



The
KOSOVO
Conflict



Consequences



for the Environment



& Human Settlements

First published in Switzerland in 1999 by the United Nations Environment Programme and the United Nations Centre for Human Settlements (Habitat)

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ISBN 92-807-1801-1

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United Nations Environment Programme

PO Box 30552

Nairobi

Kenya

Tel: +254 2 621234

Fax: +254 2 623927

E-mail: cpinfo@unep.org

Web: <http://www.unep.org>

United Nations Centre for Human Settlements (Habitat)

PO Box 30030

Nairobi

Kenya

Tel: +254 2 621234

Fax: +254 2 624266/624267

E-mail: habitat@unchs.org

Web: <http://www.unchs.org>

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Design and Layout: LIV Communications, Morges, Switzerland

Editor: Tim Jones

Maps by: GRID Arendal and GRID Geneva

Front cover background picture: Pančevac

Front cover pictures: BTF

Photolithographers: CityComp S.A., Morges, Switzerland

Printed by: SADAG, France

Printed on Chlorine-free paper

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UNEP/UNCHS (Habitat) Balkans Task Force

Foreword

The twentieth session of the Governing Council of the United Nations Environment Programme (UNEP) in 1999 was an important landmark in the development and policy focus of the organisation. The meeting strongly endorsed the re-orientation of the corporate objectives of UNEP and focused UNEP activities into five core areas of concentration.

Central to this new rationalised policy focus is the commitment by UNEP to enhance and strengthen its capability in the fields of information, monitoring, assessment and early warning. This crucial decision is at the heart of UNEP's role within the United Nations family as the catalytic organisation for the environment. It positions the organisation to be able to respond and be available for effective and objective neutral scientific assessments in such areas as natural disasters and man-made environmental problems.

In keeping with this Governing Council decision and at the strong recommendation of the United Nations Inter-agency Humanitarian Needs Assessment Mission, which visited the Federal Republic of Yugoslavia under the leadership of UN Under-Secretary-General, Sergio Vierra de Mello, the Joint UNEP/UNCHS (Habitat) Balkans Task Force (BTF) came into being. It was charged with the task of urgently carrying out a detailed assessment of the environmental and human settlements impact of the conflict.

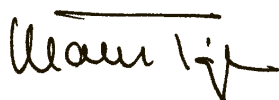
BTF was a joint initiative between UNEP and UNCHS (Habitat) and in line with the mandate of UNCHS to focus on normative functions, the task force integrated a human settlements component working alongside the United Nations Mission in Kosovo (UNMIK).

Pekka Haavisto, the former Finnish Environment and Development Cooperation Minister, agreed to serve as BTF chairman. He quickly set about pulling together an international group of experts to work in conjunction with the Nairobi headquartered in-house UNEP and UNCHS teams. I should like to thank Pekka Haavisto for his personal commitment and hard work in carrying out this role.

Throughout the BTF process some sixty experts have been involved in the assessment missions. They were drawn from a wide range of different backgrounds and experience and included input from six UN agencies and departments, 19 countries and 26 NGOs and scientific institutions.

One of the central requirements of the BTF project was that its activities should not divert resources from existing UNEP and UNCHS programmes in other parts of the world. To this end, I am pleased to be able to report that the entire BTF operation has been funded from additional voluntary contributions ensuring no dilution of activities to existing priorities and commitments. My thanks go to those donors who contributed finance and support in kind.

The results and recommendations of the BTF make interesting reading. They highlight the linkage between environmental pollution and humanitarian assistance. This report also demonstrates the need for environmental and human settlement planning in conflict management. I am convinced that such a neutral, objective and scientific assessment of the real situation on the ground in a post-conflict situation is essential. This approach provides a much-needed and reliable source of information to the peoples affected. It also provides a management tool for the international community as an integrated part of the needs assessment requirements in the overall emergency humanitarian effort in war-torn areas.



Klaus Töpfer
United Nations Under-Secretary-General
Executive Director of the United Nations Environment Programme
Acting Executive Director of the United Nations Centre for Human Settlements



2 Introduction

Perhaps the most endangered natural resource in times of war is truth. This became very evident during the Kosovo Conflict. When the Rambouillet accord failed and NATO air strikes started on 24 March 1999, alarming reports began to appear about the environmental damage caused by the bombing. Images of Pančevo and Novi Sad oil refineries on fire, toxic chemicals leaking into the River Danube, and bomb craters in protected areas were competing with those of tens of thousands of refugees fleeing their homes in Kosovo.

Whilst the immediate humanitarian consequences of the conflict were clear, public opinion was more divided over the possible consequences for the environment. On one hand, there was fear of widespread ecological damage and destruction in the Federal Republic of Yugoslavia and neighbouring countries. On the other hand, NATO argued that its use of sophisticated weapons against carefully selected targets would minimise environmental and other ‘collateral’ damage. This was the dilemma the Joint UNEP/UNCHS (Habitat) Balkans Task Force (BTF) faced from its establishment in early May 1999.

The Kosovo Conflict also had wider regional impacts: Albania and The Former Yugoslav Republic of Macedonia had to receive huge numbers of refugees from Kosovo although they were unprepared for the scale of the influx. Other neighbouring countries, especially Bulgaria and Romania, downstream along the Danube, feared the effects of transboundary pollution from targeted industrial facilities. The fires in the oil refineries and oil storage depots sometimes lasted for many days and created clouds of pollution over wide areas, whilst news of the leakage of dangerous chemicals to air, land and water were prominent in the international media.

In Kosovo, Serbian forces systematically emptied and destroyed many towns and villages. The damage to living quarters, infrastructure, clean drinking water supply and waste systems was obvious. When the Kosovan Albanians fled their homes, much of the documentation setting out legal ownership of land and property was lost or taken by force, in turn complicating the return of the refugees to their home areas.

Although addressed largely by other UN bodies, environmental problems caused by the stream of refugees also became an issue, with sanitation and drinking water services under enormous pressure in the overcrowded refugee camps.

MAP (1) The Balkan Region and the Danube Basin



Source: Atlas de Poche, Philippe Rekacewicz, Editions du Livre de Poche, Paris, 1996.

International scientific teams were formed

After studying carefully all the incoming news and information about the possible consequences of the conflict for the environment and human settlements, the BTF decided to concentrate on five areas, as follows:

- 1) Environmental consequences of air strikes on industrial sites – field mission
- 2) Environmental consequences of the conflict on the Danube river – complementary field mission
- 3) Consequences of the conflict on biodiversity in protected areas – field mission
- 4) Consequences of the conflict for human settlements and the environment in Kosovo – field assessment and project development/implementation
- 5) Possible use of depleted uranium weapons in Kosovo – desk assessment

MAP (2) Federal Republic of Yugoslavia



Source: Base map from the United Nations Department of Public Information, Cartographic Section, New York, 1999.



The missions were organised in such a way that, in addition to the UNEP and UNCHS staff, a representative and independent team of international experts from different countries was put together. This final BTF report therefore represents the joint result of the mission findings and detailed expert research. The exact sites to be visited by the various missions were selected after systematically reviewing information from a wide range of sources, and undertaking a preliminary field assessment from 17-21 June. Whilst these sites were considered by BTF to be those most affected by environmental consequences of the conflict, it should be stressed that it was not feasible to undertake a comprehensive field assessment of every targeted location.

The first technical mission visited the following key areas (see maps 4 & 5): Pančevo, Novi Sad, Kragujevac, Bor, Priština, Niš, Novi Beograd, Obrenovac, Kraljevo and Prahovo. The mission included 16 experts and two mobile laboratories from Denmark and Germany specialising in environmental contamination. Samples were taken from the soil, air and groundwater and analysed either on-the-spot using the mobile laboratories, or sent to laboratories in Denmark and Germany. Investigations were made at bombed industrial sites and the areas adjoining them. Special attention was given to the possible contamination of agricultural land close to targeted facilities.

Nine experts took part in the Danube field mission, which was organised in close co-operation with the International Commission for the Protection of the Danube River (ICPDR). The principal sites visited were Novi Sad, Pančevo, the 'Iron Gate' Reservoir and the Lepenica and Morava rivers, tributaries of the Danube close to Kragujevac. The scientific work focused mainly on sampling river water, bottom and bank sediments, mussels and other invertebrates. For comparison, samples were taken upstream and downstream of the industrial areas. The samples were analysed at a specialised laboratory in Hungary.

The biodiversity mission, composed of five scientists, visited Fruška Gora National Park, Kopaonik National Park, Zlatibor in Serbia and Lake Skadar in Montenegro (see map 3).

During the field missions the BTF organised stake-holder meetings in Belgrade, Pančevo, Novi Sad, and Niš with representatives of local NGOs, environmental experts, and local authorities (often in political opposition to Belgrade).

The UNCHS (Habitat) team started its work in Kosovo in July. It has now entered a crucial first phase of implementation in the fields of municipal administration, regularisation of housing and property rights and development of a cadastral information system. Work also included analysis of the environmental policy and institutional framework in the Province of Kosovo.

Dumping of weapons in the Adriatic Sea and the issue of depleted uranium

During the NATO air campaign, there were environmental concerns linked directly to the use of specific weapons. Firstly, it was reported that up to 100 bombs had been jettisoned into the Adriatic Sea by NATO aircraft returning to bases in Italy. This led to pollution fears amongst countries bordering the Adriatic. However, according to information received by BTF in August 1999, some 93 bombs had been located and detonated by NATO, with a small number remaining in deep water (below 250 m).

According to media and NGO sources, weapons containing depleted uranium were used in the Kosovo war. In spite of attempts by the BTF, it was not possible to obtain official confirmation of this – or a map of the areas which might possibly have been hit by this type of weapon – either from NATO (and its member states) or from the Yugoslavian authorities.

It was therefore decided to carry out this part of the investigation by means of a desk assessment through an expert group comprised of representatives from the World Health Organisation, the International Atomic Energy Agency (IAEA), the Swedish Radiation Protection Institute and UNEP. The desk assessment group undertook one fact-finding mission to Kosovo, taking basic measurements of radioactivity from random bombsites. The main part of the group's work, however, consisted of developing conclusions and recommendations relating to areas where depleted uranium was used or is suspected to have been used.

Environmental 'hot spots' found in four cities

The Balkans Task Force found environmental hot spots in the four areas (Pančevo, Kragujevac, Novi Sad and Bor), where urgent action is needed. It is important to ensure the safety of the environment and the clean-up of these areas immediately, in order to avoid risks to human health and long-term ecological damage. The actions include, among other work, cleaning of the canal leading to the Danube in Pančevo, cleaning of mercury from the ground in Pančevo, the decontamination of dioxin and PCB hot spots in Kragujevac, steps to ensure safety of drinking water in Novi Sad and reduction of sulphur dioxide emissions from the copper mine in Bor.

In addition to these hot spots, the BTF made other alarming observations about the environment. However, some of these problems have built up over a period of many years, and taking action would demand further investigation. These problems do not result from the recent war, but from years of environmental neglect. To mention just two examples, the sediment on the bed of the Danube river is contaminated by toxic pollutants from the 1960s, '70s and '80s, whilst pollution of the Timok river

MAP (5) Sites visited by the BTF in Yugoslavia



Source: Base map from the United Nations Department of Public Information, Cartographic Section, New York, 1999. BTF: Times atlas of the world, Bartholomew and Times Books, London, 1994 and Atlas Géographique du Monde, Institut géographique Agostini Novara, 1995.

Key Conclusions

- Our findings indicate that the Kosovo conflict has not caused an environmental catastrophe affecting the Balkans region as a whole.
- Nevertheless, pollution detected at some sites is serious and poses a threat to human health.
- BTF was able to identify environmental ‘hot spots’, namely in Pančevo, Kragujevac, Novi Sad and Bor, where immediate action and also further monitoring and analyses will be necessary. At all of these sites, environmental contamination due to the consequences of the Kosovo conflict was identified.
- Part of the contamination identified at some sites clearly pre-dates the Kosovo conflict, and there is evidence of long-term deficiencies in the treatment and storage of hazardous waste.
- The problems identified require immediate attention, irrespective of their cause, if further damage to human health and the environment is to be avoided.

human health and the environment, rather than to make unreliable judgements about responsibility.

Evidently the conflict caused widespread physical destruction. Efforts towards institutional rebuilding and physical reconstruction will have to take environmental considerations into account. The strengthening of environmental institutions will generate benefits for the economy as well as the environment, at regional, national and local scales. When political circumstances permit, the full participation of the region in international Conventions should be a high priority (see pages 80-81 for information of Basel and Danube Conventions).

In conducting its work and making recommendations, the BTF has not attempted to solve the environment-related health problems resulting from the war; this is the task of others. However, the BTF stresses that mitigating the effects of the most serious problems requires immediate action.

Environmental ‘first aid’ as part of humanitarian assistance

We believe that our recommendations concerning the Province of Kosovo and the Republic of Montenegro are such that the UN organisations and aid community can provide immediate local and regional support. In the Republic of Serbia, the political situation limits all non-humanitarian aid and prevents investments aimed at reconstruction.

The BTF proposes that the UN and other donors, as part of humanitarian aid to the region, should assist the relevant authorities in dealing with the key environmental hot spots, thus avoiding further harm to human health and the environment within the FRY and the wider Balkan region. It is clear that under present circumstances, although the Serbian authorities can deal with some of the priorities using their own expertise and funding, others will require assistance from the international community.

Acknowledgements

The Joint UNEP/UNCHS Balkans Task Force has been a six-month special project, which, having achieved its results will be concluded. UNEP is not – according to its own mandate – an implementing organisation. Therefore, responsibility for resolving the environmental problems identified lies with the authorities in the countries concerned, the international donor community, the appropriate UN bodies and other international organisations. The spirit of support and co-operation shown by the whole UN family, notably OCHA, UNDP, UN-ECE, UNHCR and UNMIK, has been crucial to the project thus far, and will greatly facilitate implementation of our recommendations. The UN Liaison Offices in Belgrade and Zagreb provided essential logistical support and local services for BTF missions.

The work of the Balkans Task Force was entirely financed by grants to the project's Trust Fund from several European countries: Austria, Denmark, Finland, France, Germany, the Netherlands, Norway, Sweden and UK. Other staff support came directly from UNEP and UNCHS (Habitat).

During this project, we have received essential assistance not only from the entire regular staff of UNEP and UNCHS, but also from many ministries of the environment and other authorities who gave us their expert advice. Special thanks go to DGI, DGXI and DGXII of the European Commission, and the European Environment Agency in Copenhagen. In matters concerning the Danube, we worked in close co-operation with the International Commission for the Protection of the Danube River.

Greenpeace International, the Danube-Carpathian Programme of WWF International, the Regional Environment Centre (REC) in Budapest, as well as the FOCUS project, which is run by the governments of Switzerland, Austria, Greece and Russia, have contributed in their own way to our work. We would like to thank everyone for the excellent spirit of co-operation shown towards BTF.



Pekka Haavisto
Chairman
Joint UNEP/UNCHS Balkans Task Force
Geneva, 5 October 1999

3 Chronology of the Kosovo Conflict

This chapter presents a chronology of the key events during the Kosovo Conflict between NATO forces and the Federal Republic of Yugoslavia. The information is taken from official news briefings, media reports and websites, and other material gathered by the UNEP/UNCHS (Habitat) Balkans Task Force. Events with special relevance to the mandate of the BTF are highlighted. See also map 4.

