

19. Environmental aspects of the planning and development of Belgrade

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The state of the environment of the city of Belgrade is defined by its natural conditions, originated from urban structure, transportation, economic and other activities.

Presently, the territory of the City of Belgrade with its close surroundings is the most developed industrial zone of the country. In this zone, there are three main chemical industry complexes (Pančevo, Šabac and Barič), intensive surface exploitation of lignite (Lazarevac), energy production (Obrenovac, Veliki Crljeni). At the same time, these complexes are the environmentally most jeopardized areas. Great concentration of population and industry caused pollution of air, water and soil, as well as other impacts to the environment.

19.1. Analysis and estimation of the state of the environment

19.1.1. Air quality

The quality of environmental air in some parts of the City is influenced by the emissions of polluting substances originated from different energetic and industrial processes, traffic, etc., and so the following problems can be mentioned as the major ones of spoiling the quality of air:

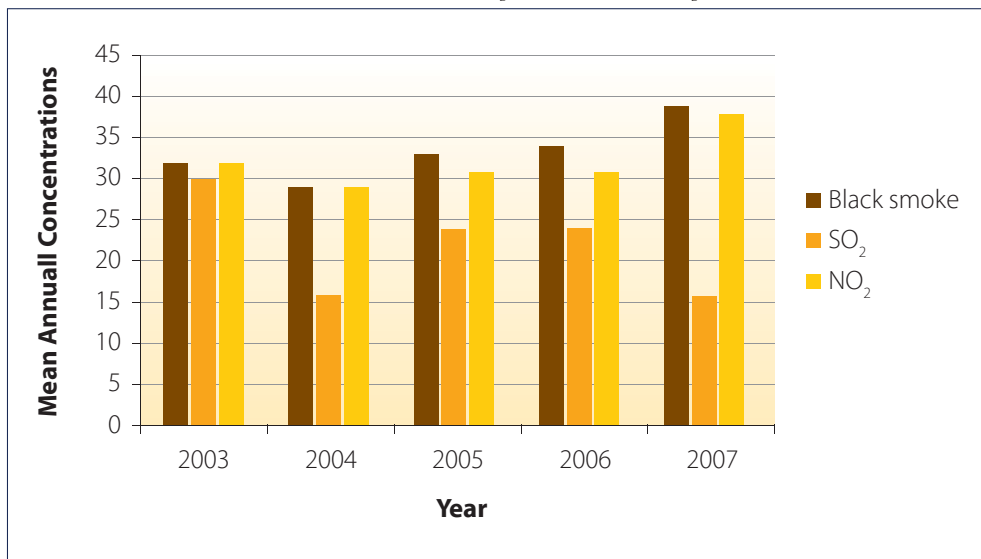
- air pollution in the regions where thermal-energetic and industrial plants are situated (Obrenovac, Lazarevac, inner city core) caused by the emission (SO_2 , NO_x , CO, PAH, aero-sediments, black smoke, etc.);
- air pollution caused by traffic (NO_x , SO_2 , low O_3 , lead, benzene, soot, CO, etc.)⁷⁸;
- high concentrations of soot in the air throughout the heating season due to emission from individual boiler rooms and households.

Based on data obtained by investigating the samples of air from the local network of urban stations⁷⁹ in the period from 2003 to 2007, it can be concluded that the mean annual values of SO_2 , soot and NO_2 are mostly within the limits (Figure 71). However, observed according to daily level, at separate measuring places, large excess occurs occasionally. Therefore, the number of days with excessive imission level value (ELV) is taken as the corresponding index of air pollution (Figure 72).

⁷⁸ Trend of air pollution, originated from traffic (based on the results of air pollution at the crossroads), pointed to the increase in all examined parameters, which was the consequence of the use of fuels of different quality, the use and import of larger number of old vehicles, donations and imports of vehicles used in city public transportation, traffic congestion, the non existence of underground that would reduce the traffic.

⁷⁹ Examination is carried out by the City Public-Health Institute Belgrade and Republic Institute for Public-Health »Dr Milan Jovanovic Batut«.

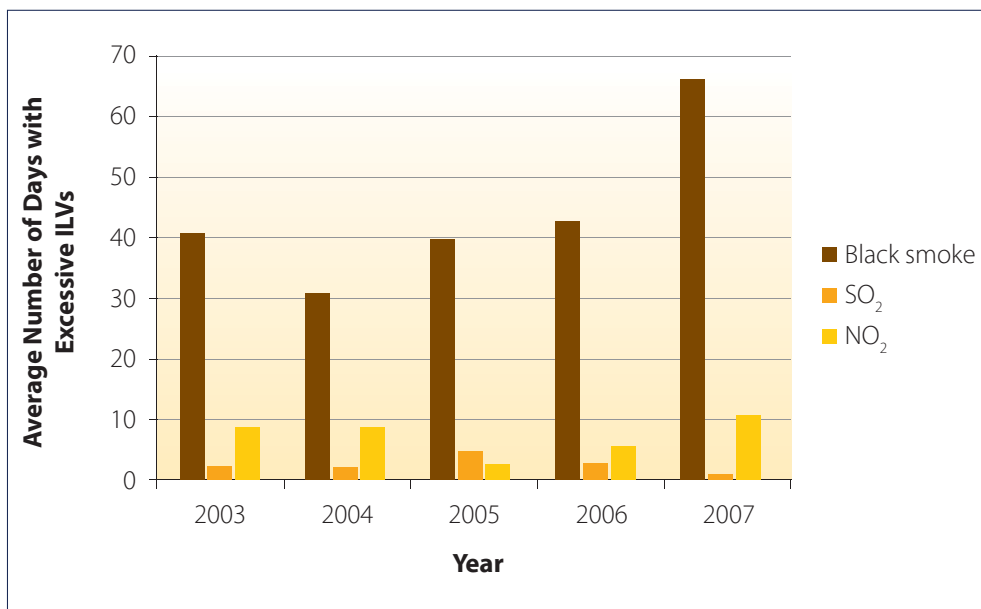
Figure 71: Annual mean black smoke, SO₂ and NO₂ concentrations (µg/m³) in Belgrade (Imission Level Value for black smoke per year: 50 µg/m³, ILVy SO₂ = 50 µg/m³, ILVy NO₂ = 60 µg/m³).



