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# ENVIRONMENTAL STATUS OF FR YUGOSLAVIA

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## ABSTRACT

This paper reviews key characteristics of environmental situation in Yugoslavia before, during and after NATO bombing against this country. Principal environmental problems and their sources are described. The "quality" of soil, water and air, as well as some other environmental parameters is documented by available data during last decade. An analysis of main environmental issues was made. Short review of key environmental policies, instruments and institutions is also presented.

Key words: environment, organization, situation

## 1. INTRODUCTION

Former Yugoslavia has made great progress in transforming its economy and society. A result of dynamic development of economy and disregarding of environmental criteria in this period led to the present condition of the environment. This created a situation of highly polluting factories, lack of proper waste facilities for municipal, industrial and hazardous effluents, insufficient monitoring of pollution in the air, water and soil. Without market economy as, yet, and with budget restrictions, maintenance of industrial facilities remains inadequate, and use of natural resources, fuel and energy uneconomical. All of these are contributing factors in environmental degradation. FR Yugoslavia in the past ten years has had the stagnation of economic performance due to economic sanctions. Despite declined industrial activities environmental situation did not changed in positive direction. Additional environmental degradation of Yugoslavia was imposed as a result of NATO aggression and destruction of chemical plants, oil storage installations and other hazardous objects. Although there was no evidence of a large-scale ecological catastrophe, pollution was very severe in the vicinity of targeted industrial complexes and many valuable ecosystems were disturbed. Just because there have been no acute large-scale visible impacts on flora and fauna or on human health at the moment does not mean that there will be no long-term effects.

This paper contains some basic data and comments on environmental status of Yugoslavia before, during and after NATO bombing. Main goal of the paper is to initiate more serious and comprehensive research on the environmental situation in Yugoslavia as basis for environmental recovery of threatened areas and to improve ecomanagement in the country.

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## 2. PRINCIPAL ENVIRONMENTAL PROBLEMS AND THEIR SOURCES

Environmental situation in Yugoslavia before NATO bombing can be analyzed using the data from the last official report on status of the environment in FRY<sup>1</sup>. Although the report includes data up to 1994, the results of analysis are actual up today, because of low level of economic activities as a consequence of economic sanctions since 1992.

### 2.1 SOIL

Destruction or degradation of soil is caused by erosion, open-pit mining, dumping of waste and ash, and diversion to the other uses (settlements, transport and other infrastructure, water collection, etc.). Overall percentage of distracted land is 0,25% of the total surface of Yugoslavia (0,24% located in Serbia). The percentage of various types of distracted land in overall surface of distracted land was as follows: open-pit mining 30%, water-reservoirs 20%, various dumps 15%, settlements 10%, factories, transport and other 25%. Main environmental impacts from non-ferrous metal mining and metallurgy are present in Bor, Majdanpek, Kosovska Mitrovica and Podgorica, and open-pit coal mining in Kolubara, Kostolac, Kosovo and Pljevlja.

Various gases, liquids and solid pollutants and toxic substances contaminate soil. Source of main environmental impact is use of the chemical fertilizers and pesticides in the agriculture. Although Yugoslavia belongs to the countries with low level of consumption of agro-chemicals, some areas are contaminated due to extensive use of chemicals. This can be illustrated by the results of soil analysis got from Vojvodina.

**Table 1 - Contents of heavy metals in the soil of Vojvodina**

Contaminant	Concentration (mg/kg)	Contaminant	Concentration (mg/kg)
Cadmium	0.06-1.68	Lead	3.6 - 82,5
Copper	1,3 - 252,5	Phosphorus	0,2 - 16,0
Mercury	0,01 - 0,054	Zinc	1,25 - 182,5

Acidification and inadequate disposal of solid and hazardous wastes from farms and industrial facilities also degrade the soil.

### 2.2 AIR AND ATMOSPHERE

Emissions of polluting substances into the air in Yugoslavia are considerable despite the fact that its level of industrialization, traffic and urbanization is low compared to European countries. Air is polluted from firing places in homes and factories, heating plants, thermal power stations and other thermal facilities, by motor vehicles, industrial processes and installations.

Variation of emission by years is closely related to the economic activity. Evident decline of emissions in year 1992 is result of UN economic sanctions established in this year against Yugoslavia (Table 2).

Levels of SO<sub>2</sub> emissions are mainly function of consumption of coal in the thermal power stations, from which emissions share are in average 88% of total sulfur emissions. Major emission sources are thermal power plants in Obrenovac, Kostolac, Lazarevac (Central Serbia), Obilić (Kosovo) and Pljevlja (Montenegro). Industry shares only 3-4% of total SO<sub>2</sub>, although there are installed respective capacities of metallurgy.

