural analysis software and some measuring and monitoring tools.

The project develops the activities of the second stage. In this stage the researching team establish the next three important elements:

- The methodologies and the form of the methodologies;
- The programs, numerical and GIS, which must be included in the methodologies chapters;
- The establishing of the software and experimental tools which must be purchased in order to develop the stage objective for the next two stages of the project;
- The acquisition of experimental data necessary for the software tests in the environment events modeling.

In actual vision of the research team of this project, pursuant to the large documentation, we want to obtain two methodologies which consist in a collection of environment events which is possible to tackle with the selected programs (GIS and numerical): pollution problems (for water, soil and air), soil erosion (caused by the water or the wind), land slide, etc. Both methodologies will contain same environmental events problems categories, but the first methodology will be endow with licensed GIS and numerical programs and the second methodology will be endow with free GIS and numerical programs. In other terms the first methodology will be a licensed methodology and the second may be named low cost methodology or free methodology. These methodologies will have an electronic presentation in order to facilitate the user quickly access at the tools which the user to connect problems.

In order to build these methodologies, in this stage is tested seven GIS software (for the selection of a licensed product), two software which evaluate the pesticide and herbicide effect in the soil, four software which can simulate the evolution of the contaminant fluids in the aquifers or the evolution of the hydrocarbure pollutants on the water surface, a software

for simulation of the evolution of the contaminants in the drainage network, a software which used to estimate the soil erosion, a software which can try to modeling the land slide (with some simplified hypothesis).

In the website www.inma.ro is presented a movie of the contaminants evolution simulation inside of an aquifer located in a certain geographic area, north of Ploiesti city.

Many tests of the software have a certain geographical localization in Romania. In this aim is frequently used in the satellite maps. These maps are the base of the drawing which describe the material support of the environment event (phenomenon).

Same two methodologies will be endowed with some monitoring procedures. The monitoring will have many function: providing initial data for simulation, environmental (natural) process supervision and checking (remote control, eventually), storing of the data necessary to prognosis elaborate and for the calculus of the constants, warning in case of appearing conditions to produce the critical (natural or non natural) event.

Some results have already presented in the Scientifically Symposium at IPCUP Ploiesti in April 25, 2007. In this symposium had been presented two papers which had given two solutions for the problem of hydrocarbure pollution of the aquifers and water: "*Software application in the direction of the amelioration of the environmental condition in the pollutions areas*", and "*Using software program for repairing the hydrocarbure polluted sites*". The programs which had been presented are included in the free methodology.

The methodologies which are the subject of this project will have a dynamical shape, because here they can be enriched all time with others problems and our solutions, and actualized with the best software.

LOCAL INTEGRATED PLATFORM FOR RENEWABLE RESOURCES SOUSTENABLE PROCESSING FROM AGRICULTURAL FARMS

Marian ANDREI
S.C. ZECASIN S.A.

The project focuses to develop a local regional platform for turning account , oleaginous seeds in order to produce fuels, rapeseed yeasts as foods additives for cattle feed. All of those in local agriculture farms also the project aims to use the biomass to produce gases by pyrolysis.

In the same time the study try to identify and to propose the best solution for Romania concerning the achieving of a certain local energetic autonomy in some agricultural regions. At least but not at last the project wants to promote alternative fuels as response to the world energy crisis.

In the project scope it was studied biodiesel obtaining process from rape oil with the a view to collect necessary data for a small production facility dedicated to an agricultural farm.

It were approached the following aspects :

- biodiesel synthesis itself in variable reaction conditions (temperature, rape oil vs. methanol rate)
- liquid - vapor equilibrium for an reacted methanol moisture removal ;
- alkalinity water washing from biodiesel;
- alkalinity and glycerine centrifugal removal
- alkalinity and glycerine removal using adsorbents

A pilotplant was achieved to study the biodiesel synthesis to a bigger scale .

Finally a modular small biodiesel production capacity was accomplished.

Also the project approached the turning to account of the squeezed rape seeds by gasification. The obtained gases contain hydrogen, methane, ethane and heavier hydrocarbons and they might be used for energy production. Studies of the influence of the oxidation agent upon the reaction temperature and the gases composition were conducted. Under certain working condition a hydrogen and carbon monoxide rich gas is obtained. A such gas might be used as a Fisher-Tropsch synthesis gas.

Bigger oxygen flow rates and smaller retention time gives a bigger tar production. Using increased air flow rates, temperature rise sharply in a shorter time and a maximum concentration in gases is obtained.

The completed with a pre-feasibility study concerning the opportunity of the eco-energetic integrated platform development at a regional level.