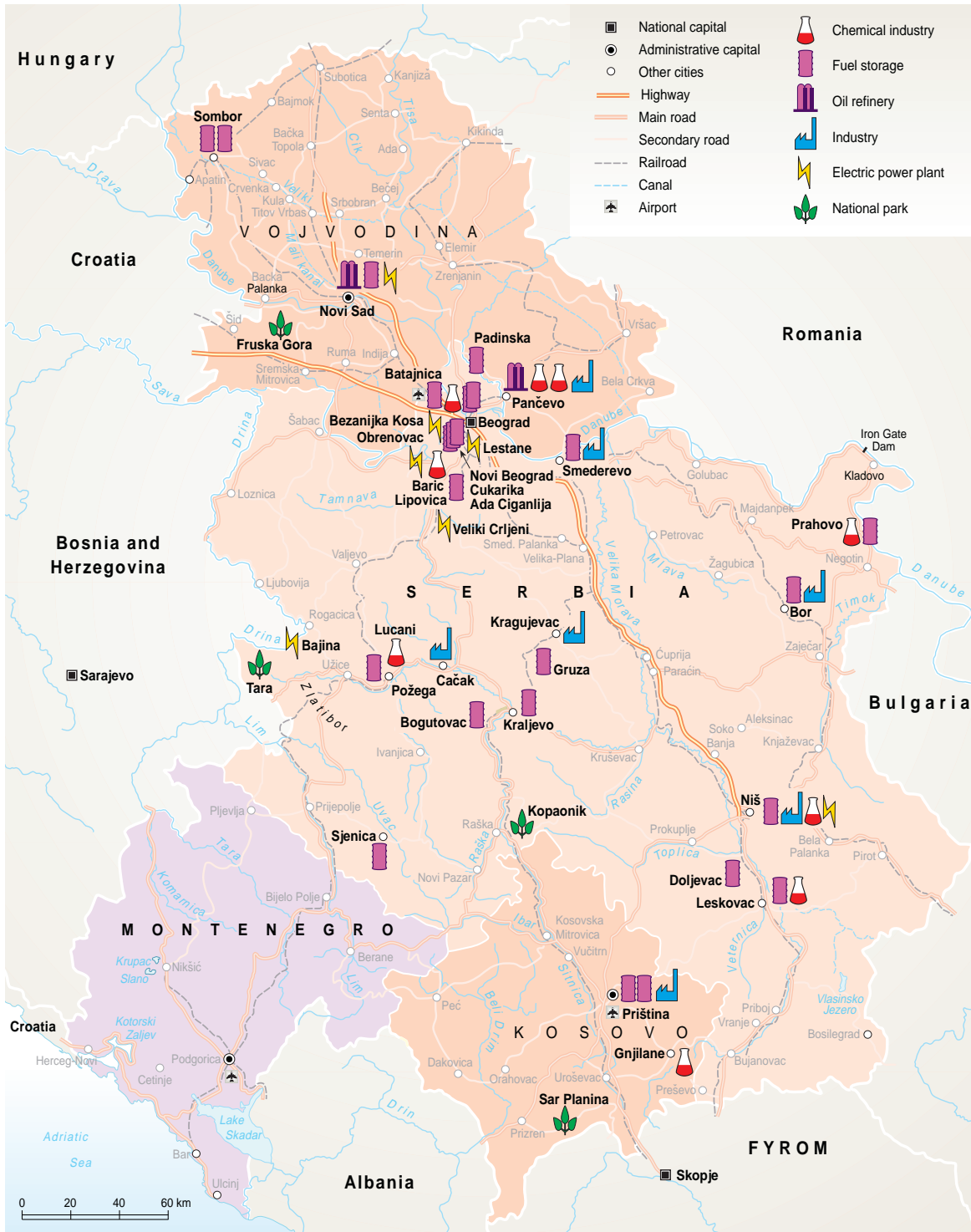
A peace agreement, aimed at resolving armed conflict between Serbs and the ethnic Albanian majority population in the Province of Kosovo, was negotiated at a conference in Rambouillet on 19 March 1999, but was not signed by the Government of Serbia.

Following the failure of the Rambouillet talks, NATO initiated an air campaign ('Operation Allied Force') on 24 March 1999 against Serbian targets. The campaign was suspended on 10 June 1999.

March 1999

- 22** • U.S. special envoy Richard Holbrooke arrives in Belgrade aiming to persuade FRY President Slobodan Milosevic to accept the Rambouillet accord.
- 23** • Serb parliament rejects NATO demands to send peacekeeping troops into Kosovo. Holbrooke ends his mission. UN aid agencies leave Kosovo. NATO authorises air strikes.
- 24** • NATO air operations against FRY start. Russia suspends cooperation with NATO. It is estimated that there are 40,000 FRY troops in and around Kosovo. UNHCR estimates that there are 475,000 Kosovars displaced by the Serbian offensive. 'Lola Utva' aircraft factory in Pančevo hit - production facilities destroyed.
- 25** • The FRY breaks off diplomatic relations with France, Germany, UK and United States.
- 26** • OSCE office in Tirana reports burning of Kosovo villages. A draft Security Council resolution tabled by Russia calling for an end to NATO's action in Kosovo is defeated. Fuel storage in Lipovica destroyed, causing a major fire in the Lipovica forest. Electrical Power Supply in Batajnica damaged.

MAP (4) Targeted Sites with potential negative environmental impacts



Source: Base map from the United Nations Department of Public Information; UNEP, GRID-Geneva&BTF database built from various sources.

- 27 • Ethnic Albanians fleeing or expelled from Kosovo begin to pour into Albania and The Former Yugoslav Republic of Macedonia (FYROM), launching refugee crisis. The airplane factory 'Lola Utva' in Pančevo is targeted again.
- 28 • Thousands of refugees flood into Albania and FYROM from Kosovo. 'Sloboda' factory in Čačak, a large manufacturer of household appliances, is hit.
- 29 • NATO says it is racing to cripple Yugoslav forces by air strikes before they clear Kosovo of ethnic Albanians. 'Lola Utva' Factory in Pančevo is targeted again.
- 30 • FRY President Slobodan Milosevic offers to withdraw some forces from Kosovo if NATO halts air war. Offer rejected. 'Sloboda' factory in Čačak is hit.
- 31 • Trains carry expelled Kosovo Albanians to FYROM border. UNHCR says exodus has reached 125,000.



Smoke cloud over Pančevo, April 1999

Photo: Pančevac

April 1999

- 1 • Tens of thousands of refugees pour out of Kosovo. Missiles strike the bridge between Novi Sad and Petrovaradin. Main water pipeline is badly damaged so much of the town is without water.
- 2 • Thousands more refugees pour out of Kosovo.

- 3 • NATO strikes hit government buildings in central Belgrade. FYROM says it will no longer allow refugees through its borders unless they continue on to third countries. It is estimated that between 50,000 and 100,000 refugees are waiting on the border.
- 4 • NATO airstrikes demolish the Yugoslav First Army headquarters in the capital. 'Beopetrol' storage in Belgrade and **Bogutovac (Kraljevo)** are damaged. Fuel storage of the boiler plant in Novi Beograd ('Beogradske elektrane') is hit. **Oil refinery in Pančevo** attacked, as well as the Slatina airfield near Priština. 'NIS Jugopetrol' in Smederevo hit.
- 5 • The number of refugees pouring out of Kosovo to neighbouring states nears 400,000. Thermo-electric power station/boiler plant in Novi Sad hit. **Oil Refinery in Novi Sad**, with storage of bitumen hit. Fuel storage 'Naftagas promet' which is located 10 km from Sombor, damaged. Damage to water supply system in Zemun. Belgrade's main airport attacked. 'NIS Jugopetrol' in Priština is hit. The 'DIN' tobacco factory in Niš is hit. The 'Milan Blagojević' chemical plant in Lucani is hit.
- 6 • The Yugoslav government declares a unilateral cease-fire, but the US and UK dismiss the move. 'Beopetrol' storage depot in the village of Mala Krusa in the municipality of Priština is hit. Strikes are carried out on 'Milan Blagojević' chemical plant in Lucani.
- 7 • 'Jugopetrol' storage in Sombor damaged. Central Priština is extensively bombed: a **'Beopetrol' fuel storage** facility is damaged. Garages and a warehouse at an **oil refinery in Novi Sad** are destroyed. The 'Milan Blagojević' chemical plant in Lucani is hit.
- 8 • Fears spread that ethnic Albanian refugees are becoming human shields as FRY seals its borders. **'Beopetrol' Storage depot in Bogutovac, municipality of Kraljevo** is hit. Army building in the centre of Belgrade is bombed. Kraljevo, Ladjevci, and a fuel depot in Vitanovci are attacked. **Bombing of 'Tornik', a ski resort on Mount Zlatibor, south of Belgrade.** Town of Chubria is bombed. NATO threatens to bomb Yugoslavian TV and Radio stations unless they agree to allow for 6 hours of broadcasts to be determined by NATO.
- 9 • UN Secretary-General Kofi Annan makes a statement establishing five conditions for an end to the conflict in Kosovo: an end to the violence; withdrawal of Yugoslav forces; deployment of peacekeeping force; return of refugees, and resumption of talks for a political solution. The **'Zastava Automobili' in Kragujevac** is hit. 'NIS Jugopetrol' in Smederevo hit. 'RTS' transmitter on Mount Goles, near Priština, is destroyed. G-8 political leaders meet in Germany to discuss Kosovo.
- 10 • Damage to a power station in Bogutovac. Bombing of Priština and its airport, Niš, and Kraljevo.
- 11 • 'Divcibare' mountain resort close to Mount Zlatibor is damaged. A Novi Sad residential area is hit.

- 12 • NATO Foreign Ministers meet in Brussels and confirm the determination of the Alliance and its five conditions for ending the air operations. A five-carriage train is hit as it crosses a railway bridge spanning the Yuzhna Morava River. 'Jugopetrol' warehouse in Priština hit. **'Baciste' Hotel on Mount Kopaonik damaged.** Damage to a power station in Priština. Bombing of town of Krusevac: city power plant and the major 'October 14' plant, which produced heavy machinery, is destroyed. **'NIS' oil refinery in Novi Sad suburb** is hit. **Oil refinery in Pančevo** struck. The **'Zastava Automobili' in Kragujevac** is hit.
- 13 • 'Jugopetrol' installations in Smederevo damaged. **'Jugopetrol' petrol station in Priština hit. Meteorological station on Mount Kopaonik damaged.** Damage to 'Bistrica' hydroelectric power station in Polinje. **Oil refinery in Pančevo** is targeted again. **'Plastika' factory** and **oil depot 'Jugopetrol' in Priština** are bombed.
- 14 • EU Summit declaration reiterates the international community's five demands. A refugee convoy is hit. After initial denials, NATO confirms that it mistook the refugee column for a tank formation. **Petrochemical industry 'DP HIP Petrohemija' and Fertiliser plant 'DP HIP Azotara' in Pančevo are hit.** **'Plastika' factory** in Priština is attacked again.
- 15 • Petrochemical industry **'DP HIP Petrohemija' in Pančevo** seriously damaged. **Fertiliser plant 'DP HIP Azotara' in Pančevo** also seriously damaged. Facilities of '14 Oktobar' factory in Krusevac are hit.
- 16 • **Oil Refinery in Pančevo** is targeted by numerous air strikes and badly damaged. **Oil refinery in Novi Sad** is hit again.
- 18 • **'DP HIP Petrohemija' in Pančevo** and the **fertiliser plant 'DP HIP Azotara' in Pančevo** are hit. Extensive attacks on Priština including the nearby Slatina airport.
- 19 • Subotica, NW Serbia, attacked. Chemical plant **'Prva Iskra' in Barić** hit - destruction of the production line. Communications transmitter near Priština is hit.
- 20 • 'Belacevac' mines west of Priština are hit. Priština government building reported hit, and Novi Sad oil refinery struck.
- 21 • 23-storey 'Usce business centre' (HQ of the Socialist Party of Serbia) in Belgrade is targeted and hit.
- 22 • Krusik factory in Valjevo attacked. One of President Milosevic's residences bombed. Afternoon attacks on Priština and Novi Sad.
- 23 • NATO issues the Washington Declaration placing an embargo on petroleum products against the Federal Republic of Yugoslavia and the Republic of Serbia (but not the Republic of Montenegro). Bombing of 'Radio Televizija Srbija' (RTS) Studio, in central Belgrade. 'Zezelj' bridge in Novi Sad attacked again. Sabac, Svemska Mitrovitca, and Smederevo hit.

- 24 • **Factory 'Milan Blagojević' in Lucani** is extensively damaged. **Oil refinery in Novi Sad** is hit again.
- 25 • Extensive attack on the industrial area in Niš. Strike at an **oil refinery in Novi Sad**, and an oil refinery near Priština. Town of Velika Dobranja is attacked. Slatina airport attacked again.
- 26 • The European Union adds additional sanctions by banning the sale of crude oil and petroleum products to FRY, with the ban taking effect by 30 April 1999. Sombor in NW Serbia, Novi Sad, Niš, Kragujevac, Slatina airport and the Valjevo fuel depot attacked.
- 27 • Heavy bombardment of Belgrade, with renewed attack on the Usce business centre, destroying the transmitter on top of the building. The Lipljan region south of Priština is attacked; Slatina airport near Priština, Decani and Pec also attacked. Missiles fired at town of Surdulica (a small Serbian town near the Bulgarian border). NATO acknowledges its own mistake. Mount Goles, near Lipljana in south Kosovo, is attacked. Severe damage to the '25 Maj' bridge connecting Srem and Ilok.
- 28 • **Novi Sad Oil refinery** and **TV transmitter on Fruška Gora Mt.** are hit during the day. Strikes on the fuel depot of the state oil company ('Jugopetrol') near the town of Pozega. Strikes on Kosovska Mitrovica; Priština, Mount Mokra; and coal mines in Stari Trg. **Further bombardment of the oil refinery in Novi Sad.** A missile accidentally hits Sofia, Bulgaria.
- 30 • During the night of 29/30 April, government buildings in Belgrade are targeted by intensive air strikes.

