
EFFECTS OF NATO AIR-RAIDS ON HUMAN ENVIRONMENT AND HEALTH OF THE POPULATION OF SERBIA

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ABSTRACT

The bombing targets of NATO forces were almost all larger towns in Serbia, and particularly the facilities of chemical and oil industry. The most severely attacked cities were Pančevo, Novi Sad, Belgrade, Niš, Kragujevac, Sombor, Kruševac, Bogutovac, Kraljevo, Smederevo, Bor, Prahovo, etc. Constantly and repeatedly attacked chemical and oil plants, in addition to direct destruction of the plants, produced divergent effects, such as emission of a variety of primary and secondary pollutants into the living environment (air, water, soil). The majority of these pollutants are documented to have not only the toxicological but also the potential cancerogenic, teratogenic and/or mutagenic effects. The activities of health service (preventive before all) included qualitative and, to a permissible extent, the quantitative measurements of the mineral oils, polychlorobiphenyls, polycyclic aromatic carbons, total carbons, phenol, 3-chloroethene and tetrachloroethene, benzene, toluene, xylene, ethylbenzene, styrene, phosgene, vinyl chloride monomer, 1,2-dichloroethane, dioxin, furan, toxic metals (lead, chromium, cadmium, nickel, arsenic, mercury) -first in air, then in water currents, soil, plants and animals. The peacetime networks for monitoring environmental pollution (air, water, foodstuffs) were not capable to follow up all changes that occurred during aggression. During bombing of the chemical and oil plants the health service did not register any significant increase of individuals (dwellers) presenting with accident-related signs and symptoms. The results of environmental quality obtained so far, indicate a need to follow up the subclinical and clinical manifestations of a long-term exposure of the population. However, the majority of substances that we were able to identify indicate the presence of environmental pollution which will persist for a long time in the years ahead and in concentrations which may eventually have toxicological, cancerogenic, mutagenic and teratogenic health effects.

Key words: air raids, human environment, health of population

Introduction

The threat of impending aggression on Federal Republic of Yugoslavia by NATO forces by the end of October 1998 was seriously taken by the health service, too. Nevertheless, when it occurred, by the end of March 1999, assessment of the effects of strike was seriously impeded by way in which it was carried out, its duration, and selected targets.

Bombing Targets

The bombing targets were almost all larger towns in Serbia, and particularly the facilities of chemical and oil industry. The most severely attacked cities were Pančevo, Novi Sad, Belgrade, Niš, Kragujevac, Sombor, Kruševac, Bogutovac, Kraljevo, Smederevo, Bor, Prahovo, to mention a few.

Constantly and repeatedly attacked chemical and oil plants, in addition to direct destruction of the plants, produced divergent effects, such as emission of a variety of primary and secondary pollutants into the living environment (air, water, soil). The majority of these pollutants are documented to have not only the toxicological but also the potential cancerogenic, teratogenic and/or mutagenic effects, which will be also discussed by other colleagues at some later point during this meeting.

Activities of the Health Service

Shortly afterwards, the preventive health service has adapted to this newly arisen situation by monitoring the pollutants released from, or produced by, bombing. Before all, such activities included qualitative and, to a permissible extent, the quantitative measurements of the following:

- mineral oils
- polychlorobiphenyls (PCB)
- polynuclear aromatic hydrocarbons (PAH_s)
- total carbons
- phenols
- trichloroethylene and tetrachloroethylene
- benzene, toluene, xylenes
- ethylbenzene
- styrene
- phosgene
- vinyl chloride monomer
- 1,2-dichloroethane
- dioxins
- furans
- pyralene
- toxic metals (lead, chromium, cadmium, nickel, arsenic, mercury).

The above measurements were made first in air, then in water currents, soil, plants and animals. The peacetime networks for monitoring environmental pollution (air, water, foodstuffs) were not capable to follow up all changes that occurred during aggression.

Environmental health risks

Now allow me to present some data for certain places which were most violently attacked.

NOVI SAD

Bombing of the oil refinery in Novi Sad caused burning or leakage of the reservoirs with crude oil and oil products (73,569 tons were totally destroyed, of which 90% burned out, 9.9% were uncontrollably lost, and 0.1% entered into the plant collector).² For several days a dense cloud of black smoke hanged over the town and its the surrounding area driving ash, soot, dust and divergent products of unfinished combustion (benzene, toluene, xylenes, polynuclear aromatic hydrocarbons, carbon monoxide, dioxins, furans, toxic metals etc.) in concentrations multiply exceeding the recommended reference ranges both for working and living environment. Along with the local air pollution, due to air currents, the contaminants started to circulate in all directions with effects on the entire territory of Serbia and its neighbouring countries (Romania, Hungary, Bulgaria).

