

**KOŠICE — BIOTIC AND ABIOTIC COMPONENTS OF ENVIRONMENT
PROJECT (SLOVAK – LUXEMBOURG COOPERATION)**

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Abstract: To know present state of the environment in Košice region, the Slovak – Luxembourg project „Košice – biotic and abiotic components of environment“ has been performed in 1994 – 1999 period. The results demonstrate considerable pollution of this area by anthropogeneous, partly by natural influences. It concerns ground and surface natural waters, stream sediments and atmosphere. The magnetic field is disturbed too. The part of area possesses medium and high radon risk and increased seismic hazard. The slope deformations occur as well.

Key words : Košice region, multidisciplinary research, state of pollution

Introduction

In 1994 – 1999 period, great multidisciplinary geological – environmental project „Košice – biotic and abiotic components of environment“ has been performed in the area of former Košice – City district with small wide – spreading towards the south. The project was financed by Slovak and Luxembourg ministries of environment. Coordinating company : Geocomplex a. s. Bratislava, Project Manager : Jozef Hricko.

The project consisted of following sub-projects : updating and digitizing the topomaps; remote sensing; geological map; map of physical – biological utilization of the area; geophysical data on lithosphere; hydrogeological map; engineeringgeological maps; pedological and pedogeochemical maps; geochemical-ecological map of stream sediments; map of ground and surface waters quality;

geochemistry of snows; pollution of low atmosphere; radioactivity pollution and radon risk; magnetic activity; electromagnetic smog; natural and artificial current flows; seismic hazard; computer data processing, database and maps creation; correlation of data obtained with medical-hygienic statistics; synthetic map of the risk geofactors and selection of the monitoring network.

The target of the project works was an assessment of the geological factors state and determination of the influence and extent of the pollution in Košice region with concentrated industry, mainly metalurgical production. The results should help in realization of improving measures for decrease of the influence of negative factors to an acceptable level.

Major results and conclusions

By satellite images interpretation, the special maps have been constructed: absolute black body temperature map, the maps of wetness, brightness and greenness of surface, the map of biophysical and thermal indications, biomass quality and emissions composition maps. These maps may serve in urban planning, in water economy and agriculture management, etc.

The map of physical – biological utilization of area has been compiled by CORINE – land cover Luxembourg methodology on the basis of orthophotomaps and field tests. It has multipurpose use.

The tectonic map has proved high neotectonic predisposition of the area, which increases seismic hazard and radon risk.

The resistivity maps for three depth levels have been compiled, which represent the lithological conditions of the Quaternary and Neogene. The map of Quaternary sediments thickness was also constructed. These sediments are the most important aquifers of the ground water. By complex interpretation of the geophysical data, the deep structure of the Košice region was solved. The map of pre-Tertiary basement depths as well as the map of structural – tectonic basement setting have been compiled. The results witness to existence of seismoactive zones in the basement

and to extraordinary tectonic disturbance of the territory. By synthesis of the geophysical knowledge, the hydrogeologically promising zone has been selected in ne. part of area (between Furča and Košarisko localities).

In the hydrogeological map, eight hydrogeological zones were assessed from crystalline complex and Paleozoic up to Neogene and Quaternary. For individual aquifer sets, the aquifer characteristic as hydraulic parameters, transmissivity and permeability have been obtained. The data given are important from a viewpoint of further hydrogeological and hydrological surveys and for water economical planning.

The engineering-geological maps set represents one of key compiled documents. This set is represented by three maps: map of engineering-geological zoning, map of relative susceptibility of the area to the landslides and map of important geological factors of the environment. The engineering geological maps in given scale are directly utilizable in planning the rational use of the territory.

The pedological and pedogeochemical maps bring review of the soils single types. The multi-elemental associative and mono-elemental maps have been compiled, which represented valuable base for knowing the spatial distribution of chemical elements in soils and contamination of region. The spatial protection needs mainly agriculturally intensively utilized soils of the upland level of the Košická kotlina basin. In geochemical map of stream sediments, the spatial distribution of above-limited contents of chemical elements is expressed by synthetic form. The most expressive anomalous region is in space of Ida surface stream. The arsenic exceeds indication value "C" for sanation and lead reaches indication value "B". The content of antimone is also higher. The contamination has probably geogeneous – anthropogeneous origin and source lies outside area under study, near Zlatá Idka village.