Source of data: City Public-Health Institute Belgrade.

Average number of days with excessive ILV is specific for black smoke, and almost during the hole period 2003 – 2007 is over 36.5 days per year (10 % of the measurement period), which is the recommendation of the World Health Organization for allowable excess.

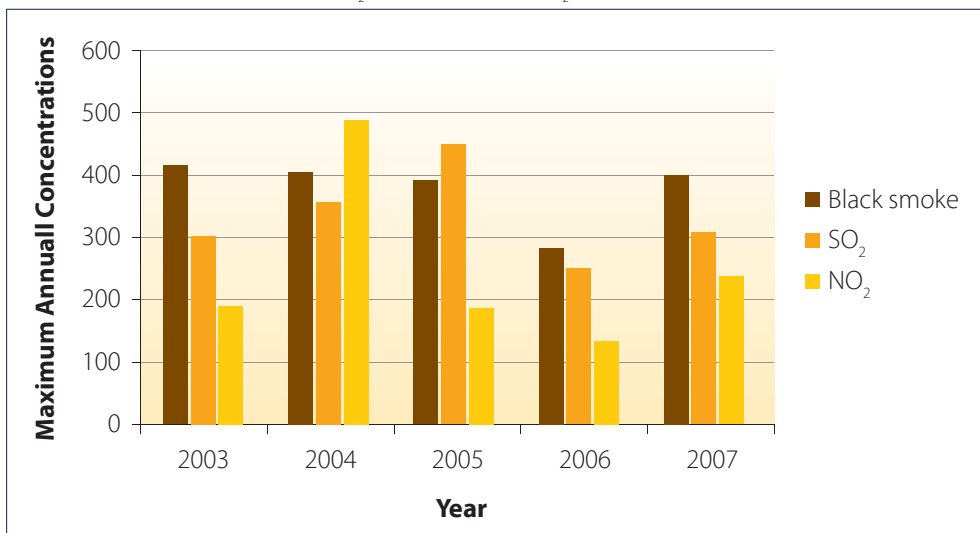
Figure 72: Average number of days with excessive ILVs for black smoke, SO₂ and NO₂ in Belgrade.



Source of data: City Public-Health Institute Belgrade.

The maximum daily concentrations throughout the whole period from 2003 to 2007 were far above the limiting imission values, particularly with black smoke for which even eight times higher values were noted (Figure 73).

Figure 73: Maximum annual concentrations registered in Belgrade, expressed in $\mu\text{g}/\text{m}^3$ (ILV for black smoke per day: $50 \mu\text{g}/\text{m}^3$, ILVd $\text{SO}_2 = 150 \mu\text{g}/\text{m}^3$, ILVd $\text{NO}_2 = 85 \mu\text{g}/\text{m}^3$).



Source of data: City Public-Health Institute Belgrade.

19.1.2. Water quality

The following rivers are included in the monitoring of the quality of surface waters, which is carried out by City Public-Health Institute of Belgrade on the territory of Belgrade: the Sava, the Danube, the Kolubara, the Galovica, the Topciderska River, the Zeleznicka, the Baricka River, the Pestan, the Turija, the Beljanica, the Lukavica, the Bolecica, the Grocica, the Veliki Lug, the Rajla, as well as the canals of the Pancevacki rit (the Kalovita, the Sibnica, the Vizelj). The control of the quality of surface waters is carried out on the territory of Belgrade for estimating the classes of river waters, following the trend of water pollution, estimating the qualities necessary to self-purification and water supply of Belgrade, Obrenovac, Baric and Vinca, the possibilities of irrigation, as well as for health protection of citizens who use these rivers for recreation. The obtained results served as the basis for the estimation of the efficiency of measures that have been overtaken in reducing the pollution, but also for suggesting new measures of protection.

Surface Waters

The largest number of profiles for measuring the quality of surface waters is on the Sava and the Danube⁸⁰, where the dynamics of sampling is the most frequent. "Makis" on the Sava and "Vinca" on the Danube are the most significant profiles because they are located at the very spring of water supplying.

⁸⁰ Profile on the Sava: village of Usce (62 km), Zabran (30 km), Duboko (24 km), Makis (10 km) and Kapetanija (1 km), on the Danube: Stari Banovci (1193 km), Zemun (1173 km), Bela Stena (1160 km), Vinca (1145 km) and Brestovik (1124 km).

Based on the examinations, carried out in the period from 1998 to 2007, it can be concluded that the water quality of the Sava is little better than the water quality of the Danube, but the difference in the quality between these watercourses is gradually reducing.

Generally observed, the water quality of the Sava was the worst in 2007 in the last decade (Table 57). Since the population number and the inflow of sanitary and industrial waste waters did not change significantly in relation to the previous years, the worsening of the situation can be explained by the phenomenon of new polluters in the basin and the intensive washing filth off the banks after more abundant precipitation. It is significant to mention that the deviations from regulated quality (II class) were mainly towards the III class of river waters⁸¹, as well as that in the Sava river basin, upstream from the spring of Belgrade water supply, there were no damaging pollutions by oil, oil derivatives, hard and toxic metals, pesticides, polychlorinated biphenyls and polycyclic aromatic hydrocarbons.