Bombing of refinery plant also resulted in direct contamination of soil, surface and ground waters. The large amounts of liquids from the fore-mentioned reservoirs have spilt into the Danube river. The project titled "Ground Waters Monitoring" is underway, which will be realised in collaboration with SDC-SDR (the Swiss humanitarian organisation) and in the areas which were most affected, including the area of Novi Sad.

PANČEVO

Bombing of industrial zone in Pan~evo which lasted from 15th to 18th April 1999 produced the following effects:

- Burning of reservoirs with the crude oil and oil products, with total destruction of 80,000 tons, of which 80% burnt out, and the remaining were uncontrollably released into atmosphere.
- Burning or leakage of reservoirs containing vinyl chloride monomer (nearly 1,200 tons), 40% sodium hydroxide (nearly 600 tons), chlorine, chlorhydric acid (nearly 800 tons), ethylene dichloride (nearly 2,000 tons).
- Damaged plants for chlorine production, with a loss of about 8 tons of mercury, and for production of nitrogen-phosphorous fertiliser (Unit 3, the terminal stage of ammonium production).

The contaminated clouds formed after bombing of this multi-processing industry contained the combustion products of vinyl chloride monomer, chlorine, chloral oxides, ammonium, nitric oxides, oil and oil products, polynuclear aromatic hydrocarbons, dioxins, furans, and other. As a result of burning of the reservoirs in "Petrohemija", which lasted for several hours, an increase in vinyl chloride monomer concentration to several thousand times the permissible levels was recorded. Along with a new cloud caused by nitric fertilisers combustion in the hit warehouses and units of the chemical fertiliser factory "Azotara", an increase in nitric oxides to 10 mg/m³ was recorded, and phosgene was also identified (2 mg/dm³). A huge cloud of smoke was formed above the hit facilities and reservoirs of the refinery reaching dimensions of 1.5 km in width, 3 km in height and 20 km in length; and leaving behind the soot, ash, dust and many

other products of unfinished combustion, such as benzene, toluene, xylenes, polynuclear aromatic hydrocarbons, dioxins, furans, carbon monoxide, formaldehyde and mercaptans in concentrations which for several days were 4-8 times above the allowable reference ranges for protracted periods in the living environment. The local air pollution was accompanied by circulation of the contaminated substances into diverse directions with effects on the entire territory of Serbia and neighbouring countries (Romania, Bulgaria, Macedonia, Greece, Hungary).

Bombing of industrial facilities in Pan-evo caused contamination of soil, surface and ground waters. The large amounts of liquids from the reservoirs of oil and oil products, liquid ammonium, toxic metals, etc.) entered into Danube via damaged channel of the industrial waters. A smaller amount of spilt mercury entered into the industrial waters channel (several hundred kilograms), while larger amount remained on ground contaminating soil, ground waters and air through vapour.

In terms of quantity of the individual materials it was estimated that the below mentioned threw into:

- air (about 460 tons of vinyl chloride monomer and about 500 kilograms of freon);
- Danube (about 170,000 m³ of materials, of which about 1000 tons of ethylene dichloride, 200 tons of mercury, 70 tons of chlorhydric acid, 40 tons of sodium hypochlorite and large amounts of oil and oil products;
- soil (about 1,100 tons of ethylene dichloride, 60 tons of chlorhydric acid, 7.8 tons of mercury, 100 tons of alkali, 40 tons of sodium hypochlorite and 500 kilograms of oil-based polychlorobiphenyls).

The “Ground Waters Monitoring” project is being carried out in collaboration with SDC-SDR in the areas that are hardest hit including the area of Pančevo.

A similar situation was recorded in some other locations of oil and chemical industry which also were the bombing targets in Belgrade (heating plant in New Belgrade, fuel warehouses in Čukarica, buildings of the Republic of Serbia Ministry of the Interior), Barič, Kruševac, Niš, Valjevo, Bogutovac, Kragujevac, Smederevo, Prahovo, Priština, Bor.

As is well known, contaminated air, water, soil and foods are significant factors at risk for human health. The effects of war are particularly important because of the experimental component involved, specially with respect to environmental pollution and incurred health risks.

During bombing of the chemical and oil plants the health service did not register any significant increase of individuals (dwellers) presenting with accident-related signs and symptoms.

