Questionnaire

Summary of the main activities of a scientific Organisation
of the Slovak Academy of Sciences

*Period: January 1, 2003 - December 31, 2006*

I. Formal information on the assessed Organisation:

1. Legal name and address
   Institute of Geotechnics, Slovak Academy of Sciences,
   Watsonova 45, 043 53 Košice, Slovakia

2. Executive body of the Organisation and its composition

<table>
<thead>
<tr>
<th>Directorate</th>
<th>name</th>
<th>age</th>
<th>years in the position</th>
</tr>
</thead>
<tbody>
<tr>
<td>director</td>
<td>Ing. Viťazoslav Krúpa, DrSc.</td>
<td>56</td>
<td>9</td>
</tr>
<tr>
<td>deputy director</td>
<td>Ing. Slavomír Hredzák, PhD.</td>
<td>39</td>
<td>2</td>
</tr>
<tr>
<td>scientific secretary</td>
<td>prof. RNDr. Peter Baláž, DrSc.</td>
<td>59</td>
<td>12</td>
</tr>
</tbody>
</table>

3. Head of the Scientific Board
   RNDr. Annamária Mockovčiaková, PhD.

4. Basic information about the research personnel
   i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2003, 2004, 2005, 2006 and average number during the assessment period
ii. Organisation units/departments and their FTE employees with the university degree engaged in research and development

<table>
<thead>
<tr>
<th>Research staff</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>FTE</td>
<td>No.</td>
<td>FTE</td>
<td>No.</td>
</tr>
<tr>
<td>organisation in whole</td>
<td>34</td>
<td>3,33</td>
<td>34</td>
<td>3,69</td>
<td>35</td>
</tr>
<tr>
<td>Dept. of destruction and construction geotechnics</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Dept. of environment and hygiene in mining</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>5,69</td>
</tr>
<tr>
<td>Dept. of physical and physico-chemical mineral processing methods</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Dept. of mechanochemistry</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Dept. of mineral biotechnologies</td>
<td>5</td>
<td>4,33</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Central laboratory</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

5. Basic information on the funding

i. Total salary budget\(^1\) of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2003, 2004, 2005, 2006, and average amount for the assessment period

<table>
<thead>
<tr>
<th>Salary budget</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td>total salary budget (millions of SKK)</td>
<td>10,055</td>
<td>10,762</td>
<td>11,742</td>
<td>11,554</td>
<td>11,028</td>
</tr>
</tbody>
</table>

6. URL of the Organisation’s web site

www.saske.sk/UGT

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\(^1\) Sum of the brutto salaries without the fund contributions.
II. General information on the research and development activity of the Organisation:

1. Mission Statement of the Organisation as presented in its Foundation Charter

The Institute of Geotechnics of SAS is according to its Foundation Charter of Presidium of SAS from the 19.12.2002 a subsidised scientific Organisation. As a legal entity the Organisation is able independently assume a right and commit. By its orientation to the basic and applied research in the field of disintegration of rocks, minerals and wastes processing, mechanochemistry, mineral biotechnologies and environmental protection related to mining activities, has the Organisation an exceptional position in Slovak Republic. The objects of scientific activities carried out by the Organisation, specified in the Foundation Charter are nowadays oriented on:

- basic research:
  - in the field of continuous disintegration of the rock mass and underground constructions stability, mass and energy transfer to the rock disintegration processes,
  - in relation of solid dispersions production, modification of their properties by physical, mechanical, chemical and biotechnological processes; qualitative and quantitative evaluation of phase interactions at production of disperse systems and at their spreading to the working and living environment,
- utilization of theoretical knowledge from the above activities to the elaboration of principles of high technologies in the fields of:
  - rock disintegration
  - complex processing of minerals
  - monitoring of selected elements of living and working environment
  - monitoring of chemical and geological changes in waste dumps with the aim of their ecological revitalizations,
- providing of advisory and expertise services relative to the main activities of the Organisation,
- participating in pedagogical processes, including doctorate studies pursuant to a separate regulation,
- carrying out international co-operation, as well as national, engaged in scientific research and development
- taking care of publishing activity of scientific-research results in periodical and non-periodical journals. The editorial activity is governed by separate regulation of the Presidium of SAS.

2. Summary of R&D activity pursued by the Organisation during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

During the period 2003 – 2006 the Institute of Geotechnics of Slovak Academy of Sciences has been involved in many scientific projects under umbrella of VEGA, APVT and APVV
institutions as well as in several European projects. The tasks of the State order and the State program have been solved as well at the Institute. The projects together with the most important results are summarized below.

Our Organisation is from the year 2002 divided to five scientific departments. The dominant ways of the basic research in individual scientific departments in years 2003-2007 are as follows:

I. Department of Destroctional and Constructional Geotechnics:
The research of the department was oriented on the study of rock disintegration by mechanical means. The aim of the research was to identify and describe the rock disintegration mechanism. The distribution of the strain in the drilling tool for the construction purposes was studied. During the mechanical disintegration, problems of the interaction between the rock and the drilling tool and the distribution of energy into a disintegration process and other effects accompanying it (heat, vibration, noise) were effectively studied. The research in rock disintegration is divided to two parts:

1. small profile rotating machinery
2. full-profile tunnelling (TBM - tunnel boring machine).

The incidental effects occurring during the small-profile rotating machinery as acoustic and vibration signals were studied both in the time and frequency domain and the quantities suitable for control of rotary drilling were then identified. The possibility of identification of some quantities in the frequency domain to be used for classification of the rock types were investigated by means of methods of artificial intelligence.

In the area of excavation was the research oriented on the rock disintegration during complicated geological and geotechnical conditions, with the aim to identify the properties of the double system tunnelling machine versus rock massive. The study of prediction of the excavation performance and evaluation of the cost items in the process of driving in tunnel constructions was the subject of priority. Quantitative and qualitative evaluation of excavation process led to the development of inverse, non-standard monitoring and optimising system assessing the properties of rock mass from monitored data (WORS and IKONA developed at the department). In present days the fuzzy expert system is completed, using the artificial intelligence with the possibility to operate with ambiguity and vagueness. These tasks were solved within the frame of VEGA projects.

Another project in the department solved the problems of compacting products intended for direct combustion - pellets, based on the bio wastes, coal, dendromass waste and fly ash. The ranges of suitable pressing regime as well as some factors influencing the properties of the compacting products were following from the evaluation of experiments.

II. Department of Environment and Hygiene in Mining

In cooperation with SVP (Water management Slovakia), š.p., Banská Štiavnica and in the frame of the study of erosion –transport processes of sediment loads in drainage basin of Hornád and Hnilec rivers, the evolution in qualitative parameters of sediments and their contamination with heavy metals by influence of old mine loadings was studied and evaluated. The possibilities of their utilisation were also discussed.

In the region of Jelšava and Lubeník the qualitative and quantitative parameters and influence of magnesite industry on the deposition of solid pollution, with orientation on the Mg components and selected heavy metals and on possible influence on other components of living environment were studied in cooperation with SMZ, a.s. Jelšava.

In cooperation with the plant Siderit, s.r.o., Nižná Slaná the qualitative and quantitative parameters and specific influence of this iron-ore processing plant on the deposition of solid imissions deposition, focussing on heavy metals are monitored and evaluated. The possibility of minimalization of resulting risks for environment was also evaluated.
In mining plants Jelšava and Nižná Slaná were the selected risks of these plants in relation to the occupational illness evaluated.

In the area of Slovenský kras the deposition and influence of selected harmful substances from industrial environment on living environment was monitored in cooperation with its management.

The change of contamination and transformation of mercury in selected components of living environment were monitored in time in those regions, which were contaminated with mercury to a maximal extent by the influence of recent and old mining and joining industries, especially in wider surroundings of old iron-ore mining plant in Rudňany, as well as in wider surroundings of old mining loadings (Štefanská Huta, Slovinky, Hnilecká dolina, Krompachy, Merník).

The above mention problems were solved also within the VEGA projects.

III. Department of Physical and Physico-Chemical Mineral Processing Methods

The positive influence of microwaves on various processing technologies is investigated in the department successfully for many years. The microwave heating of minerals and its influence on the disturbance of rocks were analysed, the effect of microwave radiation on modification of magnetic properties was shown on siderite ore. The use of microwaves for better magnetic separation and leaching of Cu-bearing ores and triboelectrostatic separation of coal were also studied. The thermal dependence of complex permittivity of carbonates, silicates and iron oxides were studied. The changes in physical and chemical properties of ore and non-metallic raw materials, coal and wastes from mining and metallurgy activities were analysed after application of microwave radiation.

A technique for rare organic materials extraction from the Slovak brown coal was developed. These materials have shown a potential biologic activity in various solvents using different extraction methods, above all in microwave field. The extracted components: kauranes, podocarpanes and azulenes were identified. The method of the separation and identification of kauranes available for biological testing on pathogenic microorganism and tumor cells was proposed. These tasks were solved within the frame of national VEGA projects.

The method of using the microwaves for vitrification of wastes with high content of iron was also elaborated. A ratio of the mixture of waste with glass, andesite and dolomite, suitable from the viscosity view, was sought, with the aim to get a mixture that can be after melting poured into water to obtain an amorphous glass. The amorphous glass was analysed by DTA, where the thermal changes were detected. The chemical stability of vitrificates were evaluated by TCLP tests and the mechanical properties of materials obtained after vitrification were analysed after application of microwave radiation.

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The possibilities of the application of natural and synthetic inorganic micro/nano particles of iron oxides/oxihydroxides (e.g. magnetite, maghemite, hematite, goethite, acageneite, lepidocrocite a.o.) and modified natural zeolites for the removal of toxic metals (e.g. cations of Cd, Pb, Zn a.o. and anions: As(III), As(V) a.o.) from the contaminated waters were studied and analyzed. By modification of the surface of natural zeolite with magnetite nanoparticles a multifunctional magnetic sorbent with high sorption affinity to arsenic oxianions was prepared. Due to its magnetic properties, the sorbent after adsorption of contaminants can be separated from the liquid phase in the magnetic field. The task was solved in cooperation with Greek researchers and within national projects.

The structural parameters of basic and modified zeolite samples were evaluated and the specific surface area, total pore volume, micropore volume and surface fractal dimension were obtained from the nitrogen adsorption data.

The magnetic particles $\gamma$-Fe$_2$O$_3$ with average size 20 nm were prepared by the microwave hydrothermal synthesis. The Mössbauer analysis has pointed out the different magnetic phases of materials prepared by classical and microwave synthesis.
The influence of the selected physical fields on the synthesis and behaviour of the magnetic sorbents in the purification of waste waters were also studied within the national projects.