Burning industrial complex, Pančevo, April 1999

Photo: Pančevac



May 1999

- 1 • U.S. extends sanctions to ban oil sales to FRY and freezes Belgrade's assets in the United States. 'Niš express' passenger bus is hit on a bridge, near the village of Luzane, 12 miles north of Priština.
- 2 • Five major electricity transformer substations are bombed by NATO overnight, leaving 70% of the population - at a NATO spokesperson's estimate - without electricity until the stations are repaired the following day. A NATO missile hits another bus in Western Kosovo, near the town of Pec. Fuel depots at Priština and near Obrenovac are hit. The 'RTS' television building and the **oil refinery in Novi Sad** are hit again.
- 5 • Joint UNEP/UNCHS Balkans Task Force is established. Kosovar Albanian leader Ibrahim Rugova, thought to be under house arrest, flies out of FRY to Rome. 'Jugopetrol' facilities in Niš are hit.
- 6 • G-8 Foreign Ministers meet in Bonn and issue a statement adopting seven key principles on the political solution to the Kosovo crisis. This blueprint hands the peace process back to the UN Security Council. UN Secretary-General Kofi Annan announces the appointments of Carl Bildt, former Swedish PM, and Edward Kukan, Foreign Minister of Slovakia, as Special Envoys of the Secretary-General for the Balkans.
- 7 • NATO mistakenly bombs the Chinese Embassy in Belgrade, killing three Chinese journalists. Extensive bombardment of Niš. Cluster bombs dropped in the market square kill 15 people. The main hospital receives collateral damage. The bridge leading to Romania is hit and destroyed.
- 8 • Further bombardment of Belgrade, again shutting down the major electricity transformer substations serving the city.
- 10 • FRY says it is withdrawing some forces from Kosovo. The UK and US dismiss the statement. 10 NATO countries participate in a preliminary hearing of the International Court of Justice in The Hague in response to a claim by the Government of FRY. Chemical plant '**Prva Iskra**' in **Barić** hit.
- 13 • Ethnic Albanians are killed and injured in a NATO bombing of Korisa village. NATO says Korisa is a Serb military command post, and suggests Serb forces trapped the refugees next to the target as human shields.
- 14 • The UN Security Council adopts Resolution 1239, which calls on all concerned parties to facilitate the provision of humanitarian assistance to all persons affected by the conflict. A refugee camp on the Priština-Prizren highway, near the village of Korisa, is bombed.
- 15 • NATO admits Korisa bombing but rejects blame for civilian deaths. '**Jugopetrol**' fuel storage in **Bor** hit. **Transformer station within the mining and smelting complex in Bor** hit. 'Jugopetrol' fuel storage in Belgrade is hit.
- 16 • **Beginning of the UN Inter-Agency Needs Assessment Mission to FRY.**



Bombed oil storage facility, Bor

Photo: BTF

- 17 • Anti-government protests are reported in Serbian towns of Aleksandrovac and Krusevac. **'Jugopetrol' fuel storage in Bor** hit.
- 19 • 'Jugopetrol' fuel storage in Belgrade is hit.
- 20 • Air strikes damage the Swiss ambassador's residence, along with the Spanish, Swedish, Norwegian and Hungarian ambassadors' residences. Damage is also reported at the Libyan Embassy and the Israeli diplomatic mission. The Dragisa Misovic hospital is damaged. 'Naftagas promet' in Sombor is hit.
- 21 • **Niš electric transformer station** is bombed.
- 22 • Electricity transformer substations hit again cutting off electricity to Belgrade and various other areas of Yugoslavia. **'Veliki Crljeni' thermal electric power plant** in Veliki Crljeni is hit.
- 23 • NATO begins intensive bombing of Yugoslav electricity grid, beginning major disruption of power and water supplies. **Niš electric transformer station** is bombed.
- 24 • The Head of the UN Needs Assessment Mission, Sergio de Mello, reports clear evidence during his trip to the region, of a deliberate campaign of ethnic cleansing in Kosovo. 'Milan Blagojević' factory in Lucani is extensively damaged.
- 25 • NATO allies agree to assemble 48,000-person peacekeeping force for Kosovo.
- 27 • **UN Needs Assessment Mission ends.** The International Criminal Tribunal for the Former Yugoslavia indicts FRY President Milosevic and four other senior



Pančevo oil refinery, April 1999

Photo: Pančevac

officials on charges of murder, persecution and deportation. **‘Jugopetrol’ fuel storage in Bor** hit. Damage to electrical installation of **transformer station Bezanijska Kosa** in Novi Beograd.

- 28 • Official Yugoslav news agency Tanjug says FRY accepts ‘the general principles’ agreed by the G-8 as a basis for bringing peace to Kosovo.
- 29 • Two Australian aid workers and a Yugoslav colleague convicted of espionage by Belgrade court and sentenced to jail terms.
- 30 • NATO aircraft bomb crowded bridge in central Serbia. NATO airstrikes damage a sanatorium in Surdulica, southeastern Serbia.
- 31 • **Niš Transformer Station is hit.**

June 1999

- 1 • FRY declares its acceptance of the G-8 principles for a resolution of the Kosovo crisis.
- 2 • Russian and European negotiators in Germany agree to a Kosovo peace plan that could bring a halt to the NATO air strikes and fly immediately to Belgrade with the proposal. International Court of Justice in The Hague rejects Yugoslav request to halt NATO bombing, but expresses concern about legal basis for the air strikes.
- 3 • The FRY Government and the Serbian Parliament agree to the international peace plan brought to Belgrade by peace negotiators, President Martti Ahtisaari of Finland and former Prime Minister Viktor Chernomyrdin of Russia, that commits the FRY to withdraw all of its forces from Kosovo.

- 4 • The North Atlantic Council provides authority under the existing Operations Plan for General Sir Michael Jackson, Commander of the international peace-keeping force KFOR, to take operational control and begin preparations for deployment.
- 5 • NATO military officials give Yugoslav officers marching orders for a pull-out from Kosovo during first round of talks.
- 6 • Start of the military-to-military talks between FRY and NATO representatives in FYROM for the withdrawal of Serb troops from Kosovo. Russian military observers also participate in the meeting.
- 7 • NATO and Yugoslav commanders fail to agree terms of pullout from Kosovo and suspend talks. NATO intensifies bombing. G-8 foreign ministers in Bonn attempt to finalise UN resolution on enforcing Kosovo peace deal. FRY insists it wants a UN Security Council resolution before any foreign troops enter Kosovo. Large-scale attacks on Belgrade. **Oil Refinery in Pančevo** is hit again.
- 8 • The Foreign Ministers of the G-8, at a meeting in Bonn, agree to the text of a draft UN Security Council resolution on Kosovo. Finnish President and EU Special Representative Martti Ahtisaari, and German Political Director Pleuger meet in Beijing with Foreign Minister Tang Jiaxuan and President Jiang Zemin to keep China apprised of developments, and to obtain Chinese support for the diplomatic efforts underway. The total number of refugees in countries of asylum is in excess of one million.
- 9 • NATO and Yugoslav military commanders agree on timing and details of Yugoslav withdrawal. The Military Technical Agreement is signed by UK General Sir Michael Jackson, on behalf of NATO, and by representatives of the FRY and the Republic of Serbia, clearing the way for Serb withdrawal, an end to the bombing, and adoption of the draft UN Security Council Resolution. UN Secretary-General Kofi Annan's Special Envoys for the Balkans, Carl Bildt and Eduard Kukan, brief the Security Council on the priorities of the civilian mission in Kosovo.
- 10 • NATO suspends 'Operation Allied Force'. UN Security Council adopts Resolution 1244. This Resolution entrusts establishment of the international civilian administration in Kosovo to the Secretary-General. Serb forces start withdrawal from Kosovo. US Deputy Secretary of State Strobe Talbott travels to Moscow to work out the Russian participation in KFOR. Troops from the Russian contingent in Bosnia and Herzegovina enter the FRY on their way to Kosovo.

A State of the Environment & Human Settlements in the Federal Republic of Yugoslavia prior to the Kosovo Conflict

In general, the environmental situation in the Federal Republic of Yugoslavia (FRY) is comparable to that of other countries in central and eastern Europe, and is influenced by the prevailing economic and political conditions. UNEP has observed that “Development under the centrally-planned economies in Central and Eastern Europe and Central Asia was understood mainly in terms of growth of physical production (especially in the industry and energy sectors) and this resulted in the severe exploitation of renewable and non-renewable resources” (see bibliography no:37).

Unfortunately, up-to-date, systematic and internationally comparable State of the Environment (SoE) reporting does not exist in the FRY. This chapter draws on official and unofficial reports issued by the FRY Ministry of Science, Development and Environment (official report of 1994, unofficial report of 1998), other statistical material published by FRY governmental agencies, reports from international organisations (UNDP, UNEP, UN/ECE, WHO, EEA and REC) and scientific publications. Information obtained from published sources has been complemented by the findings of the various BTF field missions. All the neighbouring countries (with the exception of Croatia) have participated in a co-operative project between the EU Phare programme, the EEA and UNEP to make available to a wider audience easy-to-understand, up-to-date and comparable information about the state of the environment.

Background

Before the Second World War, Yugoslavia was an underdeveloped, primarily agricultural country. From the 1950s to the 1970s the country witnessed tremendous development and economic growth, with rates of industrialisation and urbanisation among the highest in the world. This growth was based mainly on a traditional industrialisation pattern, with high use of energy and raw materials placing significant pressures on natural resources and the environment. This resulted in a decrease in forested area, deterioration of water quality in rivers and lakes, and increased air pollution in urban and industrial areas. Rapid and partially uncontrolled urban growth also led to a number of environmental problems. During the 1980s Yugoslavia faced economic stagnation which eventually led to radical institutional reforms in 1989, followed by the independence of several Yugoslav Republics in 1991 and 1992. The disintegration of the common market of the former Socialist Federal Republic of Yugoslavia (SFRY) and the sanctions imposed by the UN during the 1990s led to a dramatic decrease in economic activities, which only slightly recovered after the stabilisation programme of 1994. Economic decline and the UN sanctions against the FRY have in general led to reduced pollution of air and water. However, negative environmental consequences, in particular due to the increased use of low-quality fuels, and diminished investments by industry in environmental protection have been observed (see bibliography nos:33&36). The suspension of international co-operation has had an undisputedly negative impact on environmental management and institutional development in the FRY.

Environmental issues

■ Air

Air pollution in the FRY is considerable, but mainly concentrated in urban and industrial areas. The principal air pollution sources include thermal power and heating plants, domestic heating, motor vehicles and industrial processes. Inefficient energy utilisation, unqualified system management and low technical efficiency of equipment exacerbate the situation. The air quality is measured by monitoring the emissions of sulphur dioxide and nitrogen oxides. Measurements are regularly published for the country as a whole and for urban areas.

■ Water

The main sources of water pollution are human settlements, industry and agriculture. A significant degree of pollution enters the country through rivers; the FRY thus has

vital interests in co-operation with other Danube countries (see map 1). The quality of surface and ground waters is controlled by hydro-meteorological institutes (monitoring of hydrological, physical-chemical, biological and bacteriological properties of water) and public health institutes (monitoring of hygienic safety of drinking water). Over the last 30 years the quality of river water has dropped considerably, most rivers being downgraded by one or even two classes in the four-class water quality system adopted in 1968. More recently, an improvement of the quality of all water resources in the FRY has been recorded, most likely a result of the UN sanctions causing a decline in economic activities.

■ Waste

Yugoslavia's industry produces significant quantities of waste, with the chemical industry (37.6%) and primary metallurgy (29.1%) accounting for the largest share of the total waste generated. Large quantities of waste are also produced in the mining sector (SoE 1998). An estimated 225 thousand tonnes of hazardous waste are being produced annually. In addition to the industrial waste, an estimated 0.4 to 1.5 kg per person per day of household garbage is being generated in the FRY (see bibliography no:33). Few dumps meet strict requirements and a rather high number of illegal waste dumps exist. There are no adequate treatment or storage facilities for highly toxic waste anywhere in the country, leading to a continuous build-up of hazardous waste.

■ Soil, Forests, Agriculture

Most soil and land degradation in the FRY is caused by agriculture and mining. However, some of the pressure on agricultural land has decreased through the drastic reduction in fertiliser use in the 1990s. Total forest cover is 28% of the country's total area which is around the European average. Since the 1960s, the forested area has slightly increased (4 % between 1966 and 1993). According to official statistics, illegal cutting has decreased during the 1990s (see bibliography no:28).

■ Biodiversity

In terms of natural diversity, the FRY is one of the most important geographical regions in Europe. It is home to a wealth of species (plants, fish, birds, mammals) that is matched by few other European nations. The total area of protected and particularly valuable natural areas cover more than 400,000 hectares of the FRY's territory. There are nine national parks (Fruška Gora, Djerdap - Iron Gates, Kopaonik, Tara, Mt. Sara, Biogradska Gora, Durmitor, Lovcen and Lake Skadar) located in all three



Telecommunications facilities located in Fruška Gora National Park were destroyed during the air strikes

Photo: BTF

geographic macro-regions: Pannonian, mountainous and coastal. One of the European centres of biodiversity is shared with the mountainous part of Bulgaria (see map 3). While the general environmental situation in Montenegro and Kosovo is comparable with the rest of the FRY, there are some specific regional issues worth mentioning here:

■ Republic of Montenegro

Through its location on the Adriatic coast, Montenegro has to deal with issues of marine pollution (mainly caused by industry) and the threats posed by tourism to the coastline and the saltwater estuaries. At the Rio conference in 1992, Montenegro declared itself the world's first 'environmental state', pledging to live more harmoniously with nature.

■ Province of Kosovo

Of special concern for Kosovo is the large-scale exploitation of mineral resources. After the Second World War, mining activities expanded considerably and triggered rapid growth of various related industrial operations. Most of this mining and industrial development took place without installation of adequate environmental protection equipment and without proper siting of the industrial plants, which has resulted in serious environmental degradation and impacts on the health of the local population.

Environmental hot spots in Kosovo are Kosovska-Mitrovica (lead and zinc mines and related industry), Obiliq (open cast lignite mines and related energy industries), Glogovc (ferro-nickel mines and metallurgical industry) and Elez Han (limestone quarries and cement factory) (see bibliography no:35).

Environmental policy, legislation and institutions

Environmental protection in Yugoslavia started to be taken seriously in the 1970s. The general policy, legal and institutional framework has substantial parallels with those found in other countries in the region. For example, within the Federal Republic of Yugoslavia, there is an environmental policy statement, constitutional recognition of the right to a healthy environment, framework environmental legislation (Serbia) and environmental impact assessment legislation (Serbia). Ministries of Environment exist at the federal level and in Serbia and Montenegro. Sectoral legislation on air, water, soil, natural/cultural heritage, spatial/settlement planning and chemicals/waste is in place, comprising a large number of laws (more than 150) and other regulations (more than 100) at all levels.

The extent to which such policy instruments are effectively implemented and enforced is less clear. Reportedly, with the economic depression and the increasing international isolation of the country, working conditions in the Ministries and other branches of public service have deteriorated.

Public participation in environmental matters has to be considered as underdeveloped, even in the context of local decision-making and environmental impact assessment procedures. There is a wide variety of environmental NGOs. Many of them have considerable experience and are important and capable sources of information. However, many are also facing economic difficulties and declines in membership.

Access to environmental information is – despite extensive and rather progressive legislation – in reality not so straightforward. At the national level, there is an obvious lack of user-friendly environmental information products provided by official sources. Similarly, at the local level, individuals seem to have difficulties getting the information they need. The FRY has not yet signed the Aarhus Convention on access to information, public participation in decision-making and access to justice on environmental matters. The Federal Government seems, however, to be aware of the growing importance of environmental information and public participation and has approved a project for the design and implementation of 'An Integrated Environmental Information System of the Federal Republic of Yugoslavia' (see bibliography no:24).

The country has ratified a large number of international treaties or conventions (52 in total) relevant to the environment. International environmental co-operation has suffered recently from the effects of the UN embargo, notably in the field of technical co-operation, where other CEE countries have profited tremendously in the 1990s.

Human settlements

According to the 1991 census, the total population of Serbia was approximately 9.8 million, of which close to 2 million lived in the Province of Kosovo. There are significant differences between Serbia as a whole and the Province of Kosovo. While the degree of urbanisation in Kosovo was 32.5% before the conflict, Serbia had 48% urban inhabitants in 1991. Serbia had a total housing stock of 1.65 million units in the same year, compared with only 230,000 for Kosovo. Among other aspects, this is reflected by the inhabitants of Kosovo having only half the average floor area per person available to their Serbian counterparts.