Table 57: Results of the water quality control for the Sava on the territory of Belgrade, 1998 – 2007.

Year	Total number of examined samples	II class river waters ⁸²		Beyond class II, due to changed parameters (%)					
		No. of samples	%	Bact. and phys./chemical		Only physical/chemical		Only bacteriological	
				No. of samples	%	No. of samples	%	No. of samples	%
1998	53	21	39.6	15	28.3	13	24.5	4	7.5
1999	50	20	40.0	10	20.0	10	20.0	10	20.0
2000	53	26	49.0	9	17.0	7	13.2	11	20.8
2001	64	40	62.5	5	7.8	14	21.9	5	7.8
2002	66	35	53.0	5	7.6	15	22.7	11	16.7
2003	68	24	35.3	11	16.2	7	10.3	26	38.2
2004	68	34	50.0	11	16.2	4	5.9	19	27.9
2005	68	19	27.9	22	32.4	13	19.1	14	20.6
2006	68	22	32.4	20	29.3	4	5.9	22	32.4
2007	60	18	26.5	15	22.1	6	8.8	29	42.6

Source: *Environment in the City of Belgrade, 2008*.

⁸¹ The III class of river waters—waters that can be used for irrigation and in industry, except food-processing industry.

⁸² The II class of river waters (according to Regulation on the classification of waters, »Serbian Official Registers«, no. 5/68) are waters suitable for bathing, recreation and water sports, for the breeding of less pure fish, as well as waters that can regularly be used for water supply to settlements and in food-processing industry.

Table 58: Results of the water quality control for the Danube on the territory of Belgrade, 1998 – 2007.

Year	Total number of examined samples	II class river waters ⁵		Beyond class II, due to changed parameters (%)					
		No. of samples	%	Bact. and phys./ chemical		Only physical/ chemical		Only bacterio- logical	
				No. of samples	%	No. of samples	%	No. of samples	%
1998	62	12	19.4	31	50.0	16	25.8	3	4.8
1999	58	14	24.1	29	50.0	8	13.8	7	12.1
2000	62	22	35.5	24	38.7	9	14.5	7	11.3
2001	64	21	32.8	17	26.6	19	29.7	7	10.9
2002	66	26	39.4	14	21.2	10	15.2	16	24.2
2003	67	19	28.4	24	35.8	6	9.0	18	26.8
2004	68	27	39.7	10	14.7	5	7.4	26	38.2
2005	68	13	19.2	26	38.2	9	13.2	20	29.4
2006	68	11	16.2	23	33.8	9	13.2	25	36.8
2007	68	20	29.4	17	25.0	8	11.8	23	33.8

Source: Environment in the City of Belgrade, 2008.

Generally observed, the water quality of the Danube was micro-biologically and physically-chemically considerably better throughout 2007 than 2006 and 2005, but still worse than in 2002 and 2004 (Table 58). This was an average year in the last decade. It is important that worsening of the water quality of the Danube stopped and the stopping should be continued in the following period due to the protection of the water supply springs in Vinca, possibilities for recreation on the Danube and favourable influence on hydrobionts.

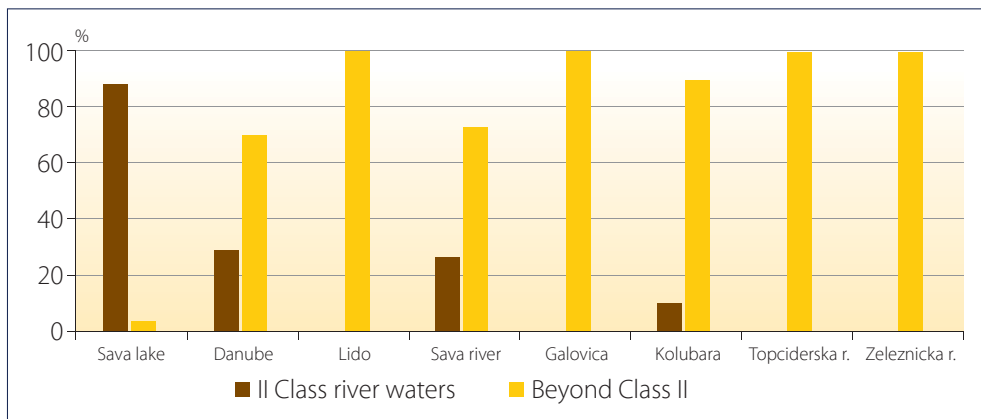
Waters of the Kolubara River most often correspond to the III-II class of the water quality. Waters of many smaller watercourses, and especially those flowing through inhabited places (the Veliki Lug, the Lukavica, the Bolecica, the Grocica, the Topciderska, the Zeleznicka, the Baricka River, as well as canals of the Galovica, the Sibnica and the Kalovita) have constantly been out of the limits of the II class river waters, while very often they belong to the IV class or they are out of all classes of river waters.

Permanently bad water quality of the Galovica canal and the Zeleznicka and the Baricka River influences unfavourably the underground waters at coast, whereas all three watercourses flow through closer zone of the sanitary protection of Belgrade water supply.

Compared with many small watercourses, the Kolubara River, as well as the Sibnica and the Vizelj canals are less polluted, while the samples corresponding to the II class river waters appear occasionally. Among small watercourses, the situation was registered to be relatively satisfying only in the Beljanica and the Rajja rivers, in which about 50 % of analysed samples were within the limits of the II class water quality.

Generally speaking, as the quality of surface waters in the area of Belgrade concerned, the situation is relatively favourable in the Beljanica, the Rajja, the Sava and the Danube, whereas the situation is upsetting in all other controlled watercourses and it is even alarming in the Bolecica, the Lukavica and the Veliki Lug.

Figure 74: Percentage of II class river waters in samples from some surface waters on the territory of Belgrade in 2007.