Within the frame of bilateral project solved with Serbian researchers, the separation parameters of the magnetic particles from the fly ashes were determined and their mineralogical, chemical and grain composition were analyzed. Their affinity to the bivalent cations Cu, Cd, Pb and Zn was estimated by the sorption tests.

**IV. Department of Mechanochemistry**

The concept of direct reduction of sulphides to nanocrystalline metals by mechanochemical treatment has been tested on several systems. Reduction with iron as reducing element for iron, lead, copper and antimony sulphides were performed (solved within the frame of DAAD-PPP project with German partners and national project APVV). In case of antimony sulphide it was shown that most of reduction was complete after 60min with grain size of antimony to be 19 nm. Conventionally, antimony sulphide is reduced via high-energy temperature annealing (773-823 K) in the presence of reducing elements. The process is inefficient because metal sulphide dissolves in the already formed iron sulphide. The conversion degree is low. Mechanochemical reduction as outlined in studied systems is a very straightforward, on-step, ambient temperature process without many operations. The key step is the high energy milling which requires a suitable industrial mill for scaling up the process. The reduction of sulphides in a ball mill is an example of a so-called “dry” technology, as reaction in gas and liquid phases are excluded.

**V. Department of Mineral Biotechnologies**

The problem of the reconstruction of bacterial activity in transformation processes of silicate minerals under terrestrial climate conditions was solved within the European Research Area, where the 17 national research policies were co-ordinated by German researchers (The European project FP5 Extension to High-resolution CONTINENTal paleoclimate record in the Lake Baikal). The biological activities in the destruction of primary silicate minerals (rocks) during microbial oxidation of organic matter leading to secondary mineral formation (amorphous phases, clays, vivianite, etc.) were documented and the quantity of bacteria controlled by climate variations in Lake Baikal was evaluated.

The further research conducted within the national state program was aimed at application of mineral biotechnologies in the remediation of contaminated soils and waters, as well as in the receiving of raw materials from low-grade sources and wastes. Some original proposals of technological procedures were developed. The results have revealed that the studied types of wastes could become exploitable raw materials for the industry, after their appropriate valorization.

Biodegradation of soils contaminated with high concentrations of high-molecular weight PAHs was studied in laboratory microcosms, simulating natural conditions. Monitoring of biodegradation rates using on-line respirometry was combined with chemical, toxicological and microbial analyses of exposed samples. Biodegradation of PAHs proceeds well in aerobic conditions with adopted microbial co-culture, reaching significant diminution of initial PAH contamination.

An another research, conducted within the national projects was aimed at the monitoring of occurrence and influence of Fe and S oxidizing bacteria of *Acidithiobacillus* genus in the processes of acidification and mineralization of mine waters in the area of old mine loadings after the mining of sulphide ores in the Slovak Republic. The application of geochemical modelling software for prediction of acid mine drainage quality evolution was used at the study of remediation possibilities of acid mine drainage, at the study of bio-geochemical weathering of rock-forming minerals and at the study of utilization of Fe$^{3+}$ bacterial reduction. In connection with the problem...
of utilization of mine and metallurgical wastes the application of biological-chemical methods in the processes of Fe nanodispersions preparation was studied. The methods for observation of heavy metals bioaccumulation from waters by bacteria and wood-rooting fungus and methods of bio-sorbents based on metal sulphides as well as in the form of microscopical fungus biomass and of wood-rooting fungus biomass were elaborated in cooperation with Czech partners within the bilateral project. Within the treatment of acid mine drainage, the experiments of selective metals removal by means of biological-chemical methods and electro-chemical methods were realized, in frame of bilateral project with Italian researchers.

The research within the scope of collaboration with the national commercial firms and corporations was focused on remediation of soil and waters contaminated with organic pollutants. Application of in-situ-installed miniaturized gas analyzers brings about improvement of the monitoring of biodegradation processes. The continuous monitoring of the composition of soil gas facilitates the use of flexible feed back for efficient regulation of conventional technologies of bioventing and air-sparging applied in remediation processes.

Cooperation with Universities and scientific Institutions
In accredited period the Institute of Geotechnics of Slovak Academy of Sciences cooperated with the most faculties of Technical University Košice (Faculty of Building, Faculty of Metallurgy, Faculty of Engineering, Faculty of Elektrotechnics and Informatics), Faculty of Natural Sciences of J. A. Komenský University Bratislava and Faculty of Natural Sciences P. J. Šafárik Košice. The active scientific co-operation has been also established with Veterinary University Košice, Mining-Geology Faculty of Technical University Ostrava (Czech Republic), University of Chemical Technology Prague (Czech Republic) and Faculty of Natural Sciences T. G. Masaryk University Brno (Czech Republic).

Scientific agreements specify experimental works in common projects in laboratories of Institute of Geotechnics (e.g. common experiments on drilling stands of the Institute with BERG Faculty and Faculty of Engineering TU Košice, etc.). On the other side, the established agreements allow to perform experiments on other workplaces. The common results have been published in proceedings of scientific conferences and journals. The common monographs, published in Slovakia and abroad as well as co-organization of conferences serve as an illustration of such efforts. The common comittees between the Institute and Technical Universities in Slovakia and in Czech Republic were established for education activities on both sides. Very strong co-operation can be mentioned with Institutes of Slovak Academy of Sciences, e.g. with Institute of Experimental Physics, Institute of Materials Research, Institute of Parasitology, Institute of Geology, Institute for Heart Research, Institute of Inorganic Chemistry, Institute of Measuring Science, Institute of Materials and Maschine Mechanics, Institute of Experimental Oncology, Physical Institute as well as with Institutes of Academy of Sciences of Czech Republic, e.g. with Institute of Geonics, Institute of Microbiology, Institute of Atmospheric Physics and Institute for Hydrodynamics. The other Universities and Institutions can be mentioned, e.g. University of Maryland Baltimore County (USA), Institut Mechaniki Gorotworu of Polish Academy of Sciences Krakow (Poland), Aristotle University Thessaloniki (Greece), Central Metallurgical Research and Development Institute Cairo (Egypt), Physico-technical Institute of Russian Academy of Sciences, Ural Branch, Iževsk (Russia), Universitäten Wien (Austria), Technische Universität Clausthal (Germany), Mineral and Energy Economy Research Institute of Polish Academy of Sciences, Krakow (Poland), Institute of Environmental Geology and Geoengineering, Rome (Italy), University of Belgrade (Serbia and Montenegro), Institute of Physical and Theoretical Chemistry, Technical University, Braunschweig (Germany), Geoforschung Zentrum, Postdam (Germany), Universidad Nacional de Ingenieria, Lima (Peru), Norges Teknik-naturvitenskapelige Universitet, Trondheim (Norway), Instituto de Ciencia de Materiales de Sevilla (Spain) and National University Busan (South Korea).
In the area of domestic application of results Institute of Geotechnics co-operated with the following Slovak institutions: ♦ Doprastav, a. s., Bratislava ♦ INGEO, a. s., Žilina ♦ BESPA, a. s., Prievidza ♦ Hydrotunel, s. r. o., Bojnice ♦ KOPEX, s. r. o., Košice ♦ UNIGEO, a. s., Ostrava-Hrabová ♦ Uranpres, s. r. o., Spišská Nová Ves ♦ Geoexprerts, s. r. o., Žilina ♦ Geofos, s. r. o., Žilina ♦ Slovenská správa ciest, a. s., Bratislava ♦ Carbotech-SR, s. r. o., Žilina ♦ Váhostav – Tunely a špeciálne zakladania, a. s., Žilina ♦ PETRA-ARTEP, s. r. o., Košice ♦ ENVIRONCENTRUM, s. r. o., Parchovany ♦ SLZ ČHEMIA, a. s., Hnúšťa ♦ Správa Národného parku Slovenský raj ♦ Slovenská agentúra životného prostredia SCHKO Ponitrie, Nitra ♦ Správa Slovenských jaskýň, Liptovský Mikuláš ♦ Hornonitrianske bane, a. s., Prievidza ♦ Bloomsbury Pacific Slovakia, a. s., Lučenec ♦ SMZ, a. s., Jelšava ♦ Slovenský vodohospodárs ký podnik, š. p., Košice ♦ Inžinierske stavby, a. s., Košice ♦ Siderit, s. r. o., Nižná Slaná ♦ SILICON, s. r. o., Dobšiná ♦ KERKO, a. s. Košice.

3. Concept of R&D activity of the Organisation for the next four years (max. 5 pages)

i. Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective

The Institute of Geotechnics of Slovak Academy of Sciences is divided into five research departments where the research efforts cover several scientific directions, see part II.2. Knowledge conditions can be described as follows:

- In the field of rock disintegration by drilling and tunel boring the Institute is the only workplace in Slovakia where the large theoretical knowledge about interaction of indentor with rock or rock massif has been accumulated. Elaborated energy concept of disintegration process optimizing is accepted worldwide.

- In the field of monitoring and ranking the quality of environment in surrounding of the mining sites and other industrial enterprises the risk factors of the uncleanliness of gas and liquid media are evaluated. The obtained data have important value because the measurements are being continuously performed for more than 30 years. The prediction models of emission distribution have been elaborated for selected regions in Gemer and Spiš. The results are the only ones of their kind from the point of view of Slovakia.

- In the field of physical, physico-chemical and mechanochemical methods of advanced materials preparation the main aim is the development of nanomaterials suitable as heavy metal sorbents as well as applicable in electrotechnics. The new methods applying the microwave energy for modification of the physical as well as mechanical properties of minerals are developed. The new method for stabilization of the waste materials by vitrification in a microwave field has been also elaborated. Research in coal science is oriented to separation of valuable organic substances from Slovak brown coal with the possible biological activity and application in medicine. Mechanochemical approach is aimed to the preparation of nanophas e advanced materials. The simple and reliable synthetic procedure for a large quality of sulphide nanocrystalline semiconductors would be very useful for practical application of these materials. These results are world-wide accepted with the high citation impact in scientific journals.

- In the field of mineral biotechnologies the Institute is unique in Slovakia and research aim is concentrated on mineral transformations in situ, liquidation of the old mine environment loadings, the remediation liquidation of oil impurity levels. The results are highly appreciated in European research area.
ii. Organisation's role or significance in the overall research effort within the field of the Concept on both the national and international scales

From conclusions of the previous Accreditation commission of Slovak Academy of Sciences (No 512/2005, April, 25, 2005):

"...the results obtained by Institute of Geotechnics are of wide point of application with a high international level and with several scientific trends having influence in current modern development trends (mechanochemistry and mineral biotechnologies) with using sophisticated research methods on high international level. The Institute supports high efficiency of PhD studies with the optimal composition of research scientists. The organization has overcome the general society problems connected with the damping of mining activities and found its new position in mineral and materials science. There is a high participation of women at the Institute with their representation in scientific bodies...".

iii. Objectives of the Concept

1. **Nanosciences and nanotechnologies**: elaboration of the principles of the synthesis and application of the nanocrystalline compounds prepared from the precursors on the base of mineral, synthetic and waste materials. The potential application assumes the nanomaterials utilization in the chemical technology (purification of waste waters), in the electrochemical industry (semiconductors and barrier – layer photocell), as well as for the special purposes.