**Table 2 - Emissions of SO<sub>2</sub> and NO<sub>x</sub> in Yugoslavia 1990-1994 (in '000 tons/year)**

Year	Pollutant	Total emission	Thermal power station	Industry	Other
1990	SO <sub>2</sub>	254.0	223.3	9.9	20.8
	NO <sub>x</sub>	66.0	59.2	4.6	2.2
1991	SO <sub>2</sub>	224.0	195.6	6.5	20.9
	NO <sub>x</sub>	57.0	50.9	4.0	2.1
1992	SO <sub>2</sub>	198.0	167.5	5.2	25.3
	NO <sub>x</sub>	49	44.1	2.4	2.5
1993	SO <sub>2</sub>	200.5	179.0	7.0	14.5
	NO <sub>x</sub>	54	47.6	5.0	1.5
1994	SO <sub>2</sub>	212.0	186.6	6.3	19.1
	NO <sub>x</sub>	52.4	47.8	2.1	2.1

Yugoslavia actively participates in the international system for monitoring transboundary transport of pollutants through atmosphere (EMEP). According to the results obtained from EMEP- program in the period 1985-1993, Yugoslavia "imported" from other European countries 256.000 tons of sulfurs, while "exported" 147.000 tons in average. Total amount of deposited sulfur in Yugoslavia was 561.000 tons. Total deposition of nitrogen, in the same period, was 132.000 tons, while "import" was 97.000 tons, and "export" was 34.000 tons.

Major polluting substances in the urban areas include: sulfur dioxide, soot, carbon dioxide, nitric oxides, formaldehyde and other organic substances, lead and specific pollutants from industrial sources. The quality of air is regularly monitored according yearly program by the network of meteorological stations, and by the network of health institutions in the settlements. According to data obtained from health institutions many settlements are overpopulated. The highest contents of SO<sub>2</sub>, soot, sediment or specific industrial pollutants were found during last decade in Belgrade, Užice, Bor, Pančevo, Kruševac, Šabac, Pljevlja, Nikšić, Bar, etc<sup>2</sup>.

### 2.3 WATERS

General appraisals of the status of majority waters in Yugoslavia, including the coastal sea water, points to deterioration in quality.

City and industrial wastewater pollute the waters of many rivers, particularly in the basins of the Danube and the Sava. Only a small number of cities have wastewater treatment equipment. In certain areas, waters are also contaminated by polluted air, especially in the vicinity of power and industrial plants.

Water flows and the sea are polluted by nutrients found in wastewaters, as well as by metals and synthetic organic compounds which accumulate in sediments. Underground waters are polluted, too, as a result of acidification and diffusive pollution of wells by wastewater from public utilities, nitric fertilizers and pesticides, industrial wastes, etc.

The quality of water in the majority of Yugoslav rivers, lakes and coastal waters should belong to class II, and only exceptionally in class III or out of standard. Unfortunately, it is the other way round and the most of waters do not fit in the classification at all. In the most of rivers have been found lower concentrations of oxygen, and higher concentrations of BOD and COD, as well as ammonia, nitrates, and occasionally in some rivers were found

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higher quantities of Fe, Pb, Hg, etc. Such results indicate that main sources of pollution are urban wastewater.

According to the official data<sup>3</sup>, examples of extremely clean, waters, which belong to class I, are very rare, e.g. Raska River, Lim, Studenica and Lepenac. The worst situation in water quality has been registered in Zlatica River, Begej, Mlava and Channel Danube-Tisa-Danube.

The quality of coastal waters in the Adriatic is still relatively good, except in parts of Kotor Bay and the port of Bar.

## **2.4 NATURAL HERITAGE**

Yugoslavia has a wealth of natural regions and values, in terms of both quantity and quality. According to the inventory of all protected natural goods which covers the period until 1994 inclusive, our country has 1700 valuable natural goods, on an area of 400,000 ha, or 4% of total area. In Yugoslavia under formal protection are 9 national parks, 20 regional parks, 19 protected coastal areas, 122 reservations of nature, about 1000 protected species of flora and fauna, etc.

Yugoslavia's natural values, which are on the List of World Heritage, include National Park Durmitor (with the Tara Canyon as biosphere reservation included) and Kotor-Risan Bay, as the natural and cultural-historical area. Obed Marsh and Ludog Lake have been included in the list of marshes of international importance, while "Carska bara" is locality of the greatest importance.

## **2.5 OTHER ENVIRONMENTAL PROBLEMS**

Noise in Yugoslavia, albeit not measured systematically at the most threatened locations, is definitely increasing. Critical areas in terms of noise are cities and settlements in vicinity of thoroughfares, industrial complexes and plants, multi purpose zones, airports, etc. Results of noise measured at 16 locations in Belgrade in period 1991-1999 show high levels of noise at all locations including central zones, settlements, industrial zones and main traffic routes<sup>4</sup>.