Source: Statistical yearbook of Belgrade, Institute of Statistics and Informatics, Belgrade, 2008.

The Lake of Ada Ciganlija is not completely maintained as it has been expected by the projects of construction and rebuilding, so the positive effects, achieved by sanitary cleaning of the Lake which was carried out in 1987, are gradually disappearing. Even besides the applied intensive measures of mowing in order to reduce the spread, submersible, macrophyte vegetation and removing the biomass from the Lake for several times throughout 2007, the water quality has still been spoiled, primarily due to constantly large number of bathers, which exceeds ecological capacity of the Lake, i.e. capability of self purification, as well as permanent introducing of new servicing, recreation and other contents in order to enrich the offer. The water quality at bathing beach of Lido is out of the limits of the II class water quality throughout the larger part of the bathing season. The water quality near Avala accumulations is the best on “Duboki potok”, while the water quality of “Bela reka” is little worse, whereas “Pariguz” has the worst quality of water. All three accumulations near Avala show that the processes of eutrophication are very advancing on them.

Underground Waters

The characteristics of the water-table of alluvial deposits of the Sava River are influenced by the quality of surface waters, taking the direct hydraulic link of the river bed into consideration with aquiferous horizon. The significant transformation of the Sava water qual-

ity, during feeding the water tables of Belgrade spring, is characterised in the reduction of both inorganic and organic load. The result is the satisfying quality of the water-table of alluvial deposits of the Sava River on the territory of Belgrade even above the occasional deviations from some parameters (iron, manganese, ammonia). However, relatively large vulnerability of some parts of Belgrade spring has to be considered because of its large lined indentation (length of over 50 km) and collision with urban core. Housing and industrial structures, traffic infrastructure, agricultural activity at the Sava coastline, as well as the fact that there are no corresponding communal systems for water purification in the parts of the urban whole, and especially in rural settlements, influence the degradation of the quality of the aquiferous environment.

Drinking Water

Explaining the results of the examination of waters of Belgrade water supply system for the period from 2003 to 2007, as well as based on the mentioned facts, it can be concluded that the quality of drinking water corresponds to regulated standards from health aspect. The aberration from the physical-chemical correction of water appears in 1.0 – 1.5 % of the samples, whereas bacteriological aberration is in 4.2 – 9.4 % of the samples.

Table 59: Total number of samples and percentage of physical, chemical and bacteriological aberrations in the samples of drinking water taken from The Belgrade Waterworks, 2003 – 2007.

Year	Total number of examined samples	Physical/chemical aberrations		Bacteriological aberrations	
		No. of samples	%	No. of samples	%
2003	6.565	64	1.0	275	4.2
2004	6.579	83	1.3	349	5.3
2005	6.537	100	1.5	420	6.4
2006	6.631	96	1.4	383	5.8
2007	6.628	71	1.1	626	9.4

Source of data: City Public-Health Institute Belgrade.

Physical-chemical aberration is most often the consequence of insignificant increase in the concentration of iron and muddy water, which does not have significance for human health, and it occurs due to change of pressure or lack of water resulted from planned cutting off and the condition of distributive network.

Bacteriological aberration mainly appears in summer period and mostly refers to the increased total number of bacteria (the presence of which is only acceptable in drinking water), which does not have great health significance, but it is important as the indicator of the situation. Therefore, the mentioned parameter is differently standardized, or it is not being standardized in other regulations in the world. It is necessary to emphasize that pathogenic microorganisms have never been isolated.

Waste Waters

The sewerage network is not developed enough in the settlements on the territory of Belgrade. The most significant characteristic of the sewerage system is that around 30% of urban and suburban settlements are not connected to the public sewerage system. Certain number of streets in the very urban core (municipalities of Vracar, Savski Venac, Palilula, Vozdovac, Zvezdara, Cukarica, Zemun) does not have sewerage. The suburban settlements make special problem, such as Mali Mokri Lug, Kaludjerica, larger part of Batajnica, Krnjaca, Ovca, Vinca, Lestane, as well as large number of unplanned built settlements, which also do not have the sewerage system.

In the city of Belgrade, the total of 137.610.000 m³ of waste waters were discharged in 2004, whereof 100.000.000 m³ were discharged from households. A water purification plant of the City does not exist. The condition in the city sewerage system is extremely hard and it can be described in the following way: Belgrade sewerage system has 24 discharges into the city rivers, the Sava and the Danube, without any previous purification; the largest number of the total of 37 pumping stations of the sewage system is in very bad condition; the unload of tank trucks with drains is not sanitary correctly solved; a water purification plant of Belgrade is planned to be built in Veliko Selo.

19.1.3. Soil quality

Intensive urbanisation, development of industry, traffic and agricultural activities, influence the excessive pollution of the environment and soil. The sources of soil pollution on the territory of Belgrade have dominantly been the consequence of human activities and basically they can be divided into three groups:

- 1) soil pollution originated from waste waters – waste waters from technological procedures in industry and economy; waters polluted due to agricultural activities (artificial fertilizers, pesticides and organic waste of different origin); waste waters from individual households, hotels and restaurants and maintenance of hygiene of settlements;
- 2) soil pollution originated from atmosphere – emission from industrial and technological processes; emission due to combustion of fossil fuels in industrial and energetic plants, individual and local boiler rooms, etc.; emission from motor vehicles which use oil and derivatives; emission from the combustion of different organic substances, biomass, etc.;
- 3) soil pollution originated from uncontrolled and inadequate waste disposal from industry, households, agriculture, etc.

Soil pollution is examined on many locations which are grouped in several zones on the territory of Belgrade: soil in the protection zone of Belgrade water supply, soil within city parks and recreation zones, soil near industrial structures, soil near large traffic routes, soil within agricultural area and soil within communal environment of the urban part of the city.