2. **Development of new materials and technologies**: the modification of the sorption properties of minerals, the utilization of microwave energy in the metallurgy and extraction methods used for obtaining the biologically active precursors, recycling of secondary raw materials and their utilization for the making new materials, development of advanced carbonaceous materials.

3. **Environment protection**: study of influence of the present and historical mining-processing industrial activity on the basic factors of the living and working environment, study of the solid phase of aerosols and deposition of the selected contaminants in the mineral processing industry environment, development and application of the procedures of analysis, detection and monitoring of the contaminants in the living environment and possibilities of their elimination.

4. **Mineral biotechnologies**: study of the biogeochemical processes of the minerals transformation in the surroundings of the deposits area of raw materials and in the industrial wastes. The application of geochemical modelling software for the prediction of acid mine waters quality evolution. The utilization of the classical and molecular biology methods at the assessment of the biodiversity of examined ecosystems. Study the natural and synthetic material biocorrosion. The biotechnological processes application for the processing of the minerals and wastes, for the liquidation of old mine loadings and remediation of localities polluted with anthropogenic activity.

5. **Geotechnics**: study of the mechanism of the interaction rock – tool, monitoring and optimization of the rock disintegration processes, development of the inversion and nonstandard methods for the assessment of the rock mass quality and processes efficiency, utilization of the artificial intelligence methods at the research of rotary drilling, rotary impact drilling, cutting and full-profile driving of the rock used at the survey and construction of mining, building and tunnelling underground constructions.
iv. Proposed strategies and methods to be applied, and time schedule

Institute of Geotechnics is a contributing organization of Slovak Academy of Sciences and a large portion of its budget is funded by participation in international and national projects as well as from cooperation with industrial partners. For further development of the Institute and the support of high research standard the permanent innovation of technical and information means of its laboratories is needed. There is a good age average at the Institute (41.7 years). The further permanent education of young scientists is needed with the simultaneous creation of conditions for their scientific growth. This trend requires permanent communication and mobility with the top scientific centers abroad.

The above mentioned strategic plans can be fulfilled only by full joining into the European research area and by obtaining of European projects, the bi-lateral international projects, the large national projects as well as the commercial contracts. Time span for fulfilling of these strategic aims is the year 2010.

III. Partial indicators of the main activities:

1. Research output

i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees


24. ŠEPELÁK, V. – FELDOHOFF, A. – HEITJANS, P. – KRUMEICH, F. – MENZEL, D. – LITTERST, FJ. – BERGMANN, I. – BECKER, KD. Nonequilibrium cation distribution, canted spin arrangement, and enhanced magnetization in nanosized MgFe2O4 prepared...


**ii. List of monographs/books published abroad**


**iii. List of monographs/books published in Slovakia**


iv. List of other scientific outputs specifically important for the Organisation

1. Weathering processes of rocks generated large volumes of granitic eluvium, kaolin clays and quartz sands in nature. These economically important raw materials are often used in wide variety of ceramic, glass and paper applications. Oxides and hydroxides of Fe are often deposited along with these industrially important non-metals, contaminating and making much of their unusable for commercial applications due to insufficient whiteness. Considerable efforts have been devoted to the problem of removing ferric contaminants by physical and chemical means. However, we tested ability and activity of heterotrophic bacteria at Fe removal from various non-metals under laboratory conditions. Our laboratory experiments confirmed the significant role of bacteria of Bacillus species in iron reduction where enzymatic process is similar to dissimulative nitrate reduction. Fe\(^{3+}\) is mobile only at very low pH under 3. However, microbial reduction enables Fe\(^{2+}\) formation which is mobile in normal soil pH range by production of organic acids. These organic acids are directed by glycocalyx of adherent bacteria to specific sites of mineral surface (structural defects and dislocations). Biological destruction of micas after iron removal led to illite formation and to enrichment of kaolin and quartz sands by fine-grained fraction. This fine-grained fraction was subsequently removed for example from quartz sands by elutriation when raw material with content of 0,09% Fe\(_2\)O\(_3\) and under 0,1% FeO was obtained. Bacteria of Bacillus species significantly decreased iron content also in feldspars. Removal of 46% Fe after 1 month bacterial pretreatment and subsequent organochemical treatment of granitic eluvium was also the result especially of bacterial activity. The use of the method of the monitoring of glucose consumption during bioleaching of silicate raw materials as well as the successful substitution of glucose by cheaper molasses in this process significantly helped to optimalisation of bacterial activity especially during iron reduction. There is evident that these iron-reducing bacteria can be used in iron removal from non-metals with acceptation also to present economical and ecological requests at application of biotechnology in various industry kinds. It will be necessary to test in future bacterial destruction not only under laboratory conditions but also on selected deposits of non-metals.

(Project VEGA No.: 2/2107/22, coordinator: Ing. Iveta Štyriaková, PhD.)

2. Well-crystallized zinc, cadmium and lead sulphide nanoparticles were succesfully synthesized by the mechanochemical route from the corresponding acetates and Na\(_2\)S. X-ray powder diffraction and scanning electron microscopy were used to characterize the as obtained products. The SEM and TEM measurements show the aggregates of small nanocrystals in which particle size of 5-18 nm were estimated. Simple flow chart of the preparation of sulphide nanoparticles was presented. It is posible to synthesize the particles in a laboratory as well as in industrial mill.


3. Lake Baikal represents one of the few Eurasian, continental, lacustrine sites wit an extremely long, uninterrupted record (spanning potentially 25 million years) that can be exploited for high resolution paleoclimate studies.
The first step for understanding of biogeochemical factors controlling the global circle of carbon and the changes of climate is to understand backward binding of weathering mechanism of silicate rocks. Microbial degradation of silicate rocks in the presence of organic compounds exhibits, in the dependence on temperature, many times stronger (higher) biodegradation and biotransformation of silicate minerals to clay minerals with iron admixtures in natural weathering processes. These minerals are transported together with microorganisms into Lake Baikal and there is written like in a book the climatic changes on our continents at various carbon dioxide concentrations. The exchange of glacial and interglacial periods in geological periods is not any peculiarity and it is possible to deduce the development of Earth climate in future on the basis of study of many factors including also bioformation of clay minerals in sediments of Lake Baikal.


4. The process of iron spathic ore decomposition under application of microwave energy has been studied. The formation of new mineral phases was identified and their structural and chemical parameters were determined. The degree of conversion of siderite to magnetite was assessed by the attained value of magnetic susceptibility, being the most significant parameter in the process of magnetic separation. Experiments proved, that already after 15 minutes of irradiation of siderite samples in microwave oven, the iron recovery of 97.6 % into magnetic product was achieved by low intensity magnetic separation. The application of microwave heating accelerates the process of ore decomposition and this fact results in costs saving of heating and magnetic separation.


5. Red mud, a solid byproduct of the alumina production industry, was found to be an environmentally compatible sorbent able to remove cadmium, zinc, lead and copper from model aqueous solutions. The best removal efficiency was observed for zinc (ca. 133 mg/g or 2.0 mmol/g for pH 7 in the presence of 0.01M NaNO₃. Cadmium was also satisfactorily removed at pH 6 and 0.01M NaNO₃ with maximum removal efficiency of 68 mg/g or 0.6 mmol Cd/g of solid. Copper and lead were due to precipitation effect almost completely removed at pH values 6 and 7 respectively. Presented work was supported by the Greek–Slovak cooperation under the Project “Development, testing and application of magnetic sorbents for removal of heavy metals from wastewater and soil” in 2002-2004, which continues under the NATO Collaborative Linkage Grant EST.EAP.CLG 981103 “Arsenic decontamination from water recourses” 2004-2006.

(Project NATO Collaborative Linkage Grant No. EST.EAP.CLG 981103, coordinator: Ing. M. Václavíková, PhD., Publication:M. VÁCLAVÍKOVÁ, P. MISAEIDES, G. GALLIOS, S. JAKABSKÝ AND S. HREDA - Removal of cadmium, zinc, copper and lead by red mud, an iron oxides containing hydrometallurgical waste, Studies in Surface Science and Catalysis - Oxide Based Materials, Vol 155; A. Gamba, C. Colella, S. Coluccia (eds), Elsevier, pp 517-525.)
6. Nonequilibrium cation distribution, canted spin arrangement and enhanced magnetization of nanocrystalline magnesium ferrite (MgFe$_2$O$_4$) prepared by one-step mechanochemical route. Nanocrystalline magnesium ferrite (MgFe$_2$O$_4$) with mean crystallite size of 8 nm was synthesized from simple oxides by one-step mechanochemical route. Mössbauer study of volume and nanocrystalline MgFe$_2$O$_4$ enabled to separate surface and volume effects. While crystal core of MgFe$_2$O$_4$ nanoparticles is ordered ferrimagnetic, surface layer of nanoparticles with thickness of 0.85 nm shows nonequilibrium cation distribution and canted spin arrangement. Mechanosynthesized nanoparticles have enhanced saturation magnetization of 50 emu/g and it is by 50% more than magnetization of volume MgFe$_2$O$_4$. Nanocrystalline MgFe$_2$O$_4$ is stable up to temperature of 623 K. At higher temperature, i.e. over 623 K, cation distribution and spin arrangement induced by mechanochemical preparing route relax to their equilibrium states.


7. Nanocrystalline semiconductor particles MeS (Me=Pb, Zn, Cd, Cu) were successfully synthesized by the mechanochemical route from the corresponding metal acetates and sodium sulphide in an industrial eccentric vibratory mill. Structure properties of the as-prepared products were characterized by X-ray powder diffraction which reveals the crystalline nature of MeS nanoparticles. The methods of TEM, particle size analysis and low temperature nitrogen sorption were used to analyze particle morphology and surface area measurement. The average sizes of MeS particles at 4-18 nm were estimated by Scherrer’s formula. The main advantage of the application of an industrial mill is that it is a „quantity“ process permitting kilograms of material to be produced in an ambient temperature in a very short processing time.


8. In the frame of the task of the State Program R&D the conditions of magnetic separation at deferrization of soot were defined. The soot as by-product comes from tyre pyrolysis in semi-plant operation in SLZ Chémia, Inc. Hnúšťa. Two magnetic fraction were identified in soot, namely wires of metallic iron (98.4 % of Fe) and fine-grained polyphase mixture with magnetite (23.5 % of Fe), which was detected in given fraction by XRD. The magnetic product with iron content of 53.58 % at mass yield of 3.02 % was obtained by dry low intensity magnetic separation (0.16 T). Recovery of iron into magnetic product attained 62.27 %. Three forms of carbon were identified in non-magnetic product, including two phases of graphite and lonsdaleite. Moreover, calcite and rankinite were also found. After soot deferrization carbon content exceeded 80 %.