A similar situation can be observed in the coverage of infrastructure and services. On average, 88% of the inhabitants in the Republic of Serbia were connected to services such as sewerage, water and electricity. This figure was only 40% for the Province of Kosovo.

These figures show that while human settlement conditions for Serbia as a whole were adequate, the Province of Kosovo had lower standards of housing and quality of settlement infrastructure. There are indications that this difference, and the overall deterioration of settlement conditions, was intensified during the decade preceding the conflict, thus increasing the vulnerability of the Province to the events of March-June 1999.



Refugee camp, in the Former Yugoslav Republic of Macedonia

Photo: BTF

5 Principal Findings of the BTF Technical Missions and Desk Assessment Group

The Joint UNEP/UNCHS (Habitat) Balkans Task Force (BTF) organised five Technical Missions to the Federal Republic of Yugoslavia. The missions took place with the co-operation of the local authorities and with the assistance of the United Nations Liaison Office in Belgrade and the United Nations Mission in Kosovo (UNMIK). The timing of the missions, and the issues addressed by them, were as follows:

DATE OF MISSION	TECHNICAL ISSUE UNDER CONSIDERATION
JULY-OCTOBER	Consequences of the conflict for human settlements and the environment in Kosovo
19-27 JULY	Environmental consequences of air strikes on industrial sites
16-19 AUGUST	Possible use of depleted uranium in Kosovo (preliminary fact-finding mission)
21-28 AUGUST	Environmental consequences of the conflict on the Danube river (complementary mission organised in close co-operation with International Commission for the Protection of the Danube River-ICPDR)
7-13 SEPTEMBER	Consequences of the conflict on biodiversity in protected areas

Each of the missions was composed of an international team of independent technical specialists, supported by BTF and UNEP/UNCHS (Habitat) staff. In addition, an independent 'Desk Assessment Group' was assigned to address the issue of depleted uranium, building on the work of the preliminary fact-finding

mission. The Desk Assessment Group worked during August and September, mainly by correspondence, but two meetings were held in Geneva.

A series of detailed 'Mission Reports' has been compiled, and these are accessible via the Balkans Task Force website (<http://www.grid.unep.ch/btf/>). This chapter summarises the main findings of the individual Mission Reports, but does not, in general, enter into scientific details. The findings are structured by theme, so that the results of different missions are integrated where appropriate. The main headings are:

- Principal environmental 'hot spots' visited by the missions
- Other specific locations visited by the industrial sites and Danube missions
- Environmental impacts of the conflict on the Danube river
- Depleted uranium: findings of preliminary fact-finding mission and Desk Assessment Group
- Consequences of the conflict for biodiversity
- Special considerations in relation to human settlements and Kosovo

Recommendations from the missions are presented in chapter 6 (see page 72).

Principal environmental 'hot spots' visited by the missions

■ Context

The BTF 'Industrial Sites' and 'Danube' missions visited twelve locations (in Serbia and Kosovo) regarded as potential 'hot spots' of special environmental concern as a result of damage sustained during the NATO air strikes (see map 5). At some locations, visits were made to more than one targeted facility.

Time and resource considerations meant that it was never feasible for BTF teams to visit every location targeted during the conflict. The final choice was made by the BTF on the basis of all available information, including NATO and Yugoslavian news releases, eyewitness reports by journalists and local people, NGO websites, and consultation with technical experts within and outside FRY. During the site visits, numerous soil, sediment, water, air and biota samples were taken. These were analysed either on-site, using mobile laboratories, or at laboratories in Denmark, Germany and Hungary. Wherever possible, discussions were held with site managers, local authorities and other stakeholders.

This section presents information on the four locations which, on the basis of the field visits and laboratory test results, have been identified by the BTF as 'hot spots' of special environmental concern. At all four of these locations (Pančevo, Kragujevac, Novi Sad and Bor), it was occasionally difficult to be sure of the precise extent to

MAP (5) Sites visited by the BTF in Yugoslavia



Source: Base map from the United Nations Department of Public Information, Cartographic Section, New York, 1999. BTF: Times atlas of the world, Bartholomew and Times Books, London, 1994 and Atlas Géographique du Monde, Institut géographique Agostini Novara, 1995.

which observed environmental pollution or contamination resulted directly from the air strikes, since evidence of longer-term environmental damage was also found. However, in every case, there are serious environmental issues, requiring immediate action. The problems identified have important implications for human health and welfare and should therefore be addressed in the framework of humanitarian assistance after the conflict. The BTF Chairman has already informed the Yugoslavian authorities of the most serious findings, notably at Pančevo and Kragujevac.

Pančevo (see map 6)

Main concerns: Serious leakages of 1,2-dichloroethane (EDC) and mercury; burning of vinyl chloride monomer (VCM) to form dioxins; burning of 80,000 tonnes of oil & oil products releasing sulphur dioxide and other noxious gases; high concentrations of EDC found in water of canal running into the Danube; high concentrations of mercury and petroleum products in the canal sediments.

■ Background information

Pančevo, a town of about 80,000 inhabitants, is located on the left (eastern) bank of the Danube river, approximately 20 km north east of Belgrade. A major industrial complex, including a petrochemical plant, a fertiliser plant, and a major oil refinery, lies on the southern edge of the town. An artificial canal, 1.8 km in length, carries wastewater and stormwater runoff from the complex directly into the Danube (see map 8).

The fertiliser plant does not have any industrial wastewater or stormwater treatment facilities. Effluent from the plant is discharged directly into a collection channel and subsequently to the open canal. Effluent from the petrochemical plant and the oil refinery initially flows into a sewer channel and undergoes treatment in a wastewater facility before discharge into the canal.

The industrial zone was heavily targeted during the conflict, with two air

MAP (6) Location of Pančevo in the FRY



strikes on the ‘HIP Petrohemija Pančevo’ petrochemical complex and the ‘HIP Azotara’ fertiliser plant in mid-April, and seven attacks on the ‘NIS’ oil refinery between April and June. Much of the town’s population was said to have been temporarily evacuated following the strikes of 17/18 April.

As a result of the air strikes, various hazardous substances were released into the environment, either directly from damaged storage facilities, or as a result of fires, with the most obvious visual impact being the dense clouds of black smoke which poured from burning installations. Yugoslavian media reports after the strikes of 17/18 April spoke of an unfolding environmental disaster, and “ecological catastrophe”. This theme was taken up by TV, newspapers and websites (both inside the FRY and internationally), which highlighted the health fears of Pančevo residents concerned about inhaling toxic fumes and worried about the safety of their food and water supplies. As a consequence of the smoke, ‘black rain’ fell on the area around Pančevo, heightening concerns about human health and long-term damage to crops, soil and groundwater.

In July, the New York Times (see bibliography no:11) quoted a NATO spokesperson as saying, “NATO had two types of targets. There were tactical and strategic targets. The oil refinery in Pančevo was considered a strategic target. It was a key installation that provided petrol and other elements to support the Yugoslav army. By cutting off these supplies we denied crucial material to the Serbian forces fighting in Kosovo. When targeting is done, we take into account all possible collateral damage, be it environmental, human or to the civilian infrastructure. Pančevo was considered to be a very, very important refinery and strategic target, as important as tactical targets inside Kosovo”.

The Federal Ministry of Foreign Affairs of Yugoslavia (see bibliography no:4) reports that, “The most serious environmental consequences” occurred after the attack of 17/18 April, due to the release of toxic substances from burning oil products at the refinery and burning vinyl chloride monomer (VCM) at the petrochemical plant.

A statement released by the Director General of HIP Petrohemija on 21 April reported fires, explosions and release into the air, soil and Danube of a range of hazardous substances, including EDC, PCBs and ammonia. The statement also reported that petrochemicals were still burning on 21 April.

Pančevo was visited by two of the BTF missions; namely those dealing with Industrial Sites and the Danube River. The first mission visited the petrochemical plant, fertiliser plant



Danish mobile laboratory

Photo: BTF

and oil refinery between 20 and 25 July. Discussions were held with the site managers, other local stakeholders (including the Mayor and environmental NGO representatives) and the Institute of Public Health of Belgrade. Air, soil, sediment and water samples were taken. The second mission visited the complex on 25 August, in order to take water, sediment and biota samples from the canal and from adjacent sections of the Danube river, both upstream and downstream of the canal mouth. The BTF experts on this mission also met with the manager of the HIP Petrohemija wastewater treatment plant.



BTF meeting at the Public Health Institute in Belgrade

Photo: BTF

In the light of information gathered during the two visits, the BTF reached the following conclusions concerning the main substances of concern:

- At the petrochemical plant, 2,100 tonnes of ethylene dichloride (EDC) leaked into the soil and into the wastewater canal. EDC is toxic to both terrestrial and aquatic life.
- Also at the petrochemical plant, 8 tonnes of metallic mercury leaked, of which an estimated 200 kg reached the canal. BTF experts found an estimated 50 -100 kg of metallic mercury lying on the concrete floor of a factory. Once released into the environment, metallic mercury can be converted into an organic form, methyl mercury, which is toxic and builds up in the food chain.
- 460 tonnes of vinyl chloride monomer (VCM) burned at the petrochemical plant. This would have released dioxins, which are highly toxic, hydrochloric acid, carbon

monoxide, PAHs and possibly phosgene into the air. However, with the exception of one 'hot spot' in the immediate vicinity of the VCM fire, the BTF team recorded only low levels of dioxins at Pančevo.

- The air strikes on the oil refinery caused an estimated 80,000 tonnes of oil and oil products to burn. This would have released noxious substances into the air, including sulphur dioxide, nitrogen dioxide, carbon monoxide, polyaromatic hydrocarbons (PAHs) and lead.
- As a preventive measure, about 250 tonnes of liquid ammonia was released into the open canal from the fertiliser plant by site managers fearful a direct air strike on stored ammonia could kill large numbers of people. This release was probably responsible for fish kills reported in the Danube, up to 30 km downstream. Fertiliser production prior to the air strikes had been accelerated in order to minimise the quantity of ammonia in storage.
- PCB concentrations recorded at the complex were low and did not indicate contamination from damage during the air strikes, or from previous accidental spills.

The contamination identified is considered to be a hazard to the health of workers at the complex and to the terrestrial and aquatic environment.

It was evident to the BTF team upon visiting the site that the plants employed 1960s and 1970s technology. Whilst no information on levels of contamination of the area prior to the conflict appeared to be available, a local NGO provided a list of accidents which had occurred at the industrial complex during the past 25 years. Local councillors reported that workers at the plant had suffered from so-called 'Pančevo cancer'. BTF experts considered this illness was most likely to be angiosarcoma of the liver, resulting from exposure to high levels of VCM.

■ BTF samples and results (*see map 7*)

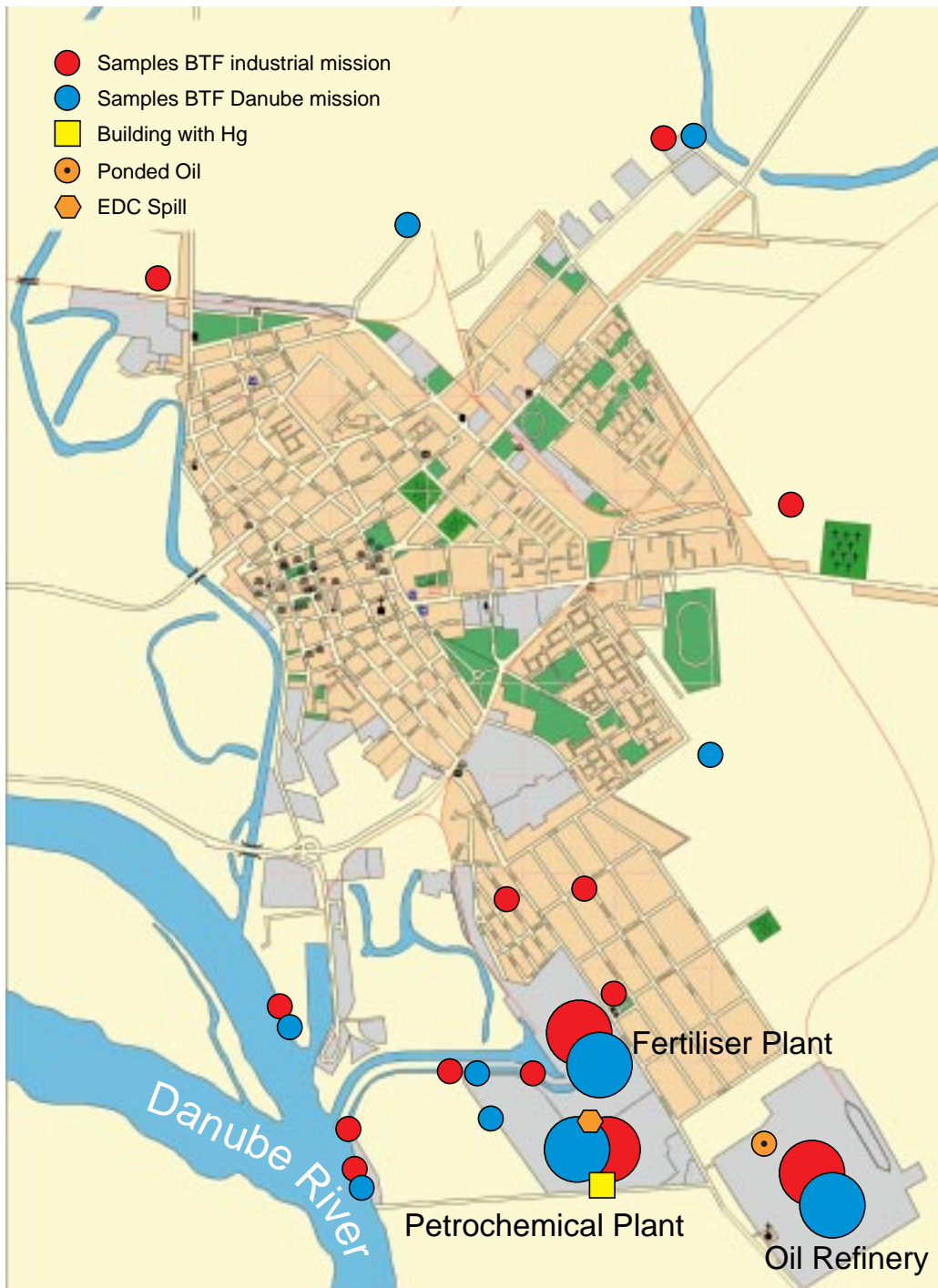
According to preliminary analyses carried out by BTF experts, the macro-invertebrate fauna in the Danube just upstream of Pančevo was similar to that found much further upstream, at sampling sites in Novi Sad. 21 taxa were identified, of which most were mussels and snails. The number of taxa decreased sharply downstream of Pančevo, where only eight living taxa were identified. The sampling site with the low-