Analytical methods for the vegetal/ animal oils trans-esterification outcome products were assimilated.

The scientific researchers in this project want to continue their studies in the following directions:

- valuable products improving efficiency by process and apparatus optimization studies;
- glycerol turning to account
- heterogeneous catalysis triglyceride trans-esterification;
- increasing energy production by biomass gasification.

ECOGEOCHEMISTRY OF GREAT URBAN AGGLOMERATIONS AN OF THE PERI-URBAN AREAS, IN A SUSTAINABLE DEVELOPMENT CONTEXT

Radu LĂCĂTUȘU¹, Mihai POPESCU², Nicolae ANASTASIU³, Petru ENCIU⁴

The project proposes a complex approach for pollution evaluation of the environment of the great urban agglomerations, with special concern for the soil, the solid particles in suspension and the radiation level. The study case regards the Bucharest municipality and its peri-urban area.

Objectives

- Main objectives of the project:
 - the development of the research activities in partnership with other universities, research and development national institutes and institutes of the Romanian Academy for a complex approach of this project;
 - the research and infrastructure development in the geological and geochemical ambience of great urban agglomerations.
- Specific objectives of the project: the morphological and hydrological characterization of Bucharest Plain; the stratigraphy of the quaternary formations in the range of 0-100 m; the lithography, the internal constitution and the area thickness variation of a great

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young unit: the Loess formation (the range of 0-25 m depth); the map of Loess formation vulnerability to pollution with metals; the determination of the soil pollution degree for 24 elements by elaborating maps of isocontents; the mineralogical and geochemical characterization of the dust from the street areas; the characterization of the urban and peri-urban soil types; the determination of Rn^{222} concentration in different constructions (buildings); the effective supplementary doses evaluation for the population by Rn^{222} inhalation.

Measurable objectives

- lithological analyze of the rocks on which the soil is formed studying approximately 900 drills; the analyze of nearly 1200 soil samples for 24 elements on an area of 300 km²; determining the Rn^{222} content from different types of buildings depending on the construction material used; determining the gamma debit dose from Bucharest soils and from peri-urban areas (250 km²); distribution maps with the 24 elements investigated in the urban and peri-urban soil; distribution maps for the metals and minerals that are present in the dust;
- maps elaboration for the urban and peri-urban soils; the elaboration of morphological map (1:100.000) by separating the areas occupied by the high fields Băneasa and Cotroceni, by the terraces and meadows of the important flows and even the area with positive and negative anthropic micro relief; the analysis of the litho stratification and the execution of several geological sections for the quaternary rocks in the 0-100 m depth interval; the elaboration of the lithological map with izopahite too of the newest formation laid-down in quaternary, Loess formation of middle-Pleistocene and superior-Pleistocene.

Results obtained so far

The Northern and Southern parts of the Bucharest municipality have been characterized from the morphological, hydrographical, and climatic point of view. Researches were carried out regarding the structure and litho-stratigraphy of loessoidal formations. The urban and peri-urban soil types have been characterized. Soil samples have been collected from different depths and determinations were carried out for 24 chemical elements. Rn^{222} and Rn^{220} contents of different types of buildings have been determined, depending on the construction materials, and the gamma debit dose has been measured. Dust samples were collected and analyzed from the mineralogical and geochemical point of view.

The soil cover of the Northern part of Bucharest is formed out of 9 soil types and sub-types, of four soil classes: Entisols¹, Mollisols, Alfisols/Ultisols, and Hidric soils. The contents of most of the investigated chemical elements are between the normal contents limits, with few exceptions, especially for heavy metals (copper, lead, zinc) in the samples collected from areas with intense anthropic activity. The natural soil radioactivity presented values between 0.11 and 0.15 μ SV/h, in accordance with the background level. The Rn^{222} contents in different types of buildings and subway stations varies depending on the constructing materials nature and ventilation, without exceeding the allowable contents of 400 Bq/m³. The dust fine fraction ($\Phi < 0.063$ mm) of the suspended particles, sampled at soil level, is constituted of 60 \pm 20% silicates, 30 \pm 10% organic matter, 20 \pm 10% carbonates. Industrial silicates sferules occur, up to 5%, proceeded from the thermo-electric power stations chimneys. In the 0.25-0.63 mm fraction, heavy minerals occur, up to approximately 3%. In the upper horizons of the soil cover, a heavy metals pollution level was registered, different from one area to another, depending on the general emissions intensity in the municipality, the local microclimate and the soil covering degree.