9. Organic epichlorhydrine-based resin was prepared with the aim to remove of arsenic oxyanions from waters. The resin was subjected to complex chemical analysis as well as to study of physical properties. Sorption of arsenic was realized in batch experiment. Maximal
sorption capacity of 250 mg As/g sorbent was confirmed. In comparison with technical literature, it is severalfold higher value, than the one attained by other sorbents.  


v. Table of research outputs

Table Research outputs shows research outputs in number of specified entries; these entries are then divided by FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

<table>
<thead>
<tr>
<th>Research outputs</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
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<tr>
<td></td>
<td>number</td>
<td>No. / FTE</td>
<td>No. / salary budget</td>
<td>number</td>
<td>No. / FTE</td>
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<td>0</td>
<td>0,00</td>
<td>0,00</td>
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<td>0,00</td>
</tr>
<tr>
<td>chapters in monographs, books published in Slovakia</td>
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<tr>
<td>publications in proc. of nat. scientific conferences</td>
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<td>0,77</td>
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<td>active participations at national conferences</td>
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<td>3,38</td>
<td>34</td>
<td>1,01</td>
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</tbody>
</table>
vi. List of patents and patent applications

vii. Supplementary information and/or comments on the scientific output of the Organisation

2. Responses to the scientific output

*Table Citations* shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

<table>
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<td>No. / FTE</td>
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<td>27</td>
<td>0,8</td>
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</tbody>
</table>
i. List of 10 top-cited publications and number of their citations in the assessment period

   Cited 13–times in Web of Science

   Cited 12–times in Web of Science

   Cited 12–times in Web of Science

   Cited 12–times in Web of Science

   Cited 11–times in Web of Science

   Cited 10–times in Web of Science

   Cited 10–times in Web of Science

   Cited 10–times in Web of Science

   Cited 9–times in Web of Science

   Cited 8–times in Web of Science

ii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the assessment period

   Cited 13–times in Web of Science

   Cited 12–times in Web of Science

   Cited 12–times in Web of Science

   Cited 12–times in Web of Science

   Cited 11–times in Web of Science

   Cited 10–times in Web of Science

   Cited 10–times in Web of Science

   Cited 10–times in Web of Science

   Cited 9–times in Web of Science

   Cited 8–times in Web of Science
iii. Supplementary information and/or comments on responses to the scientific output of the Organisation

Evaluation of the Institute of Geotechnics of Slovak Academy of Sciences by an independent Scientific Agency ARRA

Institute of Geotechnics SAS is marked in histograms as GeoTech.

Progress in citations
3. Research status of the Organisation in the international and national context

- International/European position of the Organisation
  
  i. List of the most important research activities documenting international importance of the research performed by the Organisation, incl. major projects (details of projects should be supplied under Indicator 4). Collective membership in the international research organisations, in particular within the European Research Area

One of the most important achievements documenting international importance of the research performed under umbrella of the Institute of Geotechnics of Slovak Academy of Sciences is foundation of the Slovak mechanochemical school, the school of extremal optimisation of boring and driving processes, development of high – intensity magnetic separators, development of magnetic fluid for technical purposes, elaboration and pilot – plant verification of hydrometallurgical processing of tetrahedrite ores of Slovak provenience, elaboration of Litho–jet technology, application of advanced coal technology for Slovak brown coal and Czech hard and brown coal, the fundamental Slovak research efforts in the area of mineral biotechnology and by application of microwaves in mineralurgy, fundamental works in the field of dust risk evaluation as well as proven possibility to synthesize nanosized semiconductors in an industrial mill.

Institute of Geotechnics of Slovak Academy of Sciences is a member of several international organisations like ISRM (International Society for Rock Mechanics), ITA/AITES (International Tunnelling Association / Association International de Travaux en Sonterrain) and IMA (International Mechanochemical Association).
The tradition of international conferences on mechanochemistry and mechanical alloying (INCOME) has been founded by the Institute in 1993. The 1st INCOME was held in Košice (Slovakia), the IIIrd INCOME was held in Braunschweig (Germany) under co-organisation of the Institute. The vast international collaboration is documented by a great number of collaborations in Europe, America, Australia and Asia. The common projects presentations and publications belong to regular results of this scientific effort.

HIGH-RESOLUTION CONTINENTAL PALEOCLIMATE RECORD IN THE LAKE BAIKAL
Project coordinator: Ing. Iveta Štyriaková, PhD.
Project No.: EVK2-2002-00538: FP5-Extension

STUDY OF CONTACT FATIGUE MECHANISMS OF DUPLEX TREATED LOW STEELS
Project coordinator: doc. RNDr. Jaroslav Briančin, PhD.
Project No.: COST 532-M7

ARSENIC DECONTAMINATION FROM WATER RESOURCES
Project coordinator: Dr. George Gallios - Aristotle University, Thessaloniki, Chemical Technology Division
Ing. Štefan Jakabský, PhD. – ÚGt SAV Košice
Project No.: EST.EAP.CLG 981103: NATO Brussel

CARBON DIOXIDE SEQUESTRATION BY MECHANICALLY ACTIVATED MINERALS
Participation in VIth frame European project „Environmental Gas Management Research Infrastructure”
Project coordinator: prof. RNDr. Peter Baláž, DrSc.
Project No: ENGAS (VI. frame program)

ii. List of international conferences (co-) organised by the Organisation


iii. List of international journals edited/published by the Organisation

-

iv. List of edited proceedings from international scientific conferences and other proceedings

-
- National position of the Organisation
  
i. List of selected most important national projects (Centres of Excellence, National Reference Laboratories, Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and others)

[1] CENTRUM NANOKRYŠTALICKÝCH MATERIÁLOV (NANOSMART)

POTENTIAL FELDSPAR RAW MATERIALS IN SLOVENSKÉ RUDOHORIE MOUNTAIN RANGE, STRÁŽOVSKÉ VRCHY AND BRANISKO AND THEIR BIOLOGICAL AND CHEMICAL TREATMENT
Project coordinator: Ing. Iveta Štyriaková, PhD.
Project No: 2/9001/22: state order

NEW MATERIALS AND COMPONENTS IN SUBMICRON TECHNOLOGY, PART 04: THE DEVELOPMENT OF MATERIALS BY USING OF THE MINERAL BIOTECHNOLOGY, MECHANOCHEMICAL AND CHEMICAL ROUTES
Project coordinator: Ing. Štefan Jakabský, PhD.
Project No: state order 2003 SO 51/03R 06 00/03R 06 042, MF SR

SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS PREPARED BY NONTRADITIONAL METHODS FROM METAL AND RAW MATERIAL BASED PRECURSORS
Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Project No: 51-036102: APVT

INNOVATION AND DEVELOPMENT OF TECHNOLOGIES FOR REMOVING OF HEAVY METALS FROM WATERS BY ADVANCED MAGNETIC NANOMATERIALS AND BIOSORBENTS
Project coordinator: Ing. Miroslava Václavíková, PhD.
Project No: 51-017104: APVT

ADVANCED COAL MATERIALS ON THE BASE OF SLOVAK RAW MATERIALS FOR SUSTAINABLE DEVELOPMENT
Project coordinator: doc. Ing. Ľudmila Turčániová, PhD.
Project No: 51-036102: APVT

HIGH TECH AND NEW TECHNOLOGIES IN THE FIELD OF EXPLOITATION AND PROCESSING OF INDUSTRIAL MINERALS
Úloha štátneho programu výskumu a vývoja
Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Project No: 2004 SP 26 028 0C 01

MODIFICATION OF CONDITIONS FOR BACTERIAL ACTIVITY OPTIMALIZATION IN PROCESSES OF NON-METALLIC RAW MATERIALS TREATMENTS
Project coordinator: Ing. Iveta Štyriaková, PhD.,
Project No: 51-006304 (project APVT)

SOLUTION OF THEORETICAL AND PRACTICAL PROBLEMS OF MICROWAVE ENERGY APPLICATION IN MINERALLURGY AND ENVIRONMENTAL TECHNOLOGIES
Project coordinator: Ing. Štefan Jakabský, PhD.
Project No: 51-035505 (project APVV)
STUDY OF APPLICATION POSSIBILITIES OF REMEDIATION METHOD IN THE ELIMINATION OF ENVIRONMENTAL RISK OF ACID MINE DRAINAGE AT THE OLF MINE LOADING SMOLNÍK
Project coordinator: Ing. Alena Luptáková, PhD.
Project No: 51-027705 (project APVV)

CO₂ SEQUESTRATION BY MECHANOCHEMICAL CARBONATION OF MINERALS
Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Project No: LPP-019-06 (project APVV)

ii. List of national scientific conferences (co)-organised by the Organisation

[3] Scientific conference „Natural sciences in mineralurgy and environmental science“, Košice, 5.5.2004

iii. List of national journals published by the Organisation


iv. List of edited proceedings of national scientific conferences/events

1. HREDZÁK, S. – BINDAS, Ľ. (editors): Proceedings of the XV scientific symposium with international participation „On ecology in selected agglomerations Jelšava – Lubeník and Central Spiš“, Hrádok, October 26 – 27, 2005, University of Veterinary Medicine in Košice,


- **International/European position of the individual researchers**
  i. List of invited/keynote presentations at international conferences, documented by an invitation letter or programme


ii. List of employees who served as members of the organizing and/or programme committees for international conferences

Membership in the organizing committee of 5 international conferences
[2] Ing. Slavomír Hredzák, PhD.
Membership in the organizing committee of 5 international conferences
Membership in the organizing committee of 4 international conferences
[4] Prof. RNDr. Peter Baláž, DrSc.
Membership in the organizing committee of 2 international conferences
[5] Prof. RNDr. Vladimír Šepelák, DrSc.
Membership in the organizing committee of 1 international conference
[6] Ing. Edita Lazarová, PhD.
Membership in the organizing committee of 1 international conference
Membership in the organizing committee of 1 international conference

iii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

[1] Prof. RNDr. Peter Baláž, DrSc.
member of the Editorial Board of the Hydrometallurgy journal
member of the IMA (International Mechanochemical Association)
member of the RFM (Reseau Francais de Mechanosynthese)
member of the Alexander von Humboldt Fellow Club
[3] Ing. Miroslava Vaclavíková, PhD.
representative of SR in NATO CCMS–Clean Products and Processes, Pilot Study II

iv. List of international scientific awards and distinctions

appreciation for the poster presentation

• National position of the individual researchers

i. List of invited/keynote presentations at national conferences documented by an invitation letter or programme