Systematic monitoring of radioactivity has conducted in the various types of samples from the air, waters, soils, vegetation and food. Results of monitoring have shown low levels of radioactivity in all type of samples.

Collection and treatment of urban as well hazardous wastes in Yugoslavia are largely neglected. The percent of urban wastes covered by recycling is still low.

## **2. ENVIRONMENTAL EFFECTS OF NATO BOMBING**

After more than two years it is still difficult to perceive and evaluate the entire humanitarian, economic, environmental, health and other consequences of the NATO air strikes against Yugoslavia. However, it is amply documented that the bombings of Yugoslavia are not strictly aimed at military and strategic targets as claimed by NATO. Civilian infrastructure, many industrial facilities, civil institutions as well as many protected natural areas and cultural heritage has been damaged too.

From 24 March to 10 June 1999 NATO carried out more than 35,000 assaults against Yugoslavia. Between 22,000 and 79,000 tons of explosives were dropped, including aerial bombs, cruise missiles, cluster bombs, depleted uranium weapons, etc<sup>5</sup>. The air strikes have

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so far destroyed or damaged throughout the territory of FR Yugoslavia several thousand of objects in the build and in the natural environment. List of shouted objects is long. It includes objects of the transportation infrastructure (bridges, railways, roads and airports), factories, chemical industries, refineries and warehouses, electric power stations and infrastructure, water supply infrastructure, cultural and historical monuments, housing units, protected natural areas, biodiversity, and other.

Destruction of industrial facilities, refineries, warehouses storing liquid raw materials and chemicals, thermal power stations and the electrical transformer installations and facilities has caused releasing numerous toxic substances, as well as several hundreds other chemical compounds with possible harmful effects on the environment and human health.

### **3.1 CONTAMINATION OF SOIL**

Due to the bombing of industrial facilities, a huge quantities of hazardous chemicals and oil products were spilled contaminating the soil, as well as the air and water pollution that settled into the soil in the wider areas. Identified threats to the regions' soil are:

- More then 200.000 tons of oil products have burned or were spilled into the soil at locations of Novi Sad refinery, Pančevo refinery, as well as at oil storage installations in Smederevo, Prahovo, Beograd, Bor, Nis and others<sup>5,6,7</sup>.
- By bombing of electrical transformers in Kragujevac, Bor, Resnik and Veliki Crljeni mineral oil (PCB) was spilled and strongly contaminated soil and groundwater.
- Nearly 8 tons of mercury were spilled from the electrolyze plant.

### **3.2 WATER POLLUTION**

Surface and ground waters have suffered largely as a result of leakage from damaged industrial plants. Specific impacts include the following:

- Oil products leaked into the Danube River from the Pančevo industrial zone and the refinery at Novi Sad.
- More than 20 transformer were damaged or destroyed all around Yugoslavia stations (Belgrade, Kragujevac, Nis, Bor, etc.), producing soils and underground waters contamination by PCB.
- From the Pančevo petrochemical complex 1.000 tones of ethylene dichloride leaked into the industrial channel and additional 1.100 tones spilled into soil and groundwater<sup>5</sup>.
- Over a hundred tones of sodium hydroxide were spilled from the Pancevo petrochemical complex.
- Reservoir Iron Gate Danube is in special danger because the process of sedimentation is increased due to the slowing down of the flow of the river. Therefore, Iron Gate's reservoirs act as collectors of all upstream pollution.
- Heavy metals: copper, cadmium, chromium and lead, at rates double the maximum allowed concentration, were registered in Romania's Danube.

Spilling of dangerous substances from Pančevo industrial zone during heaviest bombing at 18. April 1999 provoked heavy contamination of Danube River water and killing of fish and degradation of vegetation in the industrial channel and in the Danube several kilometers downstream of channel<sup>8</sup>. Results from samples of river water took on 18. May and latter did not shown presence of pollutants spilled from industrial zone.

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### 3.3 AIR POLLUTION

Air pollution, in the case of the bombing of chemical plants, tends to be short-term phenomena. Following cases were registered:

- Vinyl chloride monomer (VCM) was released from the Pančevo petrochemical plant. Polluted clouds carried the products of combusted VCMs: phosgene, chlorine, chlorine oxides and nitrogen oxides. It should mention that poisonous air pollutions in town of Pančevo and in some parts of Belgrade were avoided because of meteorological conditions over the Pančevo industrial zone at moments of bombing<sup>9</sup>.
- Products from incomplete hydrocarbon combustion were released as a result of strikes on oil refineries.
- During the Pančevo and Novi Sad attacks, large oil depots were burned. This resulted in the production of soot and other particulates.
- Nitrogen oxides have been released from jet aircraft and through burning industrial installations.
- Radioactive pollution from depleted uranium weapons has suspected in Kosovo and in South Serbia.
- Destruction of metal industry plants released heavy metals into the atmosphere: mercury, cadmium, chromium, copper and zinc.
- Acid rain was measured in a number of areas, including Romania and Bulgaria.
- In Timis County, Romania (North-East of Belgrade), from April 18-26, 1999, the maximum allowed concentration for sulfur dioxide, nitrogen oxide and ammonia was exceeded between 5-10 times.