The results of the examination of soil pollution, which was carried out throughout the period from 2003 to 2007, have pointed out that there are locations in the area of Belgrade in which it primarily came to degradation of the surface layer of soil. In most of the examined samples of soil, either the aberration from standardizations, regulated according to standard scale (Nickel), or the presence of some of polluting substances, which cannot be found in surface layer of soil (organic compounds), were registered. The increased concentration of nickel in most of the examined samples pointed to geological origin, i.e. natural presence of this metal in soil on the territory of the city. The presence of PAH in soil, as in the inner urban area, so in agricultural areas on the periphery of the city, points to widespread distribution and gradual accumulation of this organic polluting substance in soil, which is emitted from the sources of air pollution from the area of the city and wider surroundings. Along the main roads, particularly in the zone of impact of highway, the soil quality is damaged due to traffic, i.e. deposition of polluting substances from exhaust gasses (Pb and PAH). Increased concentrations of heavy metals (Pb, Cu and Zn), mineral oils, PAU and PCB in the samples of soil from the area of the tip of Ada Ciganlija, pointed to anthropogenic influence which is in the connection with the purpose and the way of using of the mentioned area, as well as activities being undertaken within the same. In some samples of soil, the presence of DDT, which has not been conventionally used for several years backwards, pointed to residues of this pesticide with a long half-life period.

The causes of the soil quality degradation on the territory of Belgrade should be found in the low level of communal and housing hygiene, uncontrolled use of agro-chemical means, the lack of infrastructural facilities and installations for water purification and gas emissions, disorder of the communal landfill wastes, etc.

19.1.4. Wastes

The existing system of managing the waste materials in Belgrade means gathering, transportation and waste disposal. The basic method of waste disposal is the disposal on landfills. Communal wastes, which also contain hazardous wastes from households, are most often directly transported on landfills without any previous treatment.

On the territory of 17 Belgrade municipalities, 538.164 tonnes of wastes were gathered throughout 2005. The wastes are disposed on five communal landfills⁸³, whereof most wastes, i.e. of the territory of 11 Belgrade municipalities, are disposed on the landfill in Vinca (Grocka). This landfill has been used since 1977. It represents the largest landfill in Serbia, on which 436.089 tonnes of wastes were disposed in 2005. The impact of this landfill on the environment has not been much documented. There is no systematic monitoring of any possible influence of sources (emissions, control of permeable waters, waste gas, etc.). The use of this location for the future needs of Belgrade is influenced by

⁸³ In Grocka-“Vinca” (65 ha), in Obrenovac-“Vlasko Polje-Grebaca” (10 ha), in Sopot (3 ha), in Lazarevac-“Barosevac” (2 ha) and in Mladenovac – “Vlaska” (2 ha).

its rebuilding and expansion on the total area of 70 ha. The municipalities of Lazarevac, Mladenovac, Obrenovac and Sopot have their own landfills which do not satisfy even the minimum of the technical conditions for sanitary landfills.

The information system on the flows of wastes does not exist. Disregarding the legal obligation, the precise evidence about hazardous and harmful substances in Belgrade does not exist. The incineration plants for waste do not exist, as well as for mechanical or biological treatment of communal waste. Moreover, the approved location for hazardous waste disposal does not exist in Serbia, neither a plant for the treatment of hazardous waste. Hazardous waste is temporally disposed in unsuitable warehouses (some of them have existed for many decades) near enterprises. Irregular managing the medical wastes represents significant problem of Belgrade. Considering that the sorting of wastes does not exist in the health-care facilities, the medical waste, including used needles and syringes, waste from surgeries, etc., is ending up in containers, wherefrom it is gathered and transported on the landfill by "City Sanitation Department". The degree of recycling is insufficient, i.e. the treatment of waste. There are recycling yards (containers marked for different kinds of waste) in Ada Huja and New Belgrade.

The following problems are being imposed as the basic ones in this field: poor organisation of the existing communal landfills, the capacities of landfills are full, the existing degree of recycling is insufficient, large number of "wild" landfills are still present, etc. The overall influence on the environment is characterised in the following: pollution of surface and underground waters and soil by permeable waters, uncontrolled emission of methane, degradation of area by wild landfills, pollution of soil, water and air by inappropriate treatment of special flows of waste (waste oils, old vehicles, electronic waste, electric batteries, asbestos, fluorescent pipes, etc.).

19.1.5. Noise

The level of noise has been followed for almost more than 30 years in Belgrade. In 1984, the zoning of the city from the aspect of noise was carried out only in five municipalities. By the time, the number of measuring places increased on 30 in the period from 2003 to 2007.

The levels of communal noise, registered in the period from 2003 to 2007, were both high during the day and night and they exceeded the regulated values in 25 measuring places. In dependence on the zone of purpose, the maximum noise limit exceeding was up to 15 dB (A) (2003, 2006 and 2007) throughout the day, while even 23 dB (A) was registered in the night period of 2003. On average, the largest noise level limit exceeding was in the zone of the urban centre and near mentioned traffic routes, as well as in residential zones.

Communal noise in Belgrade mainly originated from traffic, while industry, small businesses, civil engineering and other activities are of less significance.

The most frequent causes of problem refer to old vehicles with high noise emissions and old production technologies, inadequate location of industrial plants, workshops, and particularly catering establishments situated in urban zones, as well as non implementation of measures of protection.

19.1.6. Risks from Chemical Accidents

According to the number of processed industrial plants, Belgrade does not represent industrial centre. However, as the largest urban agglomeration, it represents large vulnerable zone, as from the aspect of endangerment of human health, so the environment.