**ii. List of employees who served as members of organising and programme committees of national conferences**

[1] doc. Ing. Mária Kušnierová, PhD
Membership in the organizing committee of 5 conferences

[2] Ing. Slavomír Hredzák, PhD
Membership in the organizing committee of 6 conferences

[3] host. doc. RNDr. Milan Bobro, PhD
Membership in the organizing committee of 4 conferences

[4] Ing. Jozef Hančuľák, PhD
Membership in the organizing committee of 3 conferences

Membership in the organizing committee of 2 conferences

iii. **List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)**

vice-president of the Slovak Mining Society  
member of the Supervisory Board of Slovak Mining Chamber  
member of the Scientific Board of the BERG Faculty, TU Košice  
honest member of the Scientific Board of Faculty of Civil Engineering, TU Košice  
member of the Scientific Collegium of SAS for Electronics, Materials Research and Technologies  
member of the Editorial Board of the Ground Communications and Railways journal

[2] Prof. RNDr. Peter Baláž, DrSc.  
member of the National Committee IMA at IUPAC  
member of the Editorial Board of the Acta Montanistica journal  
member of the Scientific Collegium of SAS for on Earth and Space Sciences  
member of the Accreditation Committee of SAS  
constituent member of the Learned Society of SAS  
member of the Slovak Society for Scientific Degrees of the Ministry of Education of SR 2006

member of the National Committee IMA at IUPAC

[4] Ing. Slavomír Hredzák, PhD.  
head of the Special Committee for Processing and Mining Ecology of the Slovak Mining Society

member of the VEGA committee No.6
   member of the Committee for Environment at Presidium of SAS
   member of the VEGA Committee No. 6

[7] Ing. Jozef Hančulák, PhD.
   member of the Committee for Environment at Presidium of SAS

[8] RNDr. Ján Bejda, PhD.
   member of the VEGA Committee No. 6

[9] Ing. František Krepelka, PhD.
   member of the VEGA Committee No. 6

[10] Ing. Iveta Štyriaková, PhD.
    member of the VEGA Committee No. 6

[10] Assoc. Prof. Ing. František Blaško, PhD.
    member of the Editorial Board of the Acta Montanistica journal
    member of the Editorial Board of the Slovak Association of Stone Producers journal

    member of the Editorial Board of the Powder Metallurgy Progress journal

iv. List of national awards and distinctions

[1] RNDr. Erika Godočíková, PhD.
   The second place in the Competition of Young Scientific Workers organized at the 50. Anniversary of SAS

   Medal for the Contribution to the Development of the Slovak Mining Society

   The Silver Medal of the Union of Slovak Research-Development Societies

   Premium of the Literary Foundation for the Scientific Acceptance, Bratislava, 2004

[5] Prof. RNDr. Peter Baláž, DrSc.
   Premium of the Literary Foundation for the Scientific Acceptance, Bratislava, 2006

Supplementary information and/or comments documenting international and national status of the Organisation

The members of staff of the Institute participate in the activities of following international and national associations and societies:

- National group of International Society for Rock Mechanics,
- Slovak Tunnelling Association – a member of ITA/AIETES - International Tunnelling Association,
- IMA - International Mechanochemical Association,
- Czech and Slovak Crystallographic Association,
- Research Board of Advisors of the American Biographical Institute,
- RMF - Reseau Francais de Mecanosynthese – French Net of Mechanosynthesis,
- ČSVVVI – Czech Association for Research and Utilization of Clays,
- ECGA – European Clay Groups Association,
- Slovak Clay Society,
- Slovak Mining Society,
- Czechoslovak Microbiological Society,
Slovak Bioclimatological Society at Slovak Academy of Sciences,
European Microscopy Society,
Slovak Association of Aggregates Producers – a member of UEPG – European Aggregates Association,
Slovak Chemical Society,
Slovak Physical Society.

4. Project structure, research grants and other funding resources

- International projects and funding
  - List of major projects within the European Research Area – 5th and 6th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, etc. (here and in items below please specify: type of project, title, grant number, duration, funding, responsible person in the Organisation and his/her status in the project, e.g. coordinator, principal investigator, investigator)

  1. HIGH-RESOLUTION CONTINENTAL PALEOCLIMATE RECORD IN THE LAKE BAIKAL
     Project coordinator: Ing. Iveta Štyriaková, PhD.
     Duration of project: 1/2002-12/2004
     Project No.: EVK2-2002-00538: FP5-Extension
     Project budget: 37.533 EUR + 220.000,- Sk

  2. STUDY OF CONTACT FATIGUE MECHANISMS OF DUPLEX TREATED LOW STEELS
     Project coordinator: doc. RNDr. Jaroslav Briančin, PhD.
     Project No.: COST 532-M7
     Institution: Ústav geotechniky SAV
     Participating organizations: 4 – Engineering Faculty TU Košice, Slovakia; University of Ljubljana, Faculty of Mechanical Engineering, Centre of Tribology and Technical Diagnostics, Ljubljana, Slovenia; Advanced Technology Group Ltd., Research Centre Bechovice, Material and Corrosion Dept, Praha, Czech Republic; Institute for Technology, Radom, Poland
     Project budget: 150 000,- Sk

  3. ARSENIC DECONTAMINATION FROM WATER RESOURCES
     Project coordinator: Dr. George Gallios - Aristotle University, Thessaloniki, Chemical Technology Division
     Ing. Štefan Jakabský, PhD. – ÚGT SAV Košice
     Duration of project: 05. 07. 2004 - 05. 07. 2006
     Project No.: EST.EAP.CLG 981103: NATO Brussel
     Institution: Ústav geotechniky SAV, Aristotle University, Thessaloniki
     Participating organizations: 0
     Project budget: 9 800.- EUR, NATO Brussel

4. CARBON DIOXIDE SEQUESTRATION BY MECHANICALLY ACTIVATED MINERALS
Participation in VIth frame European project „Environmental Gas Management Research Infrastructure“

Project coordinator: prof. RNDr. Peter Baláž, DrSc.
Project No: ENGAS (VI. frame program)
Institution: ENGA S RI, Norwegian University of Science and Technology, Trondheim, Nórway

Participating organizations: 0
Project budget: travel + accomodation for 2 scientists paid by Norway side

ii. List of other international projects incl. funding

1. DEVELOPMENT, TESTING AND APPLICATION OF MAGNETIC SORBENTS FOR REMOVAL OF HEAVY METALS FROM WASTEWATER AND SOILS
   Project coordinator: Prof. Panagiotis Misaelides – Aristotle University, Thessaloniki
   Ing. Štefan Jakabský, PhD. – Ústav geotechniky SAV
   Duration of project: 01/2002-12/2003
   Project No: 14GRE, MF SR: Greece-Slovak project
   Project budget: 131.000,- Sk

2. BIOLOGICAL AND CHEMICAL TREATMENTS IN PREPARATION OF IRON-CONTAINING NANODISPERSIONS
   Project coordinator: Doc. Ing. Mária Kušnierzová, PhD.
   Duration of project: 01/2002-12/2003
   Project No: 183/048: Slovak-Czech project
   Project budget: 20.000,- Sk

3. BIOACCUMULATION OF HEAVY METALS FROM WASTE WATERS BY BACTERIA AND WOOD-ROTTING FUNGUS
   Project coordinator: Ing. Alena Luptáková, PhD.
   Duration of project: 01/2002-12/2003
   Project No: 182/176: Slovak-Czech project
   Project budget: 27.000,- Sk (MŠ SR)

4. BIOTRANSFORMATION OF MINERALS IN BIOGEOCHEMICAL PROCESSES
   Project coordinator: Ing. Iveta Štyriaková, PhD.
   Duration of project: 01/2002-12/2003
   Project No: Slovak-Austrian project
   Project budget: 920,- EUR

5. THE STUDY OF THE HEAVY METALS TOXIC INFLUENCE ON THE GROWTH OF SULPHATE-REDUCING BACTERIA AND WOOD-ROTTING FUNGUS AT THE METALS BIOACUMULATION FROM WATERS
   Project coordinator: Ing. Alena Luptáková, PhD.
   Duration of project: 01/2004 – 12/2005
   Project No: 124 Slovak-Czech project
6. **COMPLEX PROCESSING AND UTILIZATION OF FLY ASHES FROM COAL-FIRED POWER PLANTS**

Project coordinator: prof. Dr. Rudolf A. Tomanec - University of Belgrade, Faculty of Mining and Geology, Dept. of Mineral Processing  
Ing. Slavomír Hredzák, PhD. – ÚGt SAV Košice  
Duration of project: 01/2004 – 12/2005  
Project No: 13SR+CH, MF SR: Slovak–Serbia and Montenegro project  
Institution: Ústav geotechniky SAV Košice, University of Belgrade  
Participating organizations: 0  
Project budget: 137 000,- Sk

7. **ARSENIC DECONTAMINATION FROM WATER RESOURCES**

Project coordinator: Dr. George Gallios - Aristotle University, Thessaloniki, Chemical Technology Division  
Ing. Štefan Jakabský, PhD. – ÚGt SAV Košice  
Duration of project: 05. 07. 2004 - 05. 07. 2006  
Project No: EST.EAP.CLG 981103: NATO Brussel  
Institution: Ústav geotechniky SAV, Aristotle University, Thessaloniki  
Participating organizations: 0  
Project budget: 9 800.- EUR – from NATO Brussel

8. **THE ELIMINATION OF HEAVY METALS FROM INDUSTRIAL WASTE WATER BY BIOSORBETS**

Project coordinator: Ing. Alena Luptáková, PhD.  
Duration of project: 01/2006 – 12/2007  
Project No: 119 (Slovak-Czech project)  
Participating organizations: 2 (Ústav geotechniky SAV, Košice a Microbiological Institute AVČR, Praha)  
Project budget: 36.000,- Sk/2006 – APVV, Bratislava

9. **THE CHANGES OF COAL MATERIAL IN THE COURSE OF BACTERIAL LEACHING**

Project coordinator: Doc. Ing. Mária Kušnierová, PhD.  
Duration of project: 01/2006 – 12/2007  
Project No: SK 124/CZ 118 (Slovak-Czech project)  
Participating organizations: 2 (Ústav geotechniky SAV, Košice, VŠB TU Ostrava)  
Project budget: 35.000,- Sk – APVV, Bratislava

10. **BIOTRANSFORMATION OF MINERALS IN BIOGEOCHEMICAL PROCESSES**

Project coordinator: Ing. Iveta Štyriaková, PhD.,  
Duration of project: 06/2006 – 05/2008  
Project No: SLO 13 (Slovak-Slovenia project)  
Participating organizations: 2 - Ústav geotechniky SAV, Košice a Geological survey of Slovenia Ljubljana  
Project budget: 65.000,- Sk – APVV, Bratislava
11. STUDY OF RELATIONS OF MINERALIZATION, ACIDITY AND AUTOCHTHONOUS MICROORGANISMS OCCURRENCE IN ACID MINE DRAINAGE