BTF experts used mobile laboratories from Denmark and Germany

Photo: BTF

MAP (7) Detailed Map of Pančevo with BTF sampling sites

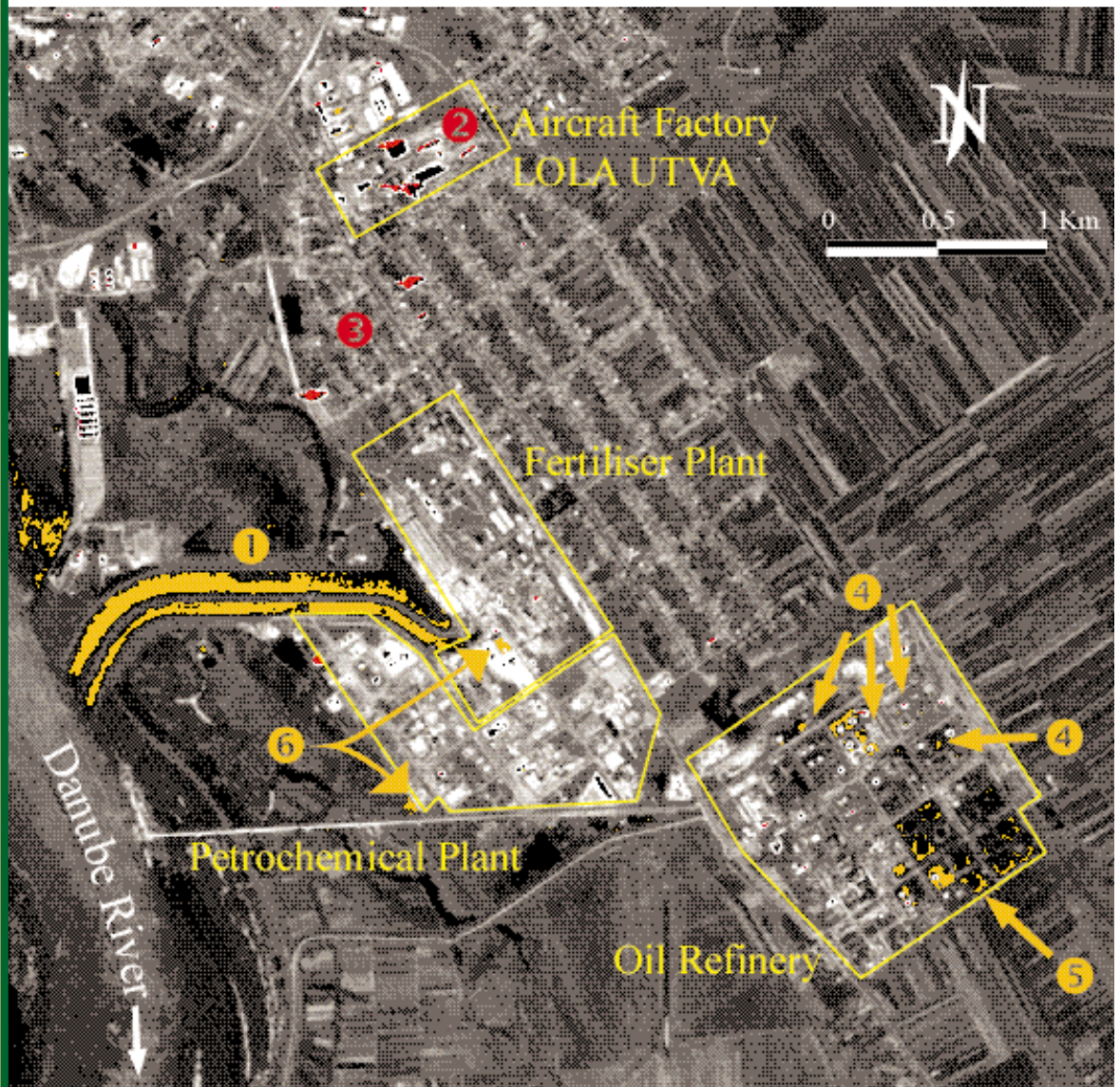


Source: Municipality of Pančevo, and BTF.

est number of taxa was at the outlet of the canal. Only six taxa were found; all of them in very low numbers, indicating serious pollution from the canal.

Other analyses (see Table 1) have shown that water and sediment samples taken from the canal contained very high levels of EDC (for example, a level of 5,960 µg/l

MAP (8) Remote Sensing Assessment of major impacts in Pančevo



Legend:

Areas that appear darker on the post-war image, (e.g. pollution, oil spills, missing oil tanks or buildings).

Areas that appear brighter on the post-war image (e.g. bomb impacts).

1. Change in water quality in the wastewater canal
2. Visible destruction of buildings at the aircraft factory LOLA UTVA.
3. Visible impacts on “unknown” buildings.
4. Destroyed Oil tanks.
5. Changes that may have resulted from oil spills.
6. “Destroyed” buildings in the fertiliser and petrochemical plants.

Source: Image taken on 27 June 1999 by the Indian Remote Sensing Satellite (IRS) panchromatic sensor with 6m ground resolution. The image processing was conducted by UNEP/GRID-Geneva, using a pre-war image from 14 March 1999.

was found in a water sample from the canal). The results also indicate that EDC is still being released into the Danube from the canal. Surface water samples downstream of the canal's confluence with the river showed EDC concentrations of 65 µg/l and 37 µg/l. These levels are considered very high; for example, the World Health Organisation (WHO) limit for EDC in drinking water is 10 µg/l.

Very high levels of chlorinated solvents, including EDC, were found in both shallow and deep groundwater samples. The deep contamination would have occurred prior to the conflict, and it is likely that the entire aquifer is affected. It is probable that contamination with these chemicals resulted from PVC production at the complex. Whilst samples taken from upstream drinking water abstraction points were not contaminated, there is a possibility that Pančevo's municipal supply could become contaminated in the future. More research would be needed to assess the degree of risk.

Analysis of the sediment core taken from the canal suggests that oil released as a result of the air strikes had added a layer of acute contamination to an area already affected by chronic petrochemical pollution. Similarly, whilst high mercury values in the surface layers of the core sample indicated recent input of mercury to the canal, a second peak, three times higher than in the surface layer, but at a depth of 60-80 cm, was most likely the result of past mercury spills. The chronic pollution by mercury and oil products was confirmed by the results from analysis of mussels (*Anodonta anatina*) collected from the Danube upstream and downstream of the canal. Mercury increased from 0.15 to 0.22 mg/kg dry weight of mussel tissue, whereas the PAHs (Borneff-6) increased from 4.7 to 56.4 µg/kg dry weight. Benzo(a)pyrene, alone, increased from 0.9 to 23.0 µg/kg dry weight (the latter figure is about four times higher than the relevant FAO food safety standard).

Table 1: BTF Sampling Summary – Pančevo (Danube mission)

LOCATION	SAMPLE TYPE	FINDINGS
Danube upstream of Pančevo	water, bottom sediments, biota	No significant pollutants in the water column; PCBs in mussels (39.4 µg/kg)
Danube 4 km downstream of Pančevo	water, bottom sediments, bank sediments, biota	Low level of EDC in the surface water (0.3 µg/l)
Danube 100 m downstream of canal	water, bottom sediments, biota	High level of EDC in the surface water (65 µg/l at 10 m and 37 µg/l at 40 m from the shore)
In the canal	water, sediment core	Very high level of EDC in water (up to 5960 µg/l) and sediment; high levels of mercury in sediment core, both near the surface and at 60-80 cm; high levels of petroleum hydrocarbons in the sediment core.

Kragujevac *(see map 9)*

Main concerns: Zastava factory: high levels of PCBs and dioxins on paint shop floor; high levels of PCBs around power plant transformers; contaminated water tanks; inadequate storage and treatment of toxic waste; PCBs detected in Lepenica river.

■ Background information

Kragujevac, a central Serbian industrial town of 150,000 inhabitants, is the home of the 'Zastava' car factory, formerly one of the biggest industrial facilities in the entire Balkan region. A large percentage of people living in Kragujevac depend on the factory, directly or indirectly, for their livelihood. At one time, Zastava had 36,000 employees in Kragujevac, producing over 30,000 cars a year. More recently, loss of markets and competitiveness, together with the effects of the economic embargo, have resulted in output dropping to less than half this figure. The factory provides a number of secondary products and services, including heating for a significant part of the town. The factory is located on the banks of the Lepenica river, a small tributary of the Velika Morava, which in turn flows into the Danube some 60 km downstream of Belgrade. The Zdratica river is also close to the factory.

The Zastava complex was targeted twice during the conflict, on 9 and 12 April. Heavy damage was inflicted to the power station, car assembly line, paint shop, computer centre and truck plant. Some parts of the factory were completely destroyed, and production was halted.



Inspection of damaged transformers

Photo: BTF

MAP (9) Location of Kragujevac in the FRY

The air strikes reportedly caused extensive environmental pollution, with damage to soil, water and air. The main problems reported were the leaking of several tonnes of PCBs (contained in transformer oil) into the Morava river, and contamination of groundwater by PCBs and heavy metals. According to Zastava personnel, up to 2,500 kg of oil containing PCBs was released into the environment as a direct result of the air strikes, and underground water tanks below the factory were polluted with transformer oil containing PCBs.

The BTF 'Industrial Sites' mission visited the Zastava plant on 22 July. Discussions were held with factory management representatives, who provided a written report on environmental damage resulting from the NATO airstrikes. Two locations were investigated in detail, namely damaged transformers at the power station and paint shop (where leakage of transformer oil containing PCBs had been reported).

The factory managers stated that, prior to the conflict, the Zastava Group had operated a very active environmental management system, accredited under the ISO 14000 environmental management quality standard. Clean-up work started immediately after the air strikes, with the intention of resuming production as soon as possible. A target had been set for production of 5,000 cars before the end of 1999.

At the power station, two transformers were damaged during the air strikes. At the time of the BTF visit, both transformers had been removed and placed in a concrete storage area assigned for hazardous waste.

According to factory staff, only one of the transformers had contained PCB oil, but this had spilled onto the surrounding concrete floor and into the wastewater collection system. The concrete around the transformer had clearly been cleaned efficiently, since there were no visible traces of oil. The workers implementing the clean-up operation were reported to have been equipped with protective clothing. The sand used to absorb the spilt oil is now stored in four 200 litre barrels in an area reserved for hazardous waste.

BTF experts were informed that the factory is storing a further 5-6 tonnes of waste oil containing PCBs, as well as 300 tonnes of waste paint. This hazardous waste, generated before the conflict, also requires treatment, but no suitable facilities exist within the Federal Republic of Yugoslavia. The clean-up and reconstruction operations will increase the amount of hazardous waste.



The paint shop was heavily damaged during the air strikes, with only the external walls and roofing girders remaining. The roof itself and the interior of the paint shop were destroyed, and some areas showed signs of fire. At the time of the BTF visit, the factory staff had already started to remove rubble and debris prior to reconstruction. Two transformers inside the paint shop had leaked oil, but the directly affected area had not yet been cleaned. Whilst paints and solvents burnt after the air strikes, the fire apparently did not reach the transformers. BTF experts took oil samples from the concrete floor around the transformers, but unsafe debris prevented access to the transformers themselves.

There are five concrete water tanks (total estimated capacity up to 7,000 m³) beneath the paint shop, some of which contained water at the time of the air strikes, whilst others were empty and being used for storage. One of the tanks is close to the area where transformer oil was leaked. According to the staff, solvents, paints, and PCBs had spilled into the reservoirs. The water tanks form a closed system, with no direct external connection. BTF experts took two samples to assess the presence of pollutants in the water, and specifically to check for PCBs originating from the leaked transformer oil. Earlier analysis by Yugoslavian experts had indicated transformer oil levels of 0.7 mg/l.

According to Zastava personnel, up to 2,500 kg of transformer oil was lost during the air strikes and either evaporated, burned, or spilled into the soil and wastewater system. It was suggested that PCBs and other pollutants flowed into the wastewater channel, and from there into the Lepenica river, due to damage of the water treatment plant. According to the local authorities both the rivers in Kragujevac were relatively clean before the air strikes. They assume that PCBs from the Zastava factory entered the rivers, especially the Lepenica, although drinking water analyses carried out since the conflict have not detected PCBs.

■ BTF samples and results

At the power station, the samples taken from the concrete wall around the transformers and next to a nearby wastewater gully both contained very high levels of PCBs (>1 g/kg), with the tested material containing up to 50% PCB oil. It can also be inferred that some of the PCBs entered the wastewater system. This part of the factory should therefore be considered as an environmental 'hot spot', with potential adverse effects on human health, as well as on the wider environment. A sample of the oil trapped by sand and stored in barrels was found to contain traces of PCBs. Tests confirmed that only one of the two transformers had contained PCB oil.

The samples taken at the paint shop (two samples from the floor around the transformers; one at a distance of 10 m) contained high levels of PCBs and dioxins. The German action level for industrial sites is exceeded by a factor of ten in the case



Destroyed factory hall, Kragujevac

Photo: BTF

of dioxin/furan, and the level of concern for PCB is exceeded by a factor of 1,000. These results confirm that this part of the factory is also a serious environmental 'hot spot'. BTF experts estimated that the affected area covers some 400-500 m² of the concrete floor of the paint shop. Due to evaporation of its volatile components, the toxic residue is extremely viscous, requiring the breaking up and removal of the concrete floor to which it is stuck. Chemical 'finger printing' indicated that the dioxins originated from the leaked transformer oil.

The samples from the upper part of water tanks under the paint shop did not confirm the presence of PCBs. However, air samples from directly above the water indicated the presence of paint and filler solvents. It remains possible that parts of some tanks could be contaminated by PCBs from toxic paint and filler used in former times, or transformer oil from earlier leakages. In any case, BTF experts concluded that the tanks were probably already polluted at the time of the air strikes.

In order to investigate reports of possible PCB contamination of the Lepenica and Velika Morava river system, the BTF Industrial Sites mission took sediment samples from the Lepenica river 4 km downstream of the Zastava factory. A relatively high PCB concentration was found at this site (2.4 mg/kg, compared with the German quality objective for rivers of 0.06 mg/kg), but chemical fingerprinting showed a markedly different profile from the PCB contained in the transformer oils at the Zastava complex. Nickel and chromium were also found in concentrations above German quality objectives for rivers. BTF experts believe that these metals and PCBs are likely to have originated at the car factory.

The BTF Danube mission subsequently took water, sediment and biota samples from several sites on 27 August. Yugoslavian experts reported that a major flood had occurred in June, and that the water level around the confluence of the Lepenica and Velika Morava had been some 2 m higher.

Three sampling sites were chosen by the BTF Danube mission: (a) mouth of Lepenica; (b) upstream of the Lepenica/Velika Morava confluence; (c) downstream of the Lepenica/Velika Morava confluence.

Preliminary analysis of macro-invertebrate fauna suggests that the Lepenica has been adversely affected by pollution from Kragujevac, since the number of taxa is much lower than in the Velika Morava. The number of taxa found in the Velika Morava was higher upstream of the Lepenica confluence, than downstream.

The results from analysis of the water and sediment samples indicated PCB pollution at the mouth of the Lepenica and in the Velika Morava downstream of the Lepenica confluence. The PCBs in the Lepenica reached 18.7 ng/l, about 10 ng/l higher than in the Morava river. PCBs (sum of seven congeners) were not detected in the Morava sediment upstream of the Lepenica confluence, but a level of 22 µg/kg was measured downstream and 52 µg/kg in the mouth of the Lepenica.

Bankside sediment samples from the Lepenica showed high levels of mercury, but this is comparable with the results from the Morava upstream of the Lepenica confluence. The PCB concentration in the sediments from the Lepenica bank and at the mouth of the Lepenica indicate that PCBs had recently been carried by the Lepenica. Detailed analysis concurred with the findings of the Industrial Sites mission that the composition of the PCBs from the Lepenica differed from that of the transformer oil, but that the Zastava complex remained the most likely source of contamination.