There are many industrial plants on the territory of the city of Belgrade which use, store or produce hazardous substances. There were 69 identified hazardous industrial plants, divided into six groups of different degree of risk⁸⁴. The following industries are included in the most risky ones:

1. Industrial complex "Prva iskra"-Baric;
2. Paint and varnishes industry "Duga"-Palilula;
3. Oil refinery "Belgrade"-the Pancevo road;
4. Production of technical gases "Tehnogas"-Rakovica;
5. Store of oil and petroleum products "Jugopetrol-Belgrade"-Cukarica;
6. Pharmaceutical-chemical industry "Galenika"-Zemun (Figure 75).

Figure 75: Map of risky industrial plants in the area of Belgrade.



Source: Ecological Atlas of Belgrade.

⁸⁴ Regional spatial plan of administrative area of Belgrade

The following causes are mentioned as the most frequent ones for accidental pollutions: inappropriate storage of chemicals and hazardous waste, insufficient security of the transportation of chemicals and hazardous waste, old industrial technologies and means of transportation, as well as poor implementation of the measures of prevention.

Hazardous industries which produce, use and store dangerous substances (estimated quantity of around 1.250.000 tonnes per year, whereof 15.000 tonnes of hazardous waste) represent the primary problem of Belgrade and bear high degree of risk to human health and environment (Filipovic and Obradovic, 2004).

In the area of the City, chemical accidents most often occur during transport of hazardous substances, carried out by highway, railroad and river transportation. The risk, originated from highway transportation of dangerous substances, will considerably be reduced by finishing the Ostruznica Bridge and putting the roundabout way into function (Filipovic, 2000).

19.2. Problems of endangerment of the City of Belgrade environment

Based on the existing situation of the environment, it can be concluded that the priority problems of the city of Belgrade are the following:

- very polluted air and raised level of noise in the central zones of the City (bad organisation of traffic, non existence of roundabout and the use of fuel with addition of lead, insufficiently competitive public transport);
- inadequate managing the waste (non existence of sanitary landfill, low degree of recycling, inadequate treatment with hazardous and medical waste);
- inadequate protection of the environment near thermo-energetic structures (lack of re-cultivation of the strip mines of the Kolubara basin);
- degradation of soil due to illegal building;
- soil pollution influenced by waste waters and waste material;
- location of some industries in the central parts of the city core;
- river pollution influenced by the discharge of non purified water from sewerage network;
- irrational use of natural resources, water and energy, particularly;
- existence of risky plants and risk from accidents during transportation of hazardous substances in the central zones of Belgrade;
- lack of forestation;
- lack of permanent monitoring of parameters of the quality of the environment.

The main problems of the environment in Belgrade are the following: irrational use of resources (soil, water, energy, etc.), increase of traffic problems, lagging behind the development of communal infrastructure, degradation and pollution of soil, air pollution and water pollution, risks from natural disasters and industrial accidents, ruining the natural and cultural wealth, as well as insufficient care for aesthetic values of the city. The state

of the environment in Belgrade shows that the strengthening of activities is necessary in certain segments in order to reduce pollution. The influence of some urban functions on the environment is shown in Table 60.

Table 60: Influence of urban functions on the pollution of the environment.

	CAUSES OF POLLUTION	FACILITIES AND ENTERPRISES	EFFECTS ON THE ENVIRONMENT
1.	TRAFFIC		
1.	Highway (city and transit)	registered 2500 vehicles of over 5 tonnes, 1500 buses, CPT+ Lasta (city+suburb. 1870 buses); transit – unknown	Pollution of air and soil, increased noise, accidents with dangerous freights, land occupation
	Bus stations, Public garages, parking lots	BBS + LASTA (1400 departures daily), Parking service (6500 lots on the streets, 5500 on parking lots, 2660 in the garages)	Air pollution, increased noise, water pollution, wastes
2	Railroad stations and Rail traffic	4 intercity stations, 20 stations for city and suburb.traffic, 15 freight stations with 85 ind. platforms	Increased noise, water pollution, land occupation Soil pollution
3	Air	Airports of Belgrade and Batajnica	Land occupation, noise, air, water and soil pollution
4	River	Belgrade Port-120 ha, 700 vessels-510.000 tonnes of capacity	Occupation of land and water surfaces, water and soil pollution
2.	CONCENTRATED POLLUTERS		
1	Industry	energetics – 56.3%, food processing – 14.4%, metal – 10.2%, and pharmaceutical-chemical complex – 6.3%.	Pollution of air, water and soil, industrial waste, hazardous waste, risk from industrial accidents
2	Heating plants and larger boiler rooms	System of "Belgrade generating stations", with 14 heating plants and 118 heating sources, capacity of 2445 MW and 3400 substations, heats over 220000 apartments and 7500 business facilities	Air pollution
3	WATER SUPPLY AND SEWERAGE		
1	Water supply	Plants of Makis, Banovo brdo, Bezanija, Belevode and Vinca	Insufficient water in summer months, losses in network, water quality
2	Sewerage	24 discharges from sewage network into the rivers without purification, numerous uncontrolled discharges	Carrying away into watercourses without purification, septic tanks – permeable or they pour out
4.	HOUSING	To the 2000 inclusive, about 426500 apartments, illegal building in 10 municipalities: 22691, weekend houses 1376, auxiliary and other buildings 32731 (the total of 56798).	irrational land use, irrational consumption of energy and water, bad managing the waste and fecal waters, air pollution
5.	MANAGING HARD WASTE	Landfill of Vinča and many trash dumps. "city Sanitation Department" gathers and dispose daily around 1200 tonnes of garbage. The total area of the landfill of Vinca is 65 hectares.	Pollution of soil,water and air due to inadequate gathering, treatment and waste disposal
6	DISPERSED POLLUTERS		
1	Agriculture	49 public sector enterprises: 17 agricultural enterprises, 25 enterprises of food-processing industry, 5 enterprises of beverage industry and 2 enterprises of fodder industry.	Pollution of soil, water and air by pesticides and artificial fertilizers, hard waste, waste waters
2	Petrol stations	135 public petrol stations and approximately the same number of internal ones	Pollution of air, water and soil, increased noise
3	Chemical workshops	Unknown.	Pollution of air, water and soil
4	Storages of chemical and fuels	Unknown	Risk from chemical accident, soil pollution
5	Individual home heating	Unknown	Air pollution, hard waste

Source: Ecological Atlas of Belgrade.