Project coordinator:  Doc. Ing. Mária Kušnierová, PhD.
Duration of project: 01/2004 – 12/2007
Project No:  12 (Slovak-Italy project)
Participating organizations:  2 (Ústav geotechniky SAV, Košice a Institute of Environmental Geology and Geoengineering, Rím)
Project budget:  93 000.- Sk – APVV, Bratislava

iii. List of other important projects and collaborations without direct funding

1. MECHANOCHEMICAL PROCESSING OF MINERALS FOR ADVANCED APPLICATIONS

Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Duration of project: 01/2003 – 12/2004
Project No:  DAAD-PPP
Project budget: mobility

2. THE POSSIBILITIES OF (RE)USE OF MINE WASTES AND MINIMISATION OF THEIR INFLUENCE ON THE ENVIRONMENT

Project coordinator:  Doc. Ing. Mária Kušnierová, PhD.
Project No:  20 (Slovak-Poland project)
Institution: Ústav geotechniky SAV
Participating organizations:  1 - Polish Academy of Sciences Mineral and Energy Economy Research Institute, Krakov
Project budget:  0,- Sk

3. MECHANOCHEMICAL PREPARATION OF NANOSIZED PHARMACEUTICAL DRUGS FOR APPLICATION IN CANCER THERAPY

Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Duration of project: 10/2005 – 01/2006
Project No:  052S-2-6 (Slovak-South Korea projekt)
Institution: Korean Federation of Science and Technology
Participating organizations:  1 – Pusan National University, Busan, Korea
Project budget: travel + accommodation with pocket money by Korean site

4. CONSTRUCTION CERAMIC MATERIALS FROM CONVENTIONAL AND MICROWAVE VITRIFICATION OF IRON-CONTAINING WASTES

Project coordinator:  Dr. Maximina Romero Instituto de Ciencias de la Construccion Eduardo Torroja, CSIC
RNDr. Michal Lovás, PhD. – ÚGt SAV Košice
Duration of project: 01/2006 - 12/2007
Project No:  2005SK0002 (Slovak–Spain project)
Institution: Ústav geotechniky SAV, Instituto de Ciencias de la Construccion Eduardo Torroja, CSIC
5. MECHANOCHEMICAL SYNTHESIS AND PROPERTIES OF NANOCRYSTALLINE MATERIALS
Project coordinator: prof. RNDr. Peter Baláž, DrSc.
Duration of project: 01/2006 – 12/2007
Project No: DAAD-PPP (Slovak-German project)
Institution: Ústav geotechniky SAV and Technische Universität Clausthal
Participating organizations: 0
Project budget: travel + accommodation with pocket money by Spain site

6. MECHANOCHEMICAL SYNTHESIS OF OXIDES AND SULFIDES FOR ENVIRONMENTAL PROTECTION
Project coordinator: RNDr. Erika Dutková, PhD.
Duration of project: 01/2006-01/2009
Project No: (Bulgarian-Slovak project)
Institution: Ústav geotechniky SAV and Institute of Catalysis of Bulgarian Academy of Sciences
Participating organizations: 0
Project budget: accommodation with pocket money by Bulgarian site

- National projects and funding
  i. List of projects supported by the Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, and their funding

1. POTENTIAL FELDSPAR RAW MATERIALS IN SLOVENSKÉ RUDOHORIE MOUNTAIN RANGE, STRÁŽOVSKÉ VRCHY AND BRANISKO AND THEIR BIOLOGICAL AND CHEMICAL TREATMENT
Project coordinator: Ing. Iveta Štyriaková, PhD.
Duration of project: 01/2002-12/2003
Project No: 2/9001/22: state order
Project budget: 200.000,- Sk

2. NEW MATERIALS AND COMPONENTS IN SUBMICRON TECHNOLOGY, PART 04: THE DEVELOPMENT OF MATERIALS BY USING OF THE MINERAL BIOTECHNOLOGY, MECHANOCHEMICAL AND CHEMICAL ROUTES
Project coordinator: Ing. Štefan Jakabský, PhD.
Duration of project: 06/2003-12/2005
Project No: state order 2003 SO 51/03R 06 00/03R 06 042, MF SR
Institution: Institute of Experimental Physics SAS Košice,
Participating organizations: Institute of Experimental Pharmacology SAS, Institute for Heart Research SAS
Project budget: 4 240.000,- Sk
SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS PREPARED BY NON-TRADITIONAL METHODS FROM METAL AND RAW MATERIAL BASED PRECURSORS

Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Duration of project: 08/2002 – 07/2005
Project No: 51-036102: APVT
Institution: Ústav geotechniky SAV
Participating organizations: 1- Institute of Experimental Physics SAS Košice
Project budget: 1 579 000,- Sk

4.
INNOVATION AND DEVELOPMENT OF TECHNOLOGIES FOR REMOVING OF HEAVY METALS FROM WATERS BY ADVANCED MAGNETIC NANOMATERIALS AND BIOSORBENTS

Project coordinator: Ing. Miroslava Václavíková, PhD.
Duration of project: 01/2005 – 12/2007
Project No: 51-017104: APVT
Institution: Ústav geotechniky SAV
Participating organizations: 0
Project budget: 1 090 000,- Sk

5.
ADVANCED COAL MATERIALS ON THE BASE OF SLOVAK RAW MATERIALS FOR SUSTAINABLE DEVELOPMENT

Project coordinator: doc. Ing. Ľudmila Turčáňiová, PhD.
Project No: 51-036102: APVT
Institution: Ústav geotechniky SAV
Participating organizations: BERG Faculty TU Košice, Institute of Animal Physiology SAS, Institute of Measurement Science Bratislava
Project budget: 4 653 000,- Sk

6.
HIGH TECH AND NEW TECHNOLOGIES IN THE FIELD OF EXPLOITATION AND PROCESSING OF INDUSTRIAL MINERALS

Úloha štátneho programu výskumu a vývoja
Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Duration of project: 07/2004 - 12/2006
Project No: 2004 SP 26 028 0C 01
Institution: Ústav geotechniky SAV
Participating organizations: BERG Faculty TU Košice Project budget: 37 327 000,- Sk – Ministry of Economy SR and co-financing organisations (SLZ Chémia, a.s. Hnúšťa, SLOVMAG, a.s. Lubeník, ATIM, s.r.o Košice, HYDROTUNEL, s.r.o., Bojnice, VÁHOSTAV-tunely a špeciálie zakladania, a.s., Žilina, MATADOR, a.s. Púchov, ZTS – Výskum a vývoj, a.s., Dubnica nad Váhom)

7.
MODIFICATION OF CONDITIONS FOR BACTERIAL ACTIVITY OPTIMALIZATION IN PROCESSES OF NON-METALLIC RAW MATERIALS TREATMENTS

Project coordinator: Ing. Iveta Štyriaková, PhD.,
Duration of project: 01/2005 – 12/2007
Project No: 51-006304 (project APVT)
Institution: Ústav geotechniky SAV
8. **SOLUTION OF THEORETICAL AND PRACTICAL PROBLEMS OF MICROWAVE ENERGY APPLICATION IN MINERALLURGY AND ENVIRONMENTAL TECHNOLOGIES**

Project coordinator: Ing. Štefan Jakabský, PhD.
Duration of project: 03/2006 – 02/2009
Project No: 51-035505 (project APVV)
Institution: Ústav geotechniky SAV
Participating organizations: 0
Project budget: 1 603.000,- Sk – APVT, Bratislava

9. **STUDY OF APPLICATION POSSIBILITIES OF REMEDIATION METHOD IN THE ELIMINATION OF ENVIRONMENTAL RISK OF ACID MINE DRAINAGE AT THE OLF MINE LOADING SMOLNÍK**

Project coordinator: Ing. Alena Luptáková, PhD.
Duration of project: 05/2006 – 02/2009
Project No: 51-027705 (project APVV)
Institution: Ústav geotechniky SAV
Participating organizations: Building Engyneering Faculty TU Košice
Project budget: 1 366.000,- Sk – APVV, Bratislava

10. **CO₂ SEQUESTRATION BY MECHANOCHEMICAL CARBONATION OF MINERALS**

Project coordinator: Prof. RNDr. Peter Baláž, DrSc.
Project No: LPP-019-06 (project APVV)
Institution: Ústav geotechniky SAV
Participating organizations: 0
Project budget: 136.000,- Sk – APVV, Bratislava

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**ii. Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding**

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>number</td>
<td>13</td>
<td>12</td>
<td>13</td>
<td>13</td>
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<tr>
<td>funding (millions of SKK)</td>
<td>0,900</td>
<td>1,015</td>
<td>1,052</td>
<td>1,451</td>
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- Summary of funding from external resources
### External resources

<table>
<thead>
<tr>
<th>External resources (millions of SKK)</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
<th>average</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>4,412</td>
<td>16,889</td>
<td>10,266</td>
<td>28,436</td>
<td>60,003</td>
<td>15,001</td>
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</table>

<table>
<thead>
<tr>
<th>external resources transferred to cooperating research organisations (millions of SKK)</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,000</td>
<td>1,115</td>
<td>1,117</td>
<td>7,758</td>
<td>9,990</td>
<td>2,498</td>
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</table>

<table>
<thead>
<tr>
<th>ratio between external resources and total salary budget</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,439</td>
<td>1,569</td>
<td>0,874</td>
<td>2,461</td>
<td>5,344</td>
<td>1,336</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>overall expenditures from external as well as institutional resources (millions of SKK)</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20,453</td>
<td>33,308</td>
<td>28,801</td>
<td>47,218</td>
<td>129,780</td>
<td>32,445</td>
</tr>
</tbody>
</table>

### Supplementary information and/or comments on research projects and funding resources

- 

### 5. Organisation of PhD studies, other pedagogical activities

#### i. List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)

21-32-9 Mineralurgy and environmental technologies
(with BERG Faculty, Technical University Košice)

5.2.40 Metallurgy
(with Faculty of Metallurgy, Technical University Košice)

#### ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)
### PhD Study

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Potential PhD Supervisors</strong></td>
<td>15</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td><strong>PhD Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>defended thesis</td>
<td>students quit</td>
<td>defended thesis</td>
<td>students quit</td>
</tr>
<tr>
<td><strong>Internal</strong></td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><strong>Supervised at External Institution by the Research Employees of the Assessed Organisation</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

### III. Postdoctoral Positions Supported by

- **a) External Funding (Specify the Source)**
- **b) Internal Funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz**

### IV. Summary Table on Pedagogical Activities in Undergraduate Programmes for Each Year

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures (hours/year)</td>
<td>46</td>
<td>52</td>
<td>96</td>
<td>60</td>
</tr>
<tr>
<td>Practicum courses (hours/year)</td>
<td>0</td>
<td>26</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>Supervised diploma works (in total)</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Members in PhD committees (in total)</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>12</td>
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<tr>
<td>Members in DrSc. committees (in total)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Members in university/faculty councils (in total)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Members in habilitation/inauguration committees (in total)</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>
v. List of published university textbooks

vi. Number of published academic course books

vii. List of joint research laboratories/facilities with the universities

[1] Common laboratory with BERG Faculty of Technical University Košice for drillability of ores study by drilling with drilling tools to 70 mm diameter.