Novi Sad *(see map 10)*

Main concerns: Risk that groundwater polluted with petrochemicals from oil refinery could enter drinking water wells; general concern over siting of wells close to refinery.

■ Background information

With 180,000 inhabitants, Novi Sad is the second largest city in the Federal Republic of Yugoslavia. It is located on the Danube river, approximately 70 km north west of Belgrade, in the district of Vojvodina. Novi Sad was heavily targeted during the conflict, with rail and road bridges across the Danube destroyed (together with water pipelines carried by the bridges), and industrial and military facilities damaged or destroyed. One of the principal targets was Novi Sad oil refinery.

The refinery is located on the left bank of the river, 3 km to the north of the city centre and just 2 km upstream of bank filtration wells used for the city's water supply. A shipping canal, with loading and unloading facilities for barges, runs along the southern edge of the refinery directly into the Danube. A system of artificial collecting channels within the refinery compound takes surface runoff to the Danube, via a wastewater treatment plant equipped with oil separators.

The groundwater table beneath the refinery is located only 1-2 m below the surface, and there is no protective barrier to prevent the possible flow of contaminated groundwater towards the bank filtration wells in the event of an oil spillage or other pollution incident. Such a barrier was reportedly planned, but never built. BTF experts, who visited Novi Sad on 23/24 July (Industrial Sites mission) and 24 August (Danube mission), were concerned that drinking water wells had been located so close to the refinery in the first place, and that no special protection measures appeared to have been implemented.



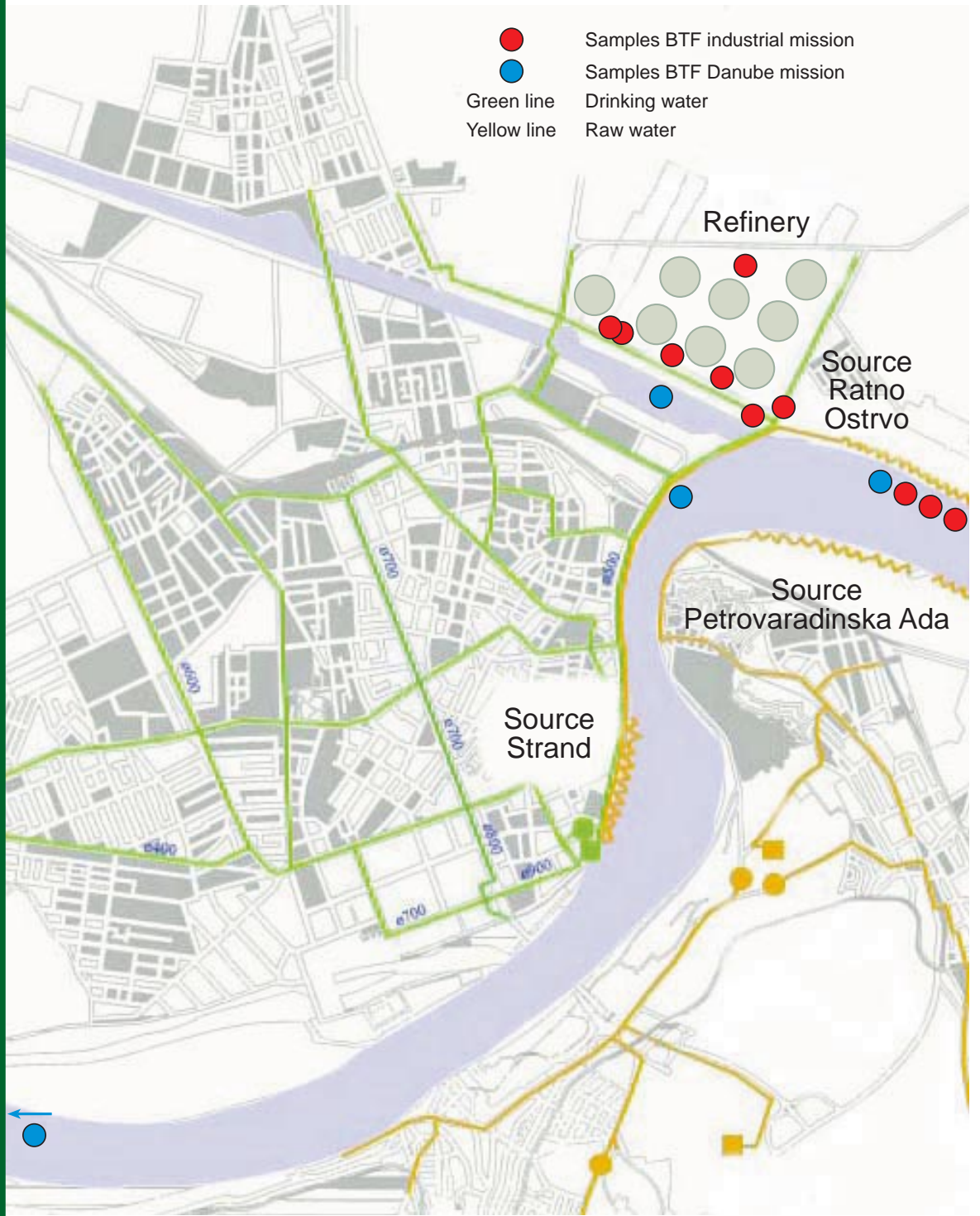
The refinery complex consists of production facilities and storage tanks for crude oil and oil products (mainly gasoline and diesel fuel). More than two-thirds of the 150 tanks were directly hit or seriously damaged by debris during at least twelve NATO air strikes (in the period 5 April – 9 June), and many consequently caught fire or leaked oil and oil products. Nevertheless, technicians were reportedly able to transfer some of the leaking substances to intact storage tanks, thereby reducing leakage into the soil and groundwater. Prior to the air strikes, the refinery staff also removed certain



Destroyed oil tank at Novi Sad

Photo: BTF

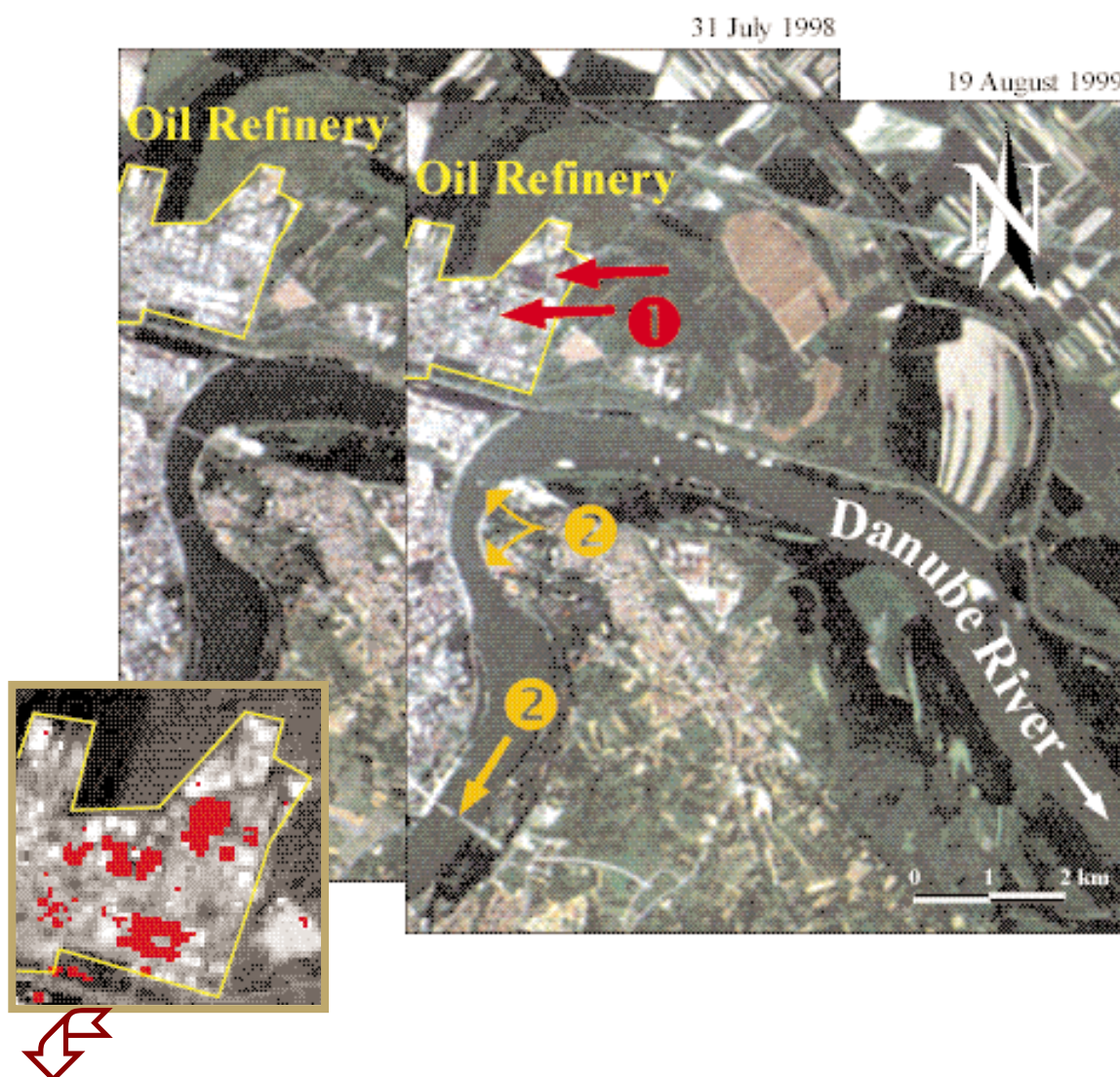
MAP (11) Detailed Map of Novi Sad with BTF sampling sites



Source: Municipality of Novi Sad, and BTF.

oil products that could be harmful to human health if spilt or burnt, such as transformer oil containing PCBs. Production was also accelerated to use up as much as possible of the crude oil, intermediate products and additives, and the final products were shipped to other locations. The remaining oil was mixed with gasoline, so that the tanks would ignite if hit, rather than leak into the soil and groundwater. (See maps 12 and 13).

MAP (12-13) Remote Sensing Assessment of major impacts in Novi Sad



Remote Sensing Assessment of major impacts in Novi Sad Oil Refinery (zoom)

Legend:

- Visible impacts with risk of pollution.
 - Visible impacts with consequences for habitat, but without risk of pollution.
1. The refinery was bombed several times between 5 April and 9 June 1999. Oil tanks were destroyed.
 2. All three bridges across the Danube in Novi Sad were destroyed.

Source:
Pre-war image (background) taken on 31 July 1998 by Landsat Thematic Mapper (TM) sensor at 30m resolution, displayed in "true-colour composite".

Post-war image (inset zoom) taken on 19 August 1999 by Landsat Thematic Mapper (TM) sensor at 30m resolution, displayed in "true-colour composite".

Air pollution is routinely monitored by the Novi Sad Institute of Public Health, and measurements were continued during the conflict. Some of the monitoring data were made available to BTF experts. As a result of fires following the air strikes, parts of Novi Sad and the surrounding districts experienced concentrations of both sulphur dioxide and airborne particles of several hundred $\mu\text{g}/\text{m}^3$ during the fires. However, such concentrations probably did not persist for more than a few hours, since the fires were of relatively short duration, and the direction of the wind was variable. At times, concentrations probably exceeded recommended air quality standards. During the conflict period, the health authorities advised the people of Novi Sad to wash food thoroughly, and not to eat food carrying soot deposits.

About 73,000 tonnes of crude oil and oil products are reported to have burnt or leaked. Local experts estimate that 90% were burnt, with the remainder having leaked into the wastewater collection canals or into the ground.

The Danube was reported to have been heavily contaminated immediately after the air strikes, due to the outflow of crude oil and oil products through the refinery's wastewater collection system. The chief engineer of the refinery told BTF experts that it was very difficult to estimate the actual amount of oil and oil products discharged to the Danube, but that about 130 tonnes of oils had been recovered from the cooling water pumping station at the outflow of the wastewater channel. Fishing was banned in the whole Vojvodina district during the time of the conflict.

Field inspection during the July BTF mission showed the refinery wastewater channels to be filled with crude oil and oil products. In the storage area, crude oil could be seen on the ground due to leakage from damaged tanks, whilst some of the concrete slabs underlying the tanks were cracked and broken. Oil could also be seen in some groundwater-filled bomb craters in the central part of the complex. Visual inspection was also made at a small shallow pond in a low-lying area some 30 m outside the refin-



Meeting with the management of the oil refinery in Novi Sad

Photo: BTF

ery compound, in the direction of the bank filtration wells along Danube. No oil film could be seen on the surface of the pond, and the aquatic flora and fauna appeared to be intact. Similarly, there was no visible oil contamination of the river banks or water surface next to the bank filtration wells.

A spokesperson at the city's water management plant told BTF experts that since the conflict, the eight bank filtration wells close to the refinery had provided 60% of Novi Sad's drinking water. The cutting of pipelines across the Danube meant that the right bank had been isolated from the treatment works; water from wells on this side of the river could not be treated, and 50,000 citizens were no longer receiving piped water. Immediately after the bombing of the refinery, two of the nearby wells were closed as a precautionary measure. Steps were also taken to clean 13,000 m² of ground around the wells, and one of the closed wells had subsequently been re-opened. During the August BTF mission, the municipal Institute of Public Health reported that one well remained closed due to "slightly elevated" mineral oil levels.

On 23 August, the BBC World Service carried a report by the Yugoslav news agency, stating that Novi Sad refinery had resumed limited production of kerosene and diesel for use in schools, hospitals and agriculture.

■ BTF samples and results *(see map 11)*

During the BTF Industrial Sites mission, soil gas and/or groundwater samples were taken from eight different locations, both inside and outside the oil refinery compound. Analysis showed that two of the groundwater samples, and one of the soil gas samples from within the refinery compound contained very high levels of volatile hydrocarbons, indicating the presence of free-phase oil (probably gasoline) on top of the groundwater. Other samples taken within and around the compound showed minor levels of volatile hydrocarbons.

Groundwater samples were also taken from the inflow to the infiltration gallery nearest the refinery wastewater treatment plant, and from the outflow pipe taking water from the infiltration galleries to the municipal waterworks for treatment. Analysis of these showed low- or very low-level contamination of groundwater by volatile hydrocarbons.



Taking soil samples in Novi Sad

Photo: BTF

During the August BTF mission, samples were taken from five sites: (a) Danube left bank upstream of Novi Sad (planned as a reference site for other samples, as the conflict is not thought to have resulted in any significant pollution between the Hungarian border and Novi Sad); (b) Danube left bank just upstream of the canal; (c) Danube left bank downstream of Novi Sad; (d) in the canal very close to its confluence with the Danube; (e) within the refinery compound. The results are summarised below in Table 2.

Interestingly, there were relatively high concentrations of PCBs and PAHs in the bottom sediments upstream of Novi Sad. This was unexpected, as this part of the Danube was reported to be relatively free of pollution, and would not have been affected by the air strikes on the refinery. It seems likely that the results derive from older, chronic pollution of the river. There was no significant difference in mercury levels in the Danube sediments upstream and downstream of Novi Sad (both low), but a significantly higher value was recorded for the canal sediment. Water samples from both the Danube downstream of Novi Sad and from the canal showed insignificant levels of mercury, and total petroleum hydrocarbons.