From the results of hydrogeochemical survey and the natural waters quality map it follows that qualitative properties of waters are very unfavourable at present. It is conditioned by considerable anthropogeneous contamination, which is caused by intense exploitation of the landscape. The source waters, industrial production (namely US Steel), urban pollution (Košice city and all smaller villages of region), intense agricultural production, pit tips and waste dumps are sources of the pollution.

With exception of nw. mountain part, we can meet the very polluted ground waters in predominant part of the area under study. From groundwater samples assessed, more than 60% lies in the worst quality class (D). In case of surface waters, no one sample corresponds by its qualitative parameters with first quality class and more than 65% lie in two worst quality classes (4-5) in whole area in question.

By geochemical survey of snows it has been found out that contents of toxic elements and other pollutants are anomalous in comparison with whole Slovakia observations and the atmosphere is highly contaminated in Košice region. The high contents of various organic and inorganic pollutants has been observed in these areas too. It can be state that Košice region represents the most contaminated territory of Slovakia in the regional extent. The highest pollution degree is in s. part of region. Second the most polluted area is Košice city.

The continuous observation of harmfulness in the atmosphere of Košice city agglomeration and its surroundings has shown that the highest dust sedimentation was in Ťahanovce locality. The smallest one was at Črmeľ locality.

The orientation survey of radioactive pollution of the Košice region by natural (U,Th,K) and artificial radionuclides (Cs-137), realized by gammaspectrometry, has shown favourable radiation – hygienic situation. The observation of radon risk brings following results: The 49.5 % of the area lies in low, 48.5 % in medium and 2.0 % in high radon risk. It means that over- limit values of volume radon activity in soil air of the surficial layer exists on 50.5 % of the area under study. The occurrence of the uranium mineralization in n. part of the territory and considerable neotectonic predisposition of the area has caused this situation.

The measurements of intensity and the variations of the magnetic field have determined the considerable disturbance of the studied region. The most magnetically disturbed areas are central parts of Košice city. The northern part of the area – Spišsko gemerské rudohorie Ore Mts. front range – is magnetically non-disturbed. It is interested that from two city hospitals, new faculty hospital lies in the area of substantially higher magnetic disturbance than old one.

From observations of the electromagnetic smog level, caused by activity of radio and television transmitters as well as mobile telephones and other sources of the electromagnetic radiation it was found out that values lower than valid limits exist in the whole area under study.

By seismotectonics analysis and seismic hazard level determination, the spatial distribution of the maximum expected earthquake intensity and seismic acceleration has been fixed within single sub-zones. The maximum value of expected macroseismic intensity reaches 7° of MSK-64 scale and minimum one – 4.4° of this scale. The higher degree of seismic hazard has been found out – beside other places – in historical city centre (surroundings of Saint Elizabeth Cathedral).

In assessment of the diseases state in Košice agglomeration and its surroundings it was observed that main risk factors for population health is polluted atmosphere, drinking water quality, noise and concentration of the urban and industrial wastes. The contamination of atmosphere is dominant factor influencing health of inhabitants. The Košice city was 30 years second the most dusted town in former Czechoslovakia – after Jelšava. The highest concentration of pollution is in Veľká Idka village and around US Steel area.

The synthetic map of risk geofactors of the Košice region is a resulting map, comprising geological and geochemical data, radioactive pollution and radon risk and other specific factors as well as “biophysical” map. The area under study is divided to sub-zones with the highest ecological stress, medium intense and the lowest ecological stress of the risk geofactors, with synergic impact effect of the regional monitoring system of the environment.

The US Steel works and Košice-City agglomeration represent areas with the highest ecological stress. These areas badly need permanent monitoring.

References

Hricko, J. et al., 1999 : Košice-biotic and abiotic component of environment. Final report, Manuscript. Archives of the Geological survey of Slovak Republic-Department of informatics, Bratislava, 333 p.