The results of environmental quality obtained so far, indicate a need to follow up the subclinical and clinical manifestations of a long-term exposure of the population. However, the majority of substances that we were able to identify indicate the presence of environmental pollution which will persist for a long time in the years ahead and in concentrations which may eventually have toxicological, cancerogenic, mutagenic and teratogenic health effects.

Continual monitoring of the population health status in Central Serbia on the basis of mortality data indicated the following:

In the 1990-1999 period, the mortality rate due to all causes of death increased for 20% (figure 1). The value is higher compared to EU countries, and similar to the values in the former Soviet Union States.

The situation is similar with mortality from circulatory diseases (heart attack and stroke) and cancer.

In the same period, mortality due to circulatory diseases increased for 20% (figure 2) and due to cancer for 24% (figure 3).



Figure 1.

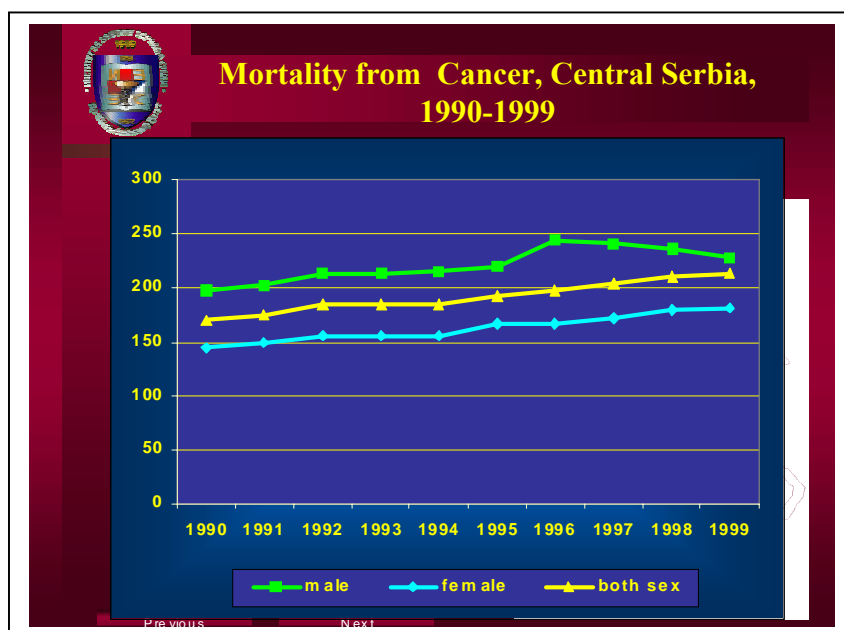


Figure 2.

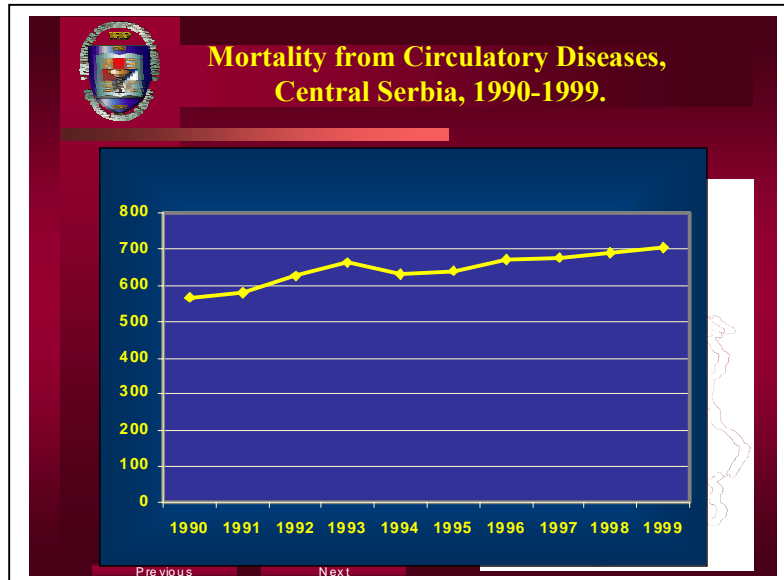


Figure 3.

