

Sofia - De gradation of Cultural Heritage in Surrounding Environment

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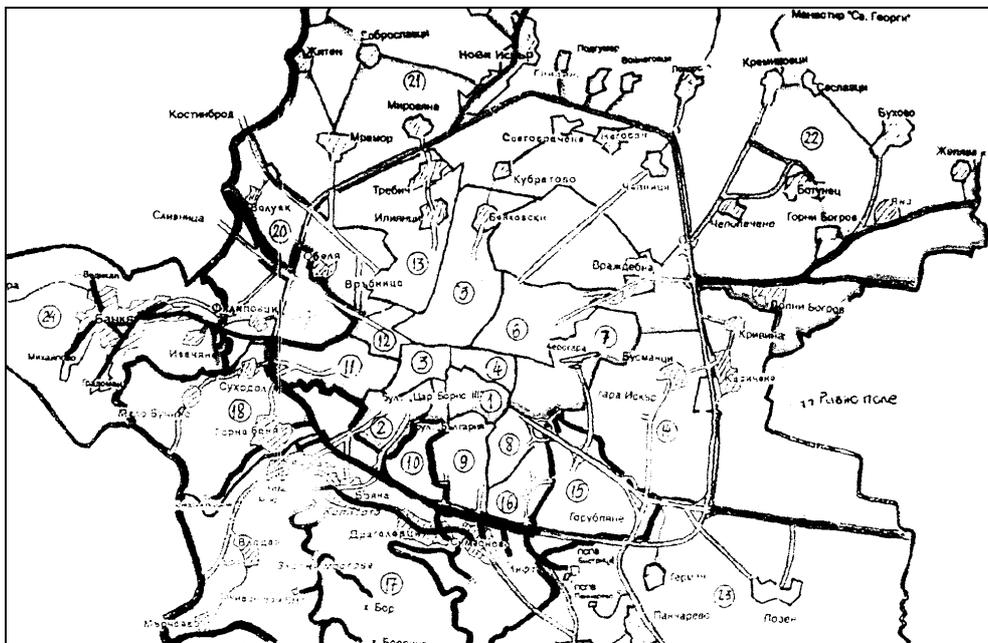
Foundation "Science" at the Union of the Scientists in Bulgaria (Sofia)

1. Introduction

Sofia - the capital of Bulgaria is the greatest local territorial source of harmful air emissions, because of:

- a) Climatic features due to situation in a valley field with predominant influence of western and eastern winds;
- b) Substantial concentration of industry in the suburbs;
- c) Intensive automobile traffic.

The paper presents a review on Sofia air pollution constitution, its effects on buildings and typical examples of CH environment degradation with accent on two central districts - "Sredetz" and "Oboriste", where is the highest concentration of CH objects.



Sofia districts:

1 - "Sredetz"; 2 - "Oboriste";

22 - "Kremikovtzi" (concentration of industry)

Table 2. Harmful emissions - "Oboriste" district

SO ₂ [Mg]					NO _x [kg]				
0,75	0,7	0,6	0,75	0,7	160	150	130	160	150
Pb [g]					CO [kg]				
50	45	40	50	45	20	17	16	20	17
1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
Year					Year				

Districts with greatest pollution emission include "Krasno selo", "Serdika", Iskar" and "Kremikovzi". Heat power stations and the "Kremikovtzi" metallurgic plant emit 90 % of the total pollution amount. Table 3 gives data on the highest pollution concentration at ground surface level measured in the "Kremikovtzi" district. Depending on wind direction it is realized a transfer of abnormal dust and sulfur dioxide (SO₂) emissions from the industrial towards the central districts.

Table 3. Concentration of pollution components in the industrial district "Kremikovtzi"

Year	SO ₂ [Mg]	NO _x [kg]	CO [kg]	Pb [kg]	Dust [Mg]
1994	8203,8	4480525	67359862	15897341	70869
1995	8302,2	4523238	73042454	16570430	74668
1996	11897,5	5493854	66379819	12501979	56679
1997	11869,1	5493854	74094740	16090905	72371
1998	11905,6	5441284	63205819	13981770	62811

4. Effects of air pollution on buildings and materials

Air pollution is a public disaster. The power level of industrial smoke sources is sufficient to inflict rainwater acid pollution. Particles and non-specific air-containment increase corrosion in metals, building degradation/destruction and also clothe wear. Fine-grained particles settle on walls, ceilings, curtains and furniture. A minimum concentration of gaseous hydrogen sulfide decolorizes surfaces treated with lead-based paints. Limestone corrodes under attack of carbon dioxide (CO₂) with abnormal concentration and in case of high air humidity carbon acid is created. Facade degradation due to smoke and soot is inevitable.

It has to be underlined that there isn't a national statistics connecting CH objects degradation with environment influence.

5. Examples of CH environmental degradation

Next is described in brief several typical examples of built and nature CH objects degradation due to environmental action.

5.1 The Alexander Nevski memorial church

About 35 years ago the surface of the main three domes was covered with extremely thin golden foil, the metal gift from the Government of Russia (16 kg of gold). Due to environmental action and poor technology the foil partially lost adhesion and integrity and corrugated, which reflected the appearance of this National CH object on the worst side, without destruction the integrity of the basic zinc sheets. Restoration activity on a newly developed technology is under execution in order to replace the damaged top lining.