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

Institute of Geotechnics belongs to the very productive institutions under umbrella of Slovak Academy of Sciences in PhD studies in the field of mining engineering and metallurgy. 15 scientific workers from 18 eligible serve as possible supervisors for PhD students. During accreditation period this number was enlarged by 2. This activities cover Technical University Košice and expanded also abroad: the Institute supplied the PhD supervisors for Mining and Geology Faculty of Technical University Ostrava (Czech Republic). 17 reports on PhD thesis have been elaborated by scientists from our Institute. Profesor Baláž has obtained APVV project for period 2007 – 2009 aimed as a support for excellent PhD supervisors enabling to hire new PhD student in the new scientific top of carbon dioxide sequestration.

6. Direct output to the society

(applications of results, popularisation and outreach activities)

i. List of the most important results of applied research projects

1. Monitoring of the extent of contamination and the attenuation ability of the environment by the means of soil gas analysis. Increasing respect has currently been devoted to elimination of crude oil pollutants from the environments. Remediation of ancient contaminations caused by leakage of crude oil products from their storage tanks as well as distribution systems has been in progress. Particularly immediate solution of accidental situations caused by massive scale leakage of crude oil from pipelines to the environments is of great importance. Institute of Geotechnics of the SAS has collaborated for few year with a private firm Environcentrum Ltd. which is engaged in remediation of environments polluted by organic pollutants. A methodological approach for evaluation of organic pollutants attenuation in natural environments has been co-developed. The Company has introduced this method since 2002 at contaminated site Čaňa (near Košice). The spectrum of monitored parameters has been extended by the analysis of soil gas composition in unsaturated zone applying permanent or portable gas probes. Continuous analyses of soil gas provide information about its actual chemical composition. The chemical changes of soil gas composition in the course of time indicate the behavior of biochemical processes taking place in soil. The monitoring of soil gas enabling on-line analysis directly on site is therefore useful indicator of the biodegradation processes of crude oil hydrocarbons in soil.
Proposed method enables us to:
- Obtain information dealing with the extent of contamination as well as the movement of the contaminant in environment eliminating soil sampling.
- Study the kinetics of crude oil degradation, and to evaluate the natural attenuation ability of the environment.
- Quantify the contribution of physical evaporation and biodegradation whenever the bioventing technology is applied.
- Study the effect of some parameters to the biodegradation process under in-situ conditions.
- Quantify the efficiency of particular technological actions in the complex of remediation technologies.
- Optimize remediation process by means of flexible feedback.

Environcentrum Ltd. has shared its own costs, operation and services capacities as well as machines and devices for making pilot experiments in compliance with the agreed research intent. Laboratory works have been done in the Biotechnology department at the Institute of Geotechnics SAS.

(Monitoring of the extent of contamination and the attenuation ability of the environment by the means of soil gas analysis, project coordinator: MVD. Daniel Kupka, PhD., Project No. OZ 04/01).

2.
The bottom sediments of the waterwork "Ružín I" have been subjected to investigation. The content of harmful elements such as Cd, Pb, Hg, As and Cu in sediments was observed. On the basis of determined contents in various localities of the waterwork the possibilities of sediments utilisation in civil engineering or resoiling (roads, dams, surface roughness) as well as in agriculture (composts, fertilization) were analysed.

(Project No. VEGA 2/2104/24, project coordinator: host. doc. RNDr. Milan Bobro, PhD.)

3.
In the frame of the task of the State Program R&D the conditions of magnetic separation at deferrization of soot were defined. The soot as by-product comes from tyre pyrolysis in semi-plant operation in SLZ Chémia, Inc. Hnúšťa. Two magnetic fraction were identified in soot, namely wires of metallic iron (98.4 % of Fe) and fine-grained polyphase mixture with magnetite (23.5 % of Fe), which was detected in given fraction by XRD. The magnetic product with iron content of 53.58 % at mass yield of 3.02 % was obtained by dry low intensity magnetic separation (0.16 T). Recovery of iron into magnetic product attained 62.27 %. Three forms of carbon were identified in non-magnetic product, including two phases of graphite and lonsdaleite. Moreover, calcite and rankinite were also found. After soot deferrization carbon content exceeded 80 %.

(PROJECT “HIGH TECH AND NEW TECHNOLOGIES IN THE FIELD OF EXPLOITATION AND PROCESSING OF INDUSTRIAL MINERALS”)

4.
Development, construction, testing and application of mini analyser of gases. Recently, such analysers are applied in technologies optimization (bioventing and sparging) at redevelopment of old loaded areas, namely SPP Bratislava, SPP Komárno and SPP Košice-Haniska.

(PROJECT “HIGH TECH AND NEW TECHNOLOGIES IN THE FIELD OF EXPLOITATION AND PROCESSING OF INDUSTRIAL MINERALS”)
ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organisations

iii. List of the most important popularisation activities


Internation exhibition Incheba 15. – 16. 4. 2003 Bratislava. 2 posters from the Institute.


„The day of the open door“ in frame of the European week of science and technology, 10. 11. 2004, Košice.

International exhibition Incheba 2004 Bratislava. 3 posters from the Institute.

4th International exhibition „Stonecutter“ – exhibition for stone industry, geology and funeral services. 2 posters from the Institute.

Interview for University of Hannover journal „Universität Hannover Intern“.

Presentation of an article in Korea Institute of Science and Technology Information Bulletin NANOWEEKLY 169, 2000, p. 18 about activities of Prof. Baláž during his participation on the Korea-Japan International Symposium on Powder Science and Technology, Busan, South Korea.

The day of open doors at the Institute of Geotechnics of Slovak Academy of Sciences, september 2006.

5th International exhibition „Kamenár“, 16. – 18. 11. 2006 Trenčín.

Exhibition, „Ekotechnika, Hydrotec“ was supplied with the results obtained at the Institute on technological implementation of biotechnology, liquidation of an old mining sites and industrial breakdowns, presentation of 1 poster from the Institute.

iv. List of patents issued abroad, incl. revenues

v. List of the patents issued in Slovakia, incl. revenues

vi. List of licences sold abroad, incl. revenues

vii. List of licences sold in Slovakia, incl. revenues
viii. List of contracts with industrial partners, incl. revenues

<table>
<thead>
<tr>
<th>No.</th>
<th>Partner</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slovak Magnesite Plant, JVC, Jelšava</td>
<td>32,800 SKK</td>
</tr>
<tr>
<td>2</td>
<td>AMETYS, Ltd., Košice</td>
<td>10,000 SKK</td>
</tr>
<tr>
<td>3</td>
<td>ZEOCEM, Inc., Bystré</td>
<td>4,500 SKK</td>
</tr>
<tr>
<td>4</td>
<td>ELEKTROCARBON, Inc., Topoľčany</td>
<td>3,000 SKK</td>
</tr>
<tr>
<td>5</td>
<td>REFRAKO, Ltd., Košice</td>
<td>1,000 SKK</td>
</tr>
<tr>
<td>6</td>
<td>The NP Administration of Slovak Carst, Brzotín</td>
<td>20,000 SKK</td>
</tr>
<tr>
<td>7</td>
<td>Engineering Construction, Inc., Košice</td>
<td>20,000 SKK</td>
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<tr>
<td>8</td>
<td>ENVIRONCENTRUM, Ltd., Košice</td>
<td>100,000 SKK</td>
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<td>9</td>
<td>SIDERIT, Ltd., Nižná Slaná</td>
<td>80,000 SKK</td>
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<td>10</td>
<td>Petra Artep, Ltd., Košice</td>
<td>90,000 SKK</td>
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<tr>
<td>11</td>
<td>Institute of Hydrodynamics of CAS, Praha</td>
<td>15,500 SKK</td>
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<tr>
<td>12</td>
<td>Institute of Geonics of CAS, Ostrava</td>
<td>20,000 SKK</td>
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<tr>
<td>13</td>
<td>Parasitological Institute of SAS, Košice</td>
<td>5,000 SKK</td>
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<td>14</td>
<td>Institute of Measurements Science of SAS, Bratislava</td>
<td>20,000 SKK</td>
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<tr>
<td>15</td>
<td>US Steel, Košice</td>
<td>36,600 SKK</td>
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<tr>
<td>16</td>
<td>Tesla Stropkov</td>
<td>20,000 SKK</td>
</tr>
</tbody>
</table>

ix. List of research projects with industrial partners, incl. revenues

1. **THE STABILIZATION OF GLAZE PROPERTIES IN TECHNOLOGY PROCESS**
   - **Project coordinator:** Ing. Iveta Štyriaková, PhD.
   - **Duration of project:** 05/2004 – 11/2004
   - **Project No.:** 4/01
   - **Participating organizations:** (KERKO, a.s., Košice)
   - **Project budget:** 48,000,- Sk

2. **MEASURING OF POLLUTION SUBSTANCES IN AIR-SO₂, Hg AND As IN A THREE MONTH INTERVALS**
   - **Project coordinator:** host’ doc. RNDr. Milan Bobro, PhD.
   - **Duration of project:** 01/2004 – 12/2004
   - **Project No.:** OZ 1/04 a OZ 7/04
   - **Participating organizations:** SIDERIT, s.r.o., Nižná Slaná
Project budget: 94.500,- Sk

3. MINING AND PROCESSING OF SECONDARY SERPENTINITE RAW MATERIAL FOR SiO₂ AND MgCl₂ PRODUCTION
   Project coordinator: Ing. Slavomír Hredzák, PhD.
   Duration of project: 01/2004 – 12/2004
   Project No: OZ 02/2004
   Participating organizations: SILICON, s.r.o., Dobšiná
   Project budget: 45.000,-

4. EXPLORATION OF SEDIMENTS PROPERTIES AND EROSION PROCESSES IN HORNÁD AND HNILEC RIVER BASIN TO DAM PROFILE VODNÉ DIELO RUŽÍN
   Project coordinator: host. doc. RNDr. Milan Bobro, PhD.
   Duration of project: 01/2004 – 03/2005
   Project No: A1/49210/32/04
   Participating organizations: Slovak water management, š.p., Košice
   Project budget: 144.000,- Sk