¹ USDA ST-1999

In the southern part of the municipality, the terrain includes four relief elements, namely: Dâmbovița waterside, the high field Cotroceni - Văcărești, the second (t_2) and the first terrace (t_1), shaped by the Argeș river. The soil cover includes four soil classes: Entisols, Mollisols, Alfisols/Ultisols, and hydric soils. In the soil samples, most of the elements have average contents between the background limits; zinc, lead, manganese, potassium, thorium, chromium have, besides a background characteristic distribution, a second one, generated by the anthropic activity; the gamma debit dose ($\mu\text{Sv/h}$) presents values between 0,11 and 0,20 $\mu\text{Sv/h}$, characteristic to the background; the radioactive gas Rn^{222} contents in different types of buildings and subway stations presents variations depending on the construction materials and especially on the ventilation level; the allowable contents of 400 Bq/m^3 has not been exceeded for the buildings built up before 2005. The dust fine fraction presents high silicates and organic matter contents: $70 \pm 20\%$, respectively $25 \pm 10\%$ (bitumen fragments, vegetal fragments, plastic mass, and hair). Fragments of carbonate nature follow, represented by fragments from concrete binder and carbonate rocks proceeded from the sand used in constructions. Carbonates (calcite and dolomite) reach $3 \pm 5\%$. The higher iron contents and the relatively high magnesium and aluminium contents are partially due to the heavy minerals from the terrigen fraction. Titanium and zirconium present slightly increased contents. Chromium, cobalt, nikel, manganese, vanadium contents are between normal limits. Lead has high contents; the background is in the alert threshold limit. Over one third of the samples have contents over the alert threshold zone. Zinc and copper present relatively normal values, but some samples are placed at the alert and even intervention threshold.

Perspectives

The same researches and determinations will be carried out for the Eastern and Western parts of the Bucharest municipality, in order to obtain data to draw distribution maps for the chemical elements. The complex research results will end with the elaboration of the „Ecogeochemical Atlas of Bucharest and peri-urban areas”, as a consequence of researches carried out on a 250 km^2 area. Taking into account other countries experience in carrying out such projects and the scientific contacts that the members of the project staff have with different research groups from other countries, collaboration with research groups from Great Britain, Germany and Serbia is intended. The presence of similar platforms at European level and in the PC 7 will make such collaboration easier.

REACTION OF THE EARTH'S SURFACE TO ACTUAL TECTONIC PROCESSES IN THE VRANCEA CONTINENTAL COLLISION ZONE

Victor MOCANU¹, Laurentiu MUNTEANU²

This projects presents the kinematics of the Vrancea seismogenic zone by satellite geodesy. Earthquakes of high magnitudes generated at intermediate depth (60-70 to 220 km depth) in the Vrancea seismogenic zone have the foci within a high velocity body . It is limited towards the internal part of the Carpathian arc by a low velocity domain where the seismic waves are highly attenuated, suggesting a very probably elevated astenosphere (Russo et al., 2005).

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The geodynamic mechanism running this area is not entirely known. Two theories are mainly used nowadays in order to explain the tectonic framework: (1) subduction of the normal oceanic lithosphere detached from the southeast European continental lithosphere which was eventually separated by the Moesian Platform under Vrancea Zone (Wortel and Spakman, 2000), and (2) subduction of the oceanic lithosphere ended sometimes in the Late Miocene; later, a delamination along a horizontal interface took place. It has a present near-vertical position due to its sinking movement within the Upper Mantle (Gvirtzman, 2002).

In the last decade, the satellite methods as the global positioning systems proved its special utility to clearing the geodynamic frame. The exceptional accuracy of determination of time variation of the coordinates of fixed stations organized in networks where there is a temporary stationing of reference network where permanent measurements are carried out, already generated remarkable results. We proved that the general movement of the region in front of the Carpathian Bending Zone is southeastwards, so getting away from the orogen. The East European Platform is getting closer to the Eastern Carpathians, pointing a big questionmark concerning the general movements of the of the internal parts of the Carpathians. We have, through international cooperation, seven permanent GPS stations and a temporary network of about 43 sites. Moreover, we could still take the advantage of a special support from the international partners. By this programme we try to complete the Vrancea kinematics picture with the part towards the Transylvanian Depression. A whole regional geodynamic model is now shaping up. We try to find a relationship between the present tectonic activity and the time variation of the Earth's surface, hopefully with an earthquake prediction possibility based on the time variation of the velocity vectors. In order to reach this target the time variations of x, y and z coordinates are monitored into both satellite networks. The seven permanent stations are part of the international permanent network. In this way, a full integration of the Romanian, European and international networks of exceptional stability and accuracy, characteristic to geodynamic analysis, is ensured.