Table 2: BTF Sampling Summary – Novi Sad (Danube mission)

According to preliminary analysis by BTF experts, the macro-invertebrate fauna sampled upstream of Novi Sad was characteristic of the Middle and Lower Danube. 13 taxa were identified. Downstream of the refinery, 17 taxa were identified, suggest-

LOCATION	SAMPLE TYPE	FINDINGS
Danube upstream of Novi Sad	water, bottom sediments, biota	Used as reference site; relatively high levels of PAHs and PCBs in sediment, indicative of chronic pollution; relatively low level of mercury in sediment.
Danube upstream of canal	water	No significant value for any parameters.
Danube downstream of Novi Sad	water, bottom sediments, biota	Slightly higher concentration of mercury in sediment when compared to upstream value; relatively high levels of PAHs.
Canal	water, bottom sediments	High mercury level in sediment.

ing that there has been no major adverse biological impact (at least in the short term) from pollution after the air strikes. Indeed, BTF experts speculate that the enforced shutdown of the refinery may even have led to local improvements in the aquatic environment, due to a possible reduction in chronic pollution.

Based on field observation and results from sample analysis, the BTF concluded that there was no evidence of significant adverse impacts on the Danube aquatic environment as a result of air strikes on Novi Sad refinery. It is thought that most of the oils and oil products released were burned and that no significant volume entered the river.

Bor (*see map 14*)

Main concerns: Severe air pollution from sulphur dioxide emissions; evidence of chronic environmental damage from copper mine; localised PCB contamination at transformer station.

■ Background information

Two areas were visited by the BTF Industrial Sites mission on 24 July, namely the copper mine and smelting plant outside Bor (a town of 40,000 inhabitants in eastern Serbia), and the nearby 'Jugopetrol' oil depot. These facilities were targeted during NATO air strikes on 15 and 17 May.

The copper industry in Bor consists of a huge open-cast mine and associated smelting plant. During the air strikes, the transformer station providing the site with electricity was damaged. Originally, it housed three large transformers and 160 capacitors, but one of the transformers was emptied and removed prior to the air strikes. The remaining two transformers each contained 25 tonnes of oil. Between 80 and 100 of the capacitors, each holding approximately one litre of oil, were destroyed. According to industry sources, the transformer oil did not contain PCBs, whereas the oil in the capacitors did. This was subsequently confirmed by BTF analysis. At the time of the BTF visit, some capacitors were still on the ground around the transformer station, but most had been removed and dumped.

Other parts of the complex were reported to have escaped serious damage, but the air strikes on the power plant, and consequent reduction of the electricity supply, had interrupted production of sulphuric acid – a by-product of the copper industry.

MAP (14) Location of Bor in the FRY



This had resulted in chronic release of sulphur dioxide gas, normally recovered during the manufacture of sulphuric acid. The BTF team could already smell sulphur dioxide several kilometres from the plant, whilst after 15 minutes at the site itself, the whole group started coughing. Based on the limited information available, the team estimated that emissions could be in the order of 100,000 tonnes of sulphur dioxide per year. However, more detailed information is needed to make a more reliable assessment. Representatives from the University of Belgrade confirmed that pollution from sulphur dioxide gas and heavy metals had been recorded previously at the site.



Inspection of damaged oil tanks

Photo: BTF

The sediment of the river Bor is reportedly 'hard-paved' from the deposition of iron pyrites (FeS_2), whilst the area's soil and surface water was said to be contaminated with heavy metals as a result of decades of mining.

Although no detailed information is available, BTF experts consider the chronic emission of sulphur dioxide from the copper mine to be a serious environmental impact. As Bor is close to the border with Bulgaria, these emissions may have had transboundary effects, according to wind direction. Immediate actions should be taken to reduce the emissions. Reports received through the website of the Bulgarian News Agency indicate that the transboundary Timok river has a history of chronic and acute pollution from the copper mine. A major pollution episode at the end of June 1999 was linked to discharge of wastewater from the mine.

The 'Jugopetrol' oil depot, which mainly served the Bor copper industry, was completely destroyed during the air strikes. However, all eight storage tanks were reported to have been emptied shortly before they were hit. Because the oil depot was empty, only minor fires occurred and no oil was spilled. Nevertheless, some transformers at the depot's electrical station had been damaged or destroyed.



Bor copper smelter and refinery

Photo: NATO

■ BTF samples and results

In order to test for the presence of PCBs at the power plant of the copper mine, BTF experts took a sample from one of the damaged transformers, but no PCBs were found. A second sample, from the soil under one of the leaking capacitors revealed PCBs contaminated with dioxins and furans.

Soil samples (from various depths) were taken from a field next to the oil depot and a sediment sample was taken from a small stream below the site. A further sample was taken from the soil beneath a leaking, damaged transformer at the electrical plant.

The stream sample, taken to assess background levels, revealed extraordinarily high concentrations of heavy metals, notably copper, but also cadmium, arsenic, lead and zinc. BTF experts concluded that these concentrations are not related to damage from the conflict, but are more likely the result of long-term industrial pollution.

The soil sample from near the damaged transformer showed a high content of PCBs (300 mg/kg) and low levels of heavy metals.

Other specific locations visited by the industrial sites and Danube missions

This section summarises the principal findings at other specific locations visited by the 'Industrial Sites' and 'Danube' missions.

Baric (*see maps 15 & 16*)

Members of the Danube mission visited this industrial complex on the banks of the Sava river, west of Belgrade, on 27 August.

The group met the Director General of the 'Prva Iskra' Holding Company, which groups ten chemical and engineering operations within a large industrial com-

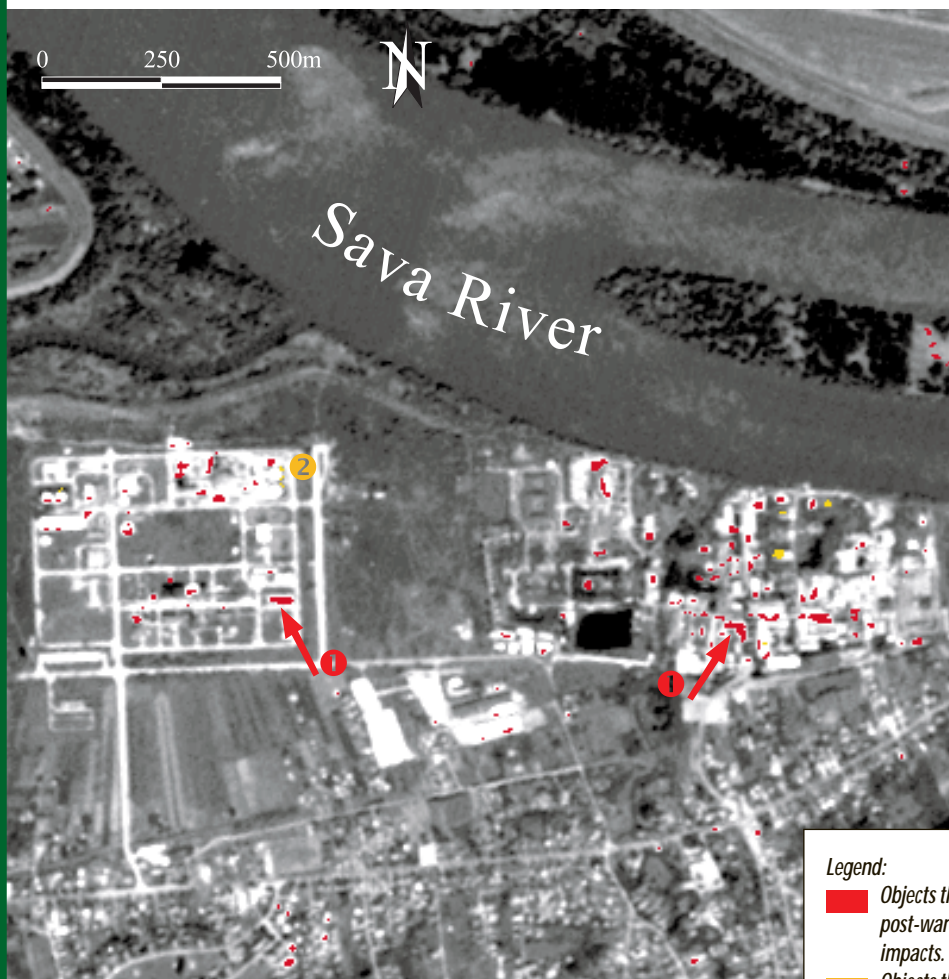
MAP (15) Location of Barić in the FRY



plex. 2,500 workers were employed at the site, which was targeted on four occasions (17 & 19 April, 10 & 20 May). Media reports at the time of the air strikes spoke of major environmental damage. However, the BTF group was told that the main factor of concern was the socio-economic impact.

The BTF experts were shown severely damaged parts of the complex, including the administration buildings, PVC film production line, polyurathene foam production line, power station, and fixtures and fittings factory. Other industrial areas in Barić were reportedly left undamaged by the conflict, and the mission did not visit these locations. In the areas visited, production facilities

MAP (16) Remote Sensing Assessment of major impacts in Barić



Legend:

- Objects that appear brighter in the post-war image, e.g. bomb impacts.
- Objects that appear darker in the post-war image.
- 1. New Buildings.
- 2. Potential Spills



Destruction at industrial complex in Barić

Photo: BTF

appeared to have been completely destroyed. It was frequently stressed to the group that only civilian production had taken place at these facilities. The group was informed that production of the highly toxic chemical TDI, used in the manufacturing of PVC, was stopped in 1992. The group was also informed that twelve large, recently renovated TDI storage tanks had been out of use for many years.

The group was unable to access the Sava river, or the mouth of the channel which flows from the complex into the Sava. One water sample was collected from the channel within the complex, and some soil samples were taken. From this brief visit, BTF experts found no evidence of any major environmental contamination in Barić.

‘Iron Gate’ (Djerdap) dam and reservoir

(see map 17)

Two major dams on the Danube (Djerdap I and II, often referred to as Iron Gate I and II), straddle the border between FRY and Romania. As Iron Gate I is the first dam downstream of Gabčíkovo in the Slovak Republic, it is liable to trap pollutants from a large part of the middle Danube basin.

It is assumed that some of the chemical pollutants released during the air strikes on FRY entered the Danube, either directly, or via tributaries. BTF experts concluded that soluble pollutants would already have reached the Black Sea by the time of the BTF Industrial Sites and Danube missions, even allowing for the retention period of two weeks in the Iron Gate reservoir. The high water levels during the June floods would also have flushed insoluble pollution downstream, to where the flow is retard-

MAP (17) Location of Iron Gate in the FRY



ed by the Iron Gate I dam. At this point, sedimentation accelerates rapidly, so that the reservoir acts as a storage area for pollutants incorporated into the sediment (e.g. organic micropollutants, heavy metals).

Two sites in the vicinity of Ram (close to the FRY/Romanian border, and at the upper part of the Iron Gate reservoir) were visited by the BTF Danube mission on 26 August. Sediment, water and biota (mussel) samples were taken. The sediment and mussel samples contained 0.15-0.19 $\mu\text{g}/\text{kg}$ of mercury, similar to sites further upstream, and revealed the accumulation of organic micropollutants (PAHs and PCBs) as a result of chronic pollution.

Measurement of cesium 137 (Cs-137) to date the layers of the sediment cores in relation to the 1986 Chernobyl disaster, indicated an annual sedimentation rate of 3.0 to 3.5 cm on the left bank and 2.0 to 2.5 cm on the right bank. PAH analysis showed levels varying from 400 to 1,400 $\mu\text{g}/\text{kg}$ for the US EPA 16 PAH compounds, whilst PCBs (seven congeners) varied from 1 to 7 $\mu\text{g}/\text{kg}$ on both sides of the river. Because these pollutants were present in the pre-1986 layers, they indicate significant chronic pollution. The mussel samples contained PAH levels of around 350 $\mu\text{g}/\text{kg}$ dry weight on both sides of the river, while the PCBs were 58 $\mu\text{g}/\text{kg}$ and 31 $\mu\text{g}/\text{kg}$ for the left and right banks, respectively.

The Yugoslavian part of the Iron Gate reservoir is included in Djerdap National Park. A scientist from the University of Belgrade confirmed that, to his knowledge, the air strikes had not resulted in any direct impacts on the park.



The Iron Gate reservoir on the Danube River straddles the border between the FRY and Romania

Photo: BTF

Kraljevo (see map 18)

The 'Beopetrol' oil depot in Kraljevo (population 60,000) was reportedly hit by 80 missiles and bombs during the conflict. The underground oil tanks are situated inside a hill, with a pumping station near the road and railway. The air strikes destroyed the tanks and the pumping station. Almost all tanks were empty when hit; in total, only 565 m³ of diesel fuel was reported to have leaked.

MAP (18) Location of Kraljevo in the FRY



The BTF team noted that at some places the soil next to the tanks was soaked with diesel. As the soil at the site is very permeable, there is a strong possibility that the spilled diesel will reach the groundwater. Sampling showed high concentrations of hydrocarbons next to one fuel tank. There are some houses downhill from the depot, whilst the river Ibe is also close by. It is possible that the diesel will reach wells near the Ibe and possibly the river itself. However, it is unlikely that the oil will reach water intake points 10 km further down the river.

BTF experts advise monitoring of the groundwater and, if high petrochemical concentrations are detected, treatment using on-site biological techniques.

Niš (see map 19)

Niš is the third largest city in the FRY (population 170,000) and is highly industrialised. It was heavily bombed during the conflict. The BTF team visited the electrical transformer station outside the city.

Two transformers were damaged by the air strikes; one had burned out completely. FRY representatives expressed concern that dioxins might have been released by the fire because the transformer oil was thought to contain PCBs. In addition, some isolators were damaged and their oil had leaked into the soil.

MAP (19) Location of Niš in the FRY



Analysis of samples taken by the BTF team show that the oils used in the transformers and the isolators did not contain PCBs. Background samples of the groundwater and soil do not indicate any pollution related to the bombing of the transformer station. The volatile organic compounds (VOCs) that were found in the groundwater sample are probably the result of chronic pollution from industries in Niš.

Novi Beograd *(see map 20)*

The central heating and power plant in Novi Beograd supplies about 1 million people in the Belgrade area with energy for heating and electricity. It is built right on the banks of the Sava river, near the confluence of the river Sava with the Danube. During NATO air strikes, eight storage tanks for heavy oil, and one tank containing gasoline, were destroyed. The gasoline tank and seven of the oil tanks were hit directly, so that most of the content burnt within a very short period of time. 2 to 3 tonnes of heavy oil are said to have been released into the river Sava. According to information obtained during the BTF visit on 26 July, no water intakes or wells are located in the immediate vicinity of the plant. As the air attack occurred towards the end of the heating season, most of the storage tanks were almost empty at the time of bombing.

The storage tanks were all built within concrete-lined basins, so that most of the spilt crude oil and gasoline could not enter the soil. In some cases, the concrete lining was penetrated directly by the missiles or cracks were formed due to the heat of the fires. At these places oil or gasoline might have penetrated into the soil underneath the concrete lining. Very little crude oil could be seen in the concrete basins and around them, and very little was seen on the ground within/around the storage area. There were no signs of oil in the river water or at the riverbank.