5. MONITORING OF THE POLLUTION RANGE AND ATTENUATOR CAPABILITY OF ENVIRONMENT BY ANALYSIS OF SOIL AIR
   Project coordinator: MVDr. Daniel Kupka, PhD.
   Duration of project: 01/2005 – 12/2006
   Project No: 2/2005 (project for branch order)
   Institution: Ústav geotechniky SAV
   Participating organizations: Environcentrum s.r.o.
   Project budget 400.000,- Sk - Environcentrum s.r.o, Parchovany

6. DETERMINATION OF NUMBER OF ISOLATABLE BACTERIA PRESENT IN DIRTY ENVIRONMENT OIL SUBSTANCES
   Project coordinator: Ing. Iveta Štyriaková, PhD.
   Duration of project: 03/2006 – 12/2007
   Project No: 2/2006 (project for branch order)
   Institution: Ústav geotechniky SAV
   Participating organizations: Geolab, s.r.o.
   Project budget: 79 600,- Sk - Geolab, s.r.o., Košice
x. Summary of outreach activities

<table>
<thead>
<tr>
<th>Outreach activities</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>studies for the decision sphere, government and NGOs, international and foreign organisations</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>articles in press media/internet popularising results of science, in particular those achieved by the Organization</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>appearances in telecommunication media popularising results of science, in particular those achieved by the Organization</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>public popularisation lectures</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

xi. Supplementary information and/or comments on applications and popularisation activities
7. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

<table>
<thead>
<tr>
<th>Personnel</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>all personnel</td>
<td>53</td>
<td>55</td>
<td>56</td>
<td>53</td>
</tr>
<tr>
<td>research employees from Tab. Research staff</td>
<td>34</td>
<td>34</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>FTE from Tab. Research staff</td>
<td>31,33</td>
<td>33,69</td>
<td>35</td>
<td>33,06</td>
</tr>
<tr>
<td>averaged age of research employees with university degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>46,5</td>
<td>45,25</td>
<td>45,83</td>
<td>41,77</td>
</tr>
</tbody>
</table>

ii. Professional qualification structure

<table>
<thead>
<tr>
<th>Number of</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>DrSc.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PhD / CSc.</td>
<td>21</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>Prof.</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Doc./Assoc. Prof.</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>
iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

- Derivatograph C/PC MOM equipped by evaluating software WIN DER,
- X-ray powder diffractometer DRON UM1 including the automatic control of GUR-8 goniometer equipped by system SCADA (Supervisory Control And Data Acquisition),
- Atomic absorption spectrometer SpectrAA-30 Varian,
- Atomic absorption spectrometer Fast Sequential AAS – AA240FS,
- Atomic absorption spectrometer Zeeman AAS AA240Z with accessories: Programmable Sample Dispenser PSD120, Graphite Tube Atomizer GTA120, Vapor Generation Accessory VGA-77,
- Drilling experimental device – drilling stand with accessories equipped by control unit Twido,
- Trace Mercury Analyser TMA 254,
- Microwave Decomposer of Samples MWS-3, Berghof,
- Mobile analyser of gaseous mercury JEROME 431-X,
- Analyser NO, NO₂, SO₂ - TET MMG 2000, GRIMM,
- Measurer of microclimatic parameters TESTOTERM testo, 452,
- Optical dust measuring apparatus Hund TM data,
- Dust sampler with pumps TVR and accessories,
- Dust sampler ZMP 01, 03,
- Impulse sound-level-meter RFT 00 023,
- Press up to 2000 kN,
- Press up to 50 kN,
- Monomill- Pulverisette 6 (Fritsch, Germany): ultrafine milling,
- Attritor-Molinex PE/075 (Netzsch, Germany): ultrafine milling,
- Apparatus Gemini 2360 (Micromeritics,USA): measurement of specific surface area by BET method,
- Diffraction Spectrometer Helos 12 LA (Sympatec GmbH, Germany) with dispersing Feeder Rodos 12 SR for dry, pulverulent solids: granulometric analysis in the range of particles 0.9-170 micrometers,
- Becton -Dickinson, Cockeysville, USA- microbiological identification system on specific identification of bacterial cultures isolated from the rocks and waters,
- PCR termoanalyser, Techne - on isolation of bacterial DNA by polymerase chain reaction,
Optical microscope Nikon Eclypse 400 - for the observation, the morphological identification and the microorganisms photodocumentation,
Bioreactor- on anaerobic and aerobic bacterial cultivation (self-construction),
Paramagnetic analyser of oxygen PAX 0501-02,
Internal bank of autochthonous and physiological adapted microorganisms,
teslameters Tesla 706509, measuring ranges 0 - 0.2 T, 0 - 0.5 T a 0 - 2 T,
measuring instrument of magnetic susceptibility Kappabridge KLY-2, Geofyzika Brno, intensity of magnetic field 300 A.m-1, field homogeneity 0.2 %, operating frequency 920 Hz, range -1,999.10-6 +650,000.10-6 SI unit,
universal microscope CARL ZEISS, polarisation microscope MEOPTA,
pH meter WTW pH 340i, electrode SenTix 41-3 with installed temperature sensor, combined redox electrode WTW SenTix ORP,
contactless thermometer Raytek RAYMX4PG (-30 °C +900 °C),
ultrasonic bath Tesla UC 002 BM1, operating frequency 20 kHz ± 1.5 kHz, magnetic stirrers MM1, HI 300N,
motion meter GREISINGER GHH91 (powdered materials, wood) with correcting thermometer and humidity meter GFT95 (ambient air),
analytical weights SARTORIUS 1801MP8, sensitivity 0.1 mg, max. 111 g,
analytical weights VEB RAPIDO owa labour model 75208, sensitivity 0.01 g, max. 160 g, model 34008, sensitivity 0.1 g, max. 1000 g,
piezoresistive pressure indicator of fluids and gases DMP-331.111-6001 with processing unit MAT-600, range 0 - 600 kPa,
Mohr’s balance for determination of heavy liquids density,
densimeters 0.6 ÷ 2.02 g.cm-3,
dynamometric sensor of liquid density,
tensiometric sensor of ferrofluids density with automatic density controller - self-development,
water bath LAZNIA LW-4,
dryer HS 121A, max. 105 °C,
strength meter of pellets MPP-1 - self-development,
conductivity meter of powdered materials MV-1 - self-development,
laboratory tube quartzy oven, max. 1 200 °C,
hardening furnace ZEZ HG 4/3, max. 1350 °C, electric input 9 kVA,
jaw crusher PS D-160, feed max. 80 mm, output 10 - 20 mm,
roll crusher,
vibrating jaw grinder VČM-3, feed max. 15 mm, output 0.2 - 3 mm,
universal laboratory ball and bar mill LP - porcelain, metallic, attrition mill,
vibrating mill VM-1 KSMH-Hranice,
jewel vibrating pulverisator KM-1,
vibrating classifier TE-III, mesh size of sieves:
40 µm, 45 µm, 50 µm, 56 µm, 63 µm, 71 µm, 80 µm, 90 µm, 100 µm, 125 µm, 150 µm, 160 µm, 180 µm, 200 µm, 250 µm, 280 µm, 315 µm, 355 µm, 400 µm, 500 µm, 630 µm, 710 µm, 750 µm, 800 µm, 900 µm
1 mm, 1,25 mm, 1,6 mm, 2 mm, 2,5 mm, 3 mm, 4 mm, 5 mm, 7 mm, 8 mm, 10 mm, 12 mm, 16 mm, 18 mm, 20 mm, 25 mm, 30 mm, 40 mm, 50 mm,
mesh size of sieves for microclassifying in ultrasonic bath: 5 µm, 10 µm, 15 µm, 20 µm, 25 µm, 30 µm, 35 µm, 40 µm, 45 µm,
air classifier, classifying cut of monomineral samples in the range of 3 -70 µm,
pilot hydrocyclone station - classifying, washing in heavy medium and without heavy medium - so called Water-Only cyclone, max. grain size 5 mm,
high-intensity magnetic separators: MECHANOBIR, WEDAG, VMR-1,
low-intensity magnetic separator - LAURILA,
universal laboratory magnetic separator JONES (0.06 ÷ 1.40 T) - polygradient, high-gradient magnetic separation, dry way and wet one,
iv. Status and development of bibliographic resources, activities of the Organisation’s library and/or information centre

During the period of accreditation the basic information centre (Scientific–Technical Information Centre) was common for two institutes, namely the Institute of Material Research of SAS and the Institute of Geotechnics of SAS. The book stock of the Institute of Geotechnics is running of 4,067 units. In the years of 2003-2006 the increase of bookstock was of 200 units. The Institute of Geotechnics of SAS is subscriber of 7 periodical journal.

v. Describe how the results and suggestions of the previous assessment were taken into account

The Accreditation Committee of SAS in the year 2005 suggested, “quoting” the modernization of the technical and information assurance, publishing the obtained scientific results in journals indexed in CC with higher impact factors, to be more engaged in submitting of projects to the European research programmes and in larger extent to look for the diversification of budget means, e.g. through the APVT, UNESCO, etc.” As the suggestions were formulated in the year 2005, there is a need to express their saturation only for the year 2005 and 2006.

Within this period, the Institute of Geotechnics have supported from its own funding:
- building-up of a new laboratory for mineral biotechnologies
- building-up of an electrophysical laboratory
- acquiring and modernization of DTA apparatus
- renovation and modernization of XRD apparatus
- renovation of the drilling stand
- purchasing of a new atomic absorption spectrometry apparatus VATRIX AA 240FS

The internal computer network of the Institute was modernized and other 20 personal computers were bought. At the present time, the computer network of the Institute is mediating the communication on 57 computers. The web page of the Institute was processing: www.saske.sk/UGT, and is always actualized.

Until the end of the year 2004, the highest achieved impact factor of the paper published in the scientific journal indexed in CC was 1.164 (Prof. Baláž). Within the next two years (2005 and 2006) the scientists from the Institute published 9 papers in periodicals with higher impact factor if compared to 2004. The highest achieved impact factor is 4.818 (Prof. Šepelák).

The number of new projects approved in the years 2005 and 2006 is 27, from this 11 are VEGA funding projects, 6 projects funded by APPV, 8 projects of MVTS and 2 projects on the branch orders. The number 27 is only a bit lower than the total number of FTE research workers of the Institute. The Institute has gained out from the institutional funding the budget that is the highest in its history.
To fulfil all of the suggestions of the previous assessment, not only a two-year period is required (as the recommendations were formulated for the four-year period).

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

The Institute of Geotechnics is, in spite of the fact that in this year is celebrating the 50th anniversary a young organisation. The average age of the employers is 41.16 years and the average age of the research workers is 41.77 years. The Institute educates at present time 11 internal doctorate students. The age of the deputy director as well as three other heads of the scientific departments is lower than 44 years.

Other information relevant to the assessment