Fig. 2. The domes with golden foil - Alexander Nevski memorial church

5.2 The National Museum of Archeology

In 1995 the original lead-sheet water insulation of the National Museum of Archeology (built in the 15-th century as a mosque) suffered environment corrosion and physical wear. The damaged lead lining was replaced with 1,5 mm-thick steel sheets (Fig. 3).

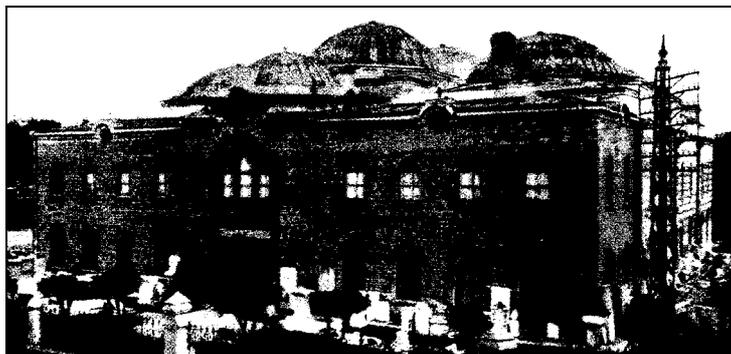


Fig. 3. The lead-covered roof - National Museum of Archeology

5.3 Facade degradation

Beautiful Bulgaria II Project - total cost 4500000 EURO - is under execution. The aim is to carry out facade repair and protection against environmental degradation of 1350 CH objects in Sofia. An additional sum of EURO 635000 (the United Nation Development Program) and EURO 725000 (Sofia Municipality fund) is provided for the purpose.

5.4 Air pollution influence on protected territories

Accordingly to the National CH legislation protected territories are categorized as:

- Reserves;
- National parks;
- Nature parks;
- Kept reserves;
- Protected countries;
- Nature sights (corresponds to category III of IUCN).

Protected territories around Sofia - included in CH - are shown in Fig. 4.

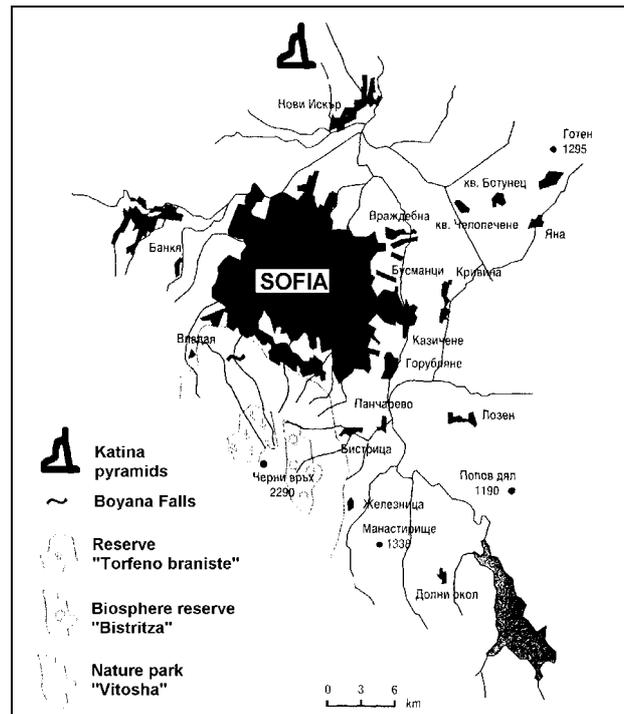


Fig. 4. Protected territories around Sofia

Accordingly to the ecology program developed by the Sofia Municipality the environment degradation of the shown in Fig. 4 nature objects is as follows:

- a) Nature sight "Katina pyramids" - a complex of earth pyramids with height 7 - 30 meters, connected by ribs, yellow at the foot and red at the top. Natural erosion and negative effects of human activity (mass tourism and air pollution);
- b) Reserve "Torfeno braniste" (protected since 1935) - contains a lot of peat and plenty of swamp plantation;
- c) Biosphere reserve "Bistrizta" (protected since 1934) - spruce woods and families of sub-alpine plantation (including Lapland willow);
- d) 1000000 people, presenting a non-controlled and non-uniformly distributed tourist flow annually visit the Nature Park "Vitosha" - a 2250-m high mountain. The result is a change in the water regime, air, water and waste pollution, growth in surface soil density, erosion and degradation.

Construction activity and non-controlled use of forest products (mushrooms, fruits, herbs), animal and reptile poaching is a negative contribution to park ecological-systems also.

There isn't yet a scientific assessment on nature CH degradation processes, but it is acknowledged the necessity to provide an unified management of the protected territories under consideration in order to improve environment and to decrease degradation.

6. Conclusions

The Ministry of Environment and Water and Sofia Municipality ("Agenda 21" program) are gradually introducing measures to control and reduce air pollution as follows:

- a) Increase in number of the stationary air-control stations;
- b) Development and expansion of the underground transport;
- c) Transfer of combustion installations to gaseous fuel;
- d) Avoiding liquid fuel with sulfur containment higher than 2,5 %;
- e) Obligatory introduction of catalysers for the motor vehicles.

The described measures inevitably will favorably reflect on CH environment degradation.

7. References

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