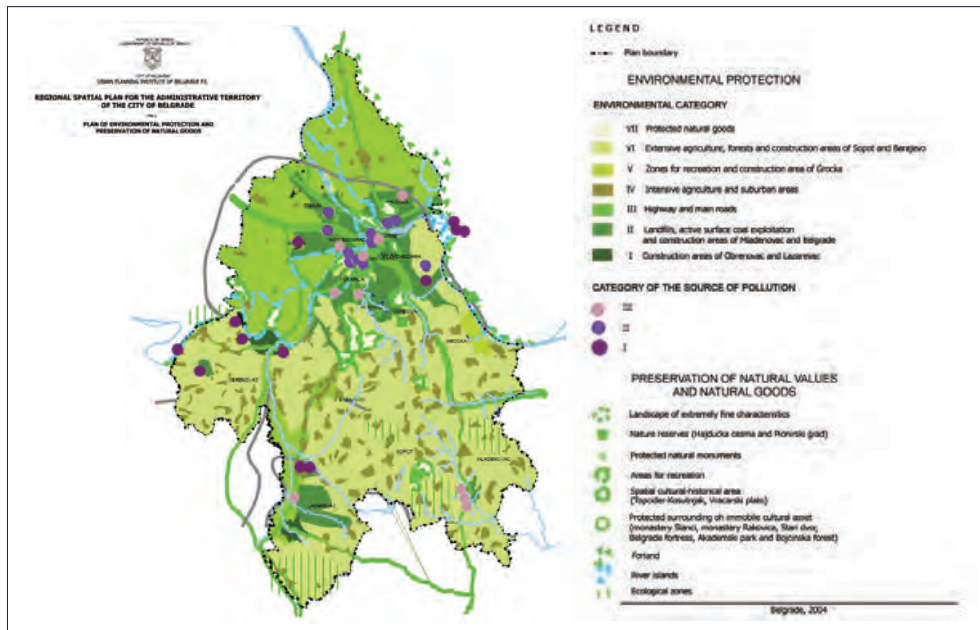
19.3. Valorisation of the environment on the territory of the City of Belgrade

Environmental pollution has been noted in almost the whole territory of the city of Belgrade. The level of pollution and other adverse impacts are not distributed equally, but depend on natural conditions and human factor. Environmental categorization of the City of Belgrade according to the level of pollution indicates to the presence of seven categories of the endangered state of the quality of the environment.

- I category – the area of thermo-energetic plants, mines and disposals of ashes and dross in Obrenovac and Lazarevac;
- II category – central area of Belgrade, Mladenovac;
- III category – belts along highways and main railroad tracks;
- IV category – settlements in edged belt of Belgrade;
- V category – Grocka;
- VI category – Barajevo, Sopot; and
- VII category – unsettled areas without source of the pollution.

The areas within the first four categories generally represent limitations for environmentally sustainable development of the area. On the other hand, an environmentally responsible use of space in the territories belonging to categories V, VI and VII represent a significant potential.

Figure 76: Categorisation of the environment on the territory of the city of Belgrade.



Adapted from Regional spatial plan of administrative area of Belgrade, 2004.

19.4. General and special goals, strategic determinations of the protection of the environment

The key priority of the future development of the city of Belgrade is achieving the rational organisation, use and arrangement of the area in accordance with the preservation of the existing natural values and protection of the environment. This goal is possible to be realised only by the coordination of the potentials and limitations in managing the natural and created values of the area.

The restoration and improvement of degraded environment has to be the main goal of the planning and developing the city of Belgrade, as well as recycling the building land and activating the brown-field locations, i.e. the preventive protection from all planned activities that could endanger the existing quality of the environment.

Therefore, it should be leant towards the following principles in the spatial organisation:

- keep and protect naturally valuable and preserved ecosystems, as well as areas at which the quality of the environment is insignificantly endangered;
- determine the most adequate way of using the natural resources and space with the aim of preserving the natural values and improving the environment;
- reserve and protect the areas which must not be polluted and destroyed for strategic reasons (spring of water supply, protective belts, protected natural wealth);
- recover and revitalize degraded and endangered ecosystems and stabilize the consequences of the pollution. This primarily and urgently refers to mining-energetic zone which includes Obrenovac and Lazarevac municipalities, as well as Ub and Lajkovac.

Concerning the stabilization and revitalization of degraded environment, it is necessary to determine the priority activities, consider all aspects of problem solving, and choose those solutions which give the long-term positive effects. The mentioned priorities are especially significant in urban centres:

- in Belgrade, as urban system of the largest complexity and activity (traffic, industry, communal activities, etc.);
- in Obrenovac municipality, with extreme problems in energetics (thermal power station A and B), in the relationship to the Sava River, as well as in traffic, industry and agricultural land;
- in Lazarevac municipality, with extreme problems of energetic resources of the strategic significance for the Republic and many ecological and social problems;
- in Mladenovac municipality, the problems are extreme in industry and hydro-technical systems;
- in Grocka municipality, there are problems with hydro-technical systems, the relationship towards the Danube, agricultural and building land and central communal waste landfill.