### 3.4 BIODIVERSITY/NATURE

The direct consequences on biodiversity and nature can be summarized as follows:

- Locally the physical destruction of habitats and plant and animal populations by air attacks.
- Degradation of habitats and plant and animal populations from chemical contaminants (borne in air, water and in soil).

Protected areas have been directly affected by the bombing include: Kopaonik Mt. National Park, Fruška Gora Mt. National Park, Tara Mt. National Park, Šar planina Mts. National Park, Vršacke Planine Mts. Natural Reserve.

## 4. ENVIRONMENTAL POLICY AND INSTRUMENTS IN YUGOSLAVIA

The policy of environmental protection in Yugoslavia have defined in federal and republic constitutions and laws, as well as in the resolution of federal government and other documents.

Basic goals, principles and programs of the environmental policy in Yugoslavia was formulated by the "Resolution on the policy of environmental protection in FRY" (adopted by Federal Government, 1993). The key elements policy are: integration of environment and development, hierarchy of interests and goals, quality control, efficiency, market neutrality, information, program directed, prevention principle, relaying on the polluter-pays principle and solidarity in financing of the environmental protection programs.

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Montenegro has a special document with defined policies that orients the republic towards ecological idea (Declaration on the Montenegro as Ecological State).

The policy was backed up by a set of instruments, which included institutional organization, legal provisions, monitoring, education, etc.

Key actors in the environmental management in Yugoslavia are organized in three-level system. There is the Sector for Environment as part of the Federal Ministry for Development, Science and Environment. Both Yugoslav Republics has their own Ministries for Environmental Protection, and certain larger cities have their local authorities for the environment.

Basic legislative acts are: federal "Law on the fundamentals of environmental protection" (1998), Law on the environmental protection (Serbia, 1991) and Law on the environment (Montenegro, 1996). There are a great number of laws in the other sectors, which cover specific requirements for environmental protection, as: territorial and urban planning, agricultural land, forests, waters, health care, design and construction of buildings, protection of national parks, etc.

Environmental impact assessment systems (EIA) as the most important precautionary instrument in the environmental protection were established in the both of republics. In Serbia the EIA system was established by the "Regulation on the analysis of impacts of objects and works on environment"(1992) and in Montenegro by "Decree on the environmental impact assessment" (1997). In general, the contents of these documents are based on EC Directive 85/337 on EIA, but our EIA systems don't include the participation of public in decision making.

Numerous institutions, offices and enterprises are included in the environmental monitoring system of Yugoslavia. They include: environmental inspections at republics and local level, hydrometeorological bureaus, public health institutions, nature protection, protection of cultural monuments, urban planning authorities, etc. Data on the environment have been collected at all levels, from municipal authorities, through republic level and to the federal government and agencies.

Having in the mind described environmental situation in Yugoslavia it is obviously that responsible institutions did not implemented declared environmental policy properly.

## **5. CONCLUSION**

Yugoslavia has made dynamic development of economy and society which created a situation of highly polluting factories which have been characterized by inefficient use of raw materials and energy, lack of proper waste facilities for municipal, industrial and hazardous effluents. As result of such development all parts of environment (soil, water and air) became polluted. Pollution in the vicinity of industrial sites, in urban areas and along highways has possible harmful effects on the environment and human health.

During NATO bombing the destruction of industrial facilities, refineries, warehouses storing liquid raw materials and chemicals, thermal power stations and the electrical transformer installations caused releasing of several highly toxic substances, as well as several hundreds other chemical compounds which contributed to further degradation of environment in Yugoslavia. Although there was no evidence of a large-scale ecological catastrophe, pollution was very severe in the vicinity of targeted industrial complexes and many valuable ecosystems were disturbed. Just because there have been no acute large-

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scale visible impacts on flora and fauna or health after two years since bombing at the moment does not mean that there will be no long-term effects.

Despite Yugoslavia have had policy; institutions and instruments for environmental protection efficiency of implementation of protective measures have not been adequately implemented in the past as well as today. There are four main problems: (1) lack of money for recovery of identified hot-spots, (2) lack of comprehensive information on the state of environment including environmental analysis and reporting, (3) inadequate implementation of preventive instruments and measures, and (4) lack of public participation in the process of decision making on environmental issues.

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