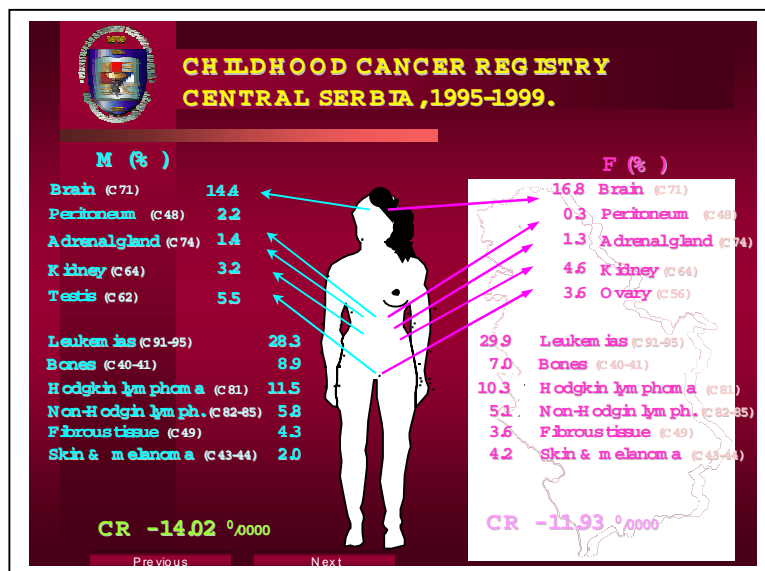


Figure 4.

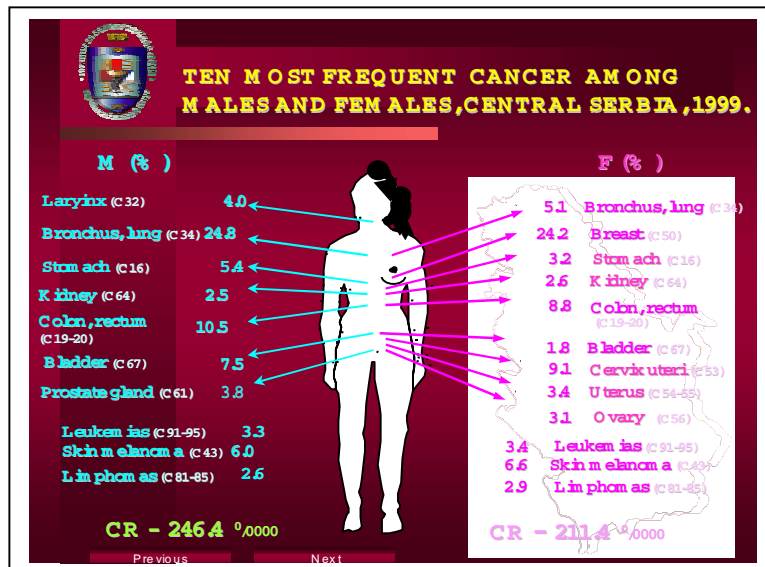


Figure 5.

Higher mortality frequency for the above mentioned diseases is probably due to:
 changes in the population structure (migrations)
 problems with diagnostic procedures
 shortage of therapy.

The next data source is population - based Cancer Registry, established in Central Serbia in 1996.

After 2 years period, necessary for data stabilization, we obtained the following results in 1999:

Incidence rate among male is 248‰ and among female 221‰.

We displayed ten of the most frequent invasive cancers in both sex.

Lung cancer is the most frequent among male and breast cancer among female (figure 4) which correlates with data from European Registries.

Childhood Cancer Registry (0-19) was established in 1995.

The average incidence rate for 1995 - 1990 among boys was 14,0‰ and among girls 11,9‰.

Out of all cancer leukemias are the most frequent in the 0-19 years age group (figure 5).

A particular attention would be paid to areas that experienced most intensive ecological damage during the NATO aggression, namely municipalities of Presevo, Bujanovac, Medvedja, Novi Sad, Pan-evo.

In order to provide better comparison, control areas, spared from any damage during the 1999 bombardment would be selected.

The two cohorts - exposed and unexposed one - would be followed for a period of at least 10 years.

Measures

Program of protection of the population from toxic waste in the environment as a result of NATO-bombing,

Program of Cancer Control,

National Campaign for Health Promotion and prevention behavioural risk factors responsible for the onset of noncommunicable diseases.

We conclude that it is necessary:

➤ To establish the network for a long-term monitoring of the quality of water, soil and foods associated with the emerging health risks.

➤ Mortality data for certain causes of death and incidence rate of cancer for 1999 would serve as base - line values for the following of future trends.

➤ To perform in the selected areas a cohort study of the individuals born between 1969 and 1999.

For the realisation of all these projects both advisory and financial help would be appreciated.

LITERATURE

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