Strategic determinations in the field of the protection of the environment refer to the following:

- providing the qualitative environment, which means fresh air, sufficient amounts of qualitative and hygienically correct drinking water, preservation of agricultural land, ecosystems and biological diversity, qualitative areas for recreation and tourism, healthy safe food, arranged settlements;
- achieving the rational organisation, arrangement and protection of area by the co-ordination of its use with the possibilities and limitations in managing the natural resources (agricultural land, forests, waters, etc.) and created values;
- holding up further degradation of the environment (air, water, soil, etc.) by defining the state, priority of the protection and conditions of the sustainable use of space; and
- overtaking adequate measures of prevention with the establishing of the systems of control of all forms of pollution.

19.5. Determinations of the environment according to activities

The general goal of the development of the city of Belgrade imposes better use of the potentials, with the estimation of demands for conservation and protection of the environment, modernization of economy with the parallel development of social and communal activities and the following services. The strategic determinations of the development, i.e. carrying out of the set general goal, mean the following:

- concentrate industrial production and storages within industrial zone, with more economic land use and special protection of the environment from possible pollution. All planned new economic structures, as potential polluters, have to satisfy the level of the quality of the environment according to corresponding standards and regulated scale of norms. It is necessary to install modern technology in all new production plants by which the harmful activity would be reduced, i.e. which contain technical-technological solutions for minimizing the emission of polluting substances into the environment. Under the issuing of the conditions, all necessary agreements have to be provided and estimations of the influence of the projects on the environment have to be done;
- protection and arrangement of agricultural land according to modern principles of the sustainable agriculture and standardized scope and way of use of agricultural land with natural conditions and limitations of the local milieu represent the basic goal of the protection of the environment when it is agriculture about. In order to realise this goal, it is necessary to initiate the revitalization of agricultural production on modern organizational and technological principles, strictly ecologically controlled;
- development of tourism should be based on natural predispositions of the area of the City, but it must not endanger the ecologically balanced wholes or the qualities of the natural area. This especially refers to protected natural resources and their

direct surroundings, in which only ecologically based forms of tourism can be organised and popularized;

- developed and modern traffic infrastructure that would enable undisturbed local economic development, give qualitative life of the population and estimation of the basic ecological standards concerning projecting, construction and exploitation of traffic infrastructure;
- protection of space and drainage basins of surface waters, protection of underground waters as well as lakes on the level of the highest ecological quality, is the basic goal of the use and protection of waters for the development of waterpower engineering. The ecological pretensions of the area demand high degree of gathering and discharging of waste waters, which means the construction of the system that would enable high quality of the environment, especially in the parts of more intensive use;
- development of some segments of communal infrastructure on the regional and local level, and with the aim of preservation and protection of the environment, means to provide the corresponding system of gathering and disposing the waste, gathering and recycling the raw materials, the system of remote heating and the system of gathering, processing and discharging the waste waters;
- development and improvement of forestry in the area of the City should confirm the high ecological-economical identity of forests, taking into consideration relatively small areas under forests. The protection, distribution and use of forest areas will be carried out over the improving of the existing states of forests, more adequate protection and care, as well as by increasing the areas under forests by planting the species of autochthonous characteristics.

19.6. Priority measures in the protection of the environment

The problem of the protection of the environment has to be integrated in the plans of the future development of the City, so with that aim, the following priorities in the protection and advancement of the environment are defined:

- stabilization of the condition of the most endangered areas-hot spots;
- strict protection and control of springs of water supply;
- adequate carrying out of the primary purification of the communal and industrial waste waters, including the reconstruction of the existing ones and installing the new water purification plants;
- soil conservation, especially the high quality one, from all kinds of pollution (excessive use of agrochemical means, unplanned construction, permeable waters, etc.);
- reduction of excessive level of noise to acceptable limit;
- solving the problems of waste disposal, including the existing landfill in Vinca, as well as transferring to the new system of managing the waste in accordance with "National Strategy of Waste Management";

- stabilization of the existing landfills and trash dumps on the territory of the City;
- strict protection and control of protected natural resources with the aim of their preservation and improvement;
- integral management of the system of green fields (improvement of the structure, enlargement of areas, connecting green areas in the settlement with the greenness of the surroundings and making protection belts of greenness);
- making cadastre of sources of the pollution of the environment in the area of all municipalities of the City of Belgrade as the first phase in the making of information system on the environment;
- establishing systematic monitoring of the quality of the environment in all municipalities;
- establishing active regional cooperation with the adjoining municipalities of the metropolitan area of Belgrade and municipalities in the surroundings with the aim of solving the actual ecological problems and protection of the space and environment.

19.7. Conclusions

The state of the environment of Belgrade is determined by its natural conditions, created urban structure, traffic, economic and other activities which are developing in the city. The care for the quality of the environment has already been accepted as the process of the synthesis of all activities in the urban system of Belgrade. Belgrade decided to respect the principles of the sustainable development, by which it emphasized its intention to join the association of healthy cities by the project "Belgrade – healthy city".

The strategy of the sustainable development of the City should provide a wide framework for integrating the aspects of the protection of the environment into all other sub-systems of the City, starting from the land purpose, over land and housing policy, the planning of advancement of traffic, managing the waters, energy and wastes, etc. An active policy of preventive protection of the environment is established under the making and carrying out of the plans, meaning the estimation of ecological efficiency of all planned solutions, programmes and activities, which is not just a condition for the improvement of the quality of life, but also the significant factor which supports the economic development.

Very high expenses of cleaning the polluted environment and irretrievably disappeared ecosystems should encourage the reduction of the pollution and the natural resources consumption. Conservation, good management, public-private partnerships in giving services, locating industries where the endangerment of the environment will be the least, encouraging the use of less polluting technologies, introducing the encouraging measures and standards for the improvement of the technological efficiency-these are the ways for the City to carry out the long-term goals of growth, sustainable for the environment.