Soil gas samples were taken at depths of 2.0 m and 3.8 m at one location between the hit gasoline tank and the river Sava. The water table could not be reached, and therefore no groundwater sample was taken. The result of the soil gas analyses showed extremely high concentration of gasoline vapour in the soil (more than 240,000 mg/l), indicating that the soil and groundwater is probably heavily contaminated with gasoline. This contamination could certainly be a consequence of the NATO air

MAP (20) Location of Novi Beograd and Obrenovac



strike. However, some of the pollution may have come from incidents pre-dating the Kosovo conflict. The contaminated groundwater (and free phase gasoline) will eventually reach the Sava. Based on the available information there seems not to be any direct risk to human health from this contamination but there are likely to be localised ecological effects on the Sava.

Obrenovac region *(see map 20)*

Immediately after the conflict, the FRY experienced heavy rains and extensive flooding. Three villages in the municipality of Obrenovac (Poljane, Konatice and Drazevac) were partly flooded and residents reported an oil film on the water. Thermal power plants and transformer stations in Urovci near Obrenovac and Veliki Crjleni near Lazarevac had been damaged during the air strikes and there was fear that transformer oil, possibly containing PCBs, had leaked and been spread by flood water.

When the BTF team visited Poljane, the water had receded, but it was clear from the houses and agricultural fields that the area had been flooded. The BTF team took samples from the soil, water and sediments from the river Pestan. Results indicate that no PCB oils were leaked and that no alarming levels of pollutants are present.



BTF missions visited agricultural areas near targeted sites

Photo: BTF

Prahovo *(see map 21)*

The BTF team visited the ‘Jugopetrol’ oil depot, which is situated on the edge of the Danube, on the border between the FRY and Romania.

Both the oil tanks and the transformer station situated at the entrance to the site were completely destroyed. Most of the nine oil storage tanks had been empty, and others contained only small amounts of oil at the time of the air strikes. High quality design and construction had helped minimise releases to the wider environment. Of the 2,500 m³ released, some had burned, some was trapped on-site, but some had reportedly leaked into the Danube.

BTF sampling results showed that none of the oils contained PCBs, and would not have released dioxins when burning. Any air and soil pollution would have been confined to the vicinity.

Priština *(see map 22)*

Two sites were visited in the principal city of Kosovo: the plastic factory, now used as a KFOR base, and the ‘Jugopetrol’ oil depot.

The plastic factory was hit by one bomb that penetrated the roof and exploded in the factory hall. Some plastics burned, but the fire was relatively small, as most plastic products in the hall did not melt.

Samples taken by the BTF team did not detect any dioxins and, as the factory was properly cleaned by KFOR, the BTF experts had no special recommendations.

The BTF team could not access the ‘Jugopetrol’ oil depot as it had not yet been cleared of mines, and a detailed assessment

MAP (21) Location of Prahovo in the FRY



MAP (22) Location of Priština in the FRY



could not be made, although it is thought that no significant quantities of oil were spilt. From a visual inspection from outside the depot and an interview with staff, it appeared that both the surface oil tanks and the underground tanks were completely destroyed. The surface tanks must have been completely or almost empty as there are no signs of oil spills and there was only a small fire. A soil sample taken from the roadside did not show any high levels of hazardous substances.

Environmental impacts of the conflict on the Danube River

During and immediately after the Kosovo conflict, one of the principal environmental concerns highlighted by the media and NGOs was the possible damage to the Danube river.

Since most of the key industrial facilities targeted during the air strikes are located either alongside the Danube (e.g. Novi Sad, Pančevo), along major tributaries such as the Sava (e.g. Barič), or on smaller tributaries such as the Lepenica and Morava (e.g. Kragujevac), there were fears that large quantities of hazardous substances could have entered the Danube system, posing risks for people in Yugoslavia and, downstream in Bulgaria and Romania, through drinking contaminated water or eating contaminated fish. The Danube is also one of Europe's most important corridors of biodiversity, meaning that any adverse impacts on human health would almost certainly be accompanied by serious effects on plants and animals and the habitats on which they depend.



The wastewater canal at Pančevo which flows into the Danube River

Photo: BTF



Taking water samples from the Pančevo canal

Photo: BTF

The Danube Basin covers 817,000 km² of 17 Central European countries, (see map 1) and the river therefore receives chronic and acute inputs of nutrients and pollutants from an enormous number of industrial, agricultural and municipal sources. Widespread concern over the unfavourable environmental status of the Danube led to the establishment of the Convention on Cooperation for the Protection and Sustainable Use of the Danube River (also known as the Danube River Protection Convention - DRPC). The DRPC entered into force in October 1998 and, at the time of writing, there are 11 Contracting Parties. It provides the legal basis for international co-operation for environmental management of the Danube Basin.

Implementation of the DRPC is assured through the International Commission for the Protection of the Danube River (ICPDR) and supported by the Environmental Programme for the Danube River Basin (EPDRB). The latter programme was launched in 1991 by the Danubian countries, international organisations, financial institutions and NGOs. Amongst the initiatives established under the EPDRB and co-ordinated by the ICPDR are the Trans-National Monitoring Network (TNMN) which provides common standards for the monitoring of key water quality and quantity parameters throughout the Danube Basin. Unfortunately, the Federal Republic of Yugoslavia is not a Party to the DRPC, and, although there have been technical-level contacts with ICPDR, the FRY does not participate formally in the work of the ICPDR or the TNMN (see also page 81).

Many of the findings of the BTF complementary mission on the Danube river, organised in close co-operation with ICPDR, have already been reported in earlier sections of this chapter (see site-specific findings for Pančevo, Kragujevac, Novi Sad, Barić and Iron Gate reservoir). However, it is worth emphasising here the general conclusions of the mission:

- There is no evidence of an ecological catastrophe for the Danube as a result of the air strikes during the Kosovo conflict.
- However, there are some serious hot spots where contamination by hazardous substances released during the air strikes poses risks for human health and the aquatic

environment. BTF recommendations relating to these hot spots should be implemented immediately.

- There is evidence of long-term chronic pollution of the Danube in the Federal Republic of Yugoslavia. Part of this pollution stems from other Danube countries, but inadequate treatment and storage of hazardous waste products within the FRY is also a significant source of contamination.
- There is an urgent need for the FRY to be integrated within international frameworks for water quality monitoring, pollution reduction and emergency response.

Depleted uranium: findings of preliminary fact-finding mission and Desk Assessment Group

■ Background

Depleted uranium (DU) is a waste product of the process used to enrich natural uranium ore for use in nuclear reactors and nuclear weapons. Compared to natural uranium which has a U-235 isotopic content of 0.7%, the isotopic content of U-235 in DU is partially depleted to about a third of its original content (0.2%).

DU is extremely dense and therefore used in the tips of bullets designed to pierce armour plating. It may also be used in cruise missile nose cones and has been used in the armour of tanks. In addition to its density, DU is also used in military applications because of its relatively low price (e.g. in comparison with tungsten alternatives) and the fact that it is available in huge quantities. Due to the pyrophoric nature of uranium metal and the extreme flash temperatures generated on impact, particles of uranium oxides are formed. Studies have shown that a high percentage of these particles may be of 'respirable' size, i.e. particles that can be inhaled into the deep areas of the lungs. Concerns about the human health implications of exposure to DU are related to both its radiological and chemical properties.

During and after the Kosovo conflict, there were regular media reports that DU had been used in military operations by NATO. Consequently, there are concerns amongst the people of Serbia and Kosovo regarding the possible post-conflict risks to human health and the environment. These concerns are also relevant for assessing the security of field staff from the UN and other international agencies.

A U.S. Department of Defense news briefing on 3 May 1999 (see bibliography no:15), appeared to confirm that depleted uranium weapons had been used by U.S. forces in the Balkans. It was reported that DU shells had been fired from A-10 aircraft. However, it is not known whether U.S. forces fired cruise missiles that contained DU. It is also not known whether other NATO forces used DU weapons in the Balkans. The present state of knowledge regarding DU use in Kosovo and possibly in Serbia is that neither the quantity of DU weapons used, nor the locations of

any targets hit by DU weapons, are known. At the time of writing, the BTF has not received any official document confirming whether or not DU was used during the conflict.

■ The Desk Assessment Group

As part of the BTF process, a special international expert group, the ‘Depleted Uranium Desk Assessment Group’ was appointed to address the issues raised, whilst recognising that health concerns would be more comprehensively assessed by the World Health Organisation.

The group also recognised that scientific evidence is still relatively weak in some areas of the debate surrounding DU, but noted the readiness of the international scientific community to further investigate these issues.

Since little or no information was available on the actual use of depleted uranium in the Kosovo conflict, the expert group was forced to rely on available published information. During a ‘fact finding mission’ organised by BTF, preliminary radiation measurements were taken from destroyed military vehicles, and from around the heavily damaged Police Station and Post Office in Pristina. Whilst no indications of contamination from depleted uranium were found, this does not exclude the possibility that there are DU-contaminated areas in Kosovo.

Through the use of available information, a hypothetical scenario was described, based on a number of conditions and assumptions. By this means, all possible exposures to depleted uranium were discussed and conclusions drawn about their significance.

Since the assumptions have not been verified, the results are subject to some uncertainty. The conclusions and recommendations are therefore framed conservatively.

■ Conclusions

On the basis of known facts, and the results of the assessments made, the Desk Assessment Group reached the following conclusions:

Lack of official information from NATO confirming that DU was or was not used during the Kosovo conflict distorted the prerequisites for the group’s work.

With the given conditions and assumptions, the significant risks are restricted to a limited area around the target. If the depleted uranium is dispersed to larger areas, the corresponding risks are reduced.

If contaminated vehicles and apparent accumulations of uranium pieces and dust are removed from the target area, the possible risks of significant exposures are related to a few specific circumstances that could be avoided by provision of adequate information and instructions.

The possible contamination of land from depleted uranium is not an obstacle to moving back to those villages and regions that were affected by attacks, and at which DU ammunition may have been used, providing that certain recommendations are taken into account (see Chapter 6 of this report).

During and immediately after any attack where depleted uranium was used, some people in the immediate vicinity may have been heavily exposed to depleted uranium by inhalation. The extent of this possible problem might be verified by special health examinations. This is applicable also to potentially affected individuals who are no longer in the area.

The results of these analyses are general in nature and, therefore, applicable not only to Kosovo but also to other areas targeted during the conflict.

A more thorough review is required of the health effects of medium- and long-term exposure to DU.

Consequences of the conflict for biodiversity

■ Background

In a European context, the Balkan region has long been recognized as being of exceptional value for the conservation of biological diversity. The richness of flora and fauna is due to a variety of factors, including the region's location at the junction of several biogeographical areas; its variety of climate, geology and topography; and the still-widespread practice of traditional, low-intensity land uses. The territory of the Federal Republic of Yugoslavia is certainly an important component of the overall richness of Balkan biodiversity. More than a third of all European flowering plants, about half of the fish species, and two-thirds of the bird and mammal fauna have been recorded in the FRY. Approximately 5% of Serbia and 8% of Montenegro are included in officially designated protected areas, such as National Parks, Nature Parks, and Nature Reserves (see map 3).

During and immediately after the conflict, media reports, NGO web sites and official statements by the Yugoslavian authorities regularly referred to serious damage inflicted by air strikes in protected areas. For example, according to a Yugoslav news agency release carried by the BBC on 17 April, the Serbian Ministry of Environmental Protection said that "damage inflicted to ecosystems and habitats of endangered species (in Kopaonik National Park) was irreparable". A booklet entitled 'Natural Heritage Under Bombs', produced in August 1999 by the Serbian Institute of Nature Protection (see bibliography no:114), contains text and photographs cataloguing air-strike damage to protected areas. Whilst these air strikes were often characterized by Yugoslavian sources as outright targeting of natural heritage, NATO stated that only military and strategic sites (especially hilltop telecommunications towers) had been targeted within protected areas.

In view of the international conservation significance of the region and the alarming reports received, it was decided that one of the Balkans Task Force technical missions should be dedicated to assessing the impact of the conflict on biodiversity, notably in protected areas. The sites to be visited were determined by the BTF, on the basis of inputs received from international conservation bodies (e.g. IUCN), discussions with the Yugoslavian authorities (e.g. Serbian Institute for Nature Protection), media reports and assessment of the security situation in Kosovo. KFOR advised against visiting protected areas in Kosovo due to the presence of uncleared minefields and unexploded ordnance. The BTF mission took place from 7-13 September, with an international team of biodiversity experts visiting sites in Serbia and Montenegro.

Fruška Gora National Park, Serbia

Fruška Gora National Park, established in 1960, covers an area of 25,393 ha, approximately 90% of which is forested. It is part of a low massif (100-539 m altitude), surrounded by a plateau descending towards the Danube. The main ecosystem types are mixed broad-leaf forest, and flooded willow and poplar forest, with limited areas of oak woodland, meadows and steppe grassland. The flora is exceptionally rich, containing about 900 vascular plant species. Fruška Gora is particularly important for its orchids, of which there are 20 species. The park also supports rare and endangered mammals, (e.g. lesser mole rat *Nanospalax leuroidon*), and rare nesting birds (e.g. saker falcon *Falco cherrug*, imperial eagle *Aquila heliaca* and white-tailed eagle *Haliaeetus albicilla*).

Expansion of weekend residences, tourism, forest resource use, and conversion of natural grassland to agricultural plots have been reported as conservation problems prior to the conflict. A zoned management plan covers the period 1997–2006, and there is a staff of 300 persons. The park normally receives about 100,000 visitors per year, mainly from Belgrade and Novi Sad.

As a result of NATO air strikes, more than one hundred craters were left in the National Park, damaging two areas of habitat for orchid species categorised as ‘endangered’ in the Red Data Book of Serbia. Many bird species were said to have been affected adversely, and one endemic butterfly (i.e. found only in Serbia), *Leptidea morsei*, was not recorded in 1999.

The BTF team visited four sites within the National Park:

- Close to the park Headquarters: 0.45 ha of forest had been damaged by air bursts. Researchers had complained of skin irritation after working in the affected area.
- Near to telecom tower ‘Iriški Venac’: approximately 30 ha of habitat for four Serbian Red Data Book orchid species (*Orchis purpurea*, *Limnodorum abortivum*, *Epipactis helleborine* and *Platanthera bifolia*) were damaged,

leaving 64 craters. A rehabilitation plan is being developed; most of the craters will be filled in and planted with local species. 6 craters will not be filled, and the natural succession will be studied.

- Large Vrdnik & Duboca stream: area of mixed forest; 3.4 ha were damaged, leaving between 30 and 40 craters.
- Telecom tower 'Crveni Cot': 1-2 ha of mixed forest damaged.

Kopaonik National Park, Serbia

Kopaonik National Park, established in 1981 and covering an area of 11,800 ha, is the northern part of Serbia's largest mountain massif. 1,000 species of vascular plant have been recorded. The main ecosystem types vary with altitude, and include broad-leaved forest, coniferous forest, meadows, alpine scrub, peat bogs and high alpine grassland. Five areas are designated as 'strict nature reserves', including 'Suvo rudiste' and 'Pančić peak', which support three endemic plant species (i.e. plants found nowhere else in the world). Reported conservation problems prior to the conflict were tourism development of the high mountain zone (skiing), and associated depletion of natural resources.

The BTF mission visited three sites:

- Hotel Bačiste: coniferous forest with crater damage and many uncleared, unexploded cluster bombs. The craters will be filled and the area rehabilitated, using local trees.
- Velika Gobelja: sub-alpine meadow; 1 ha damaged by 11 craters. Some of the craters on steep hillsides should be filled to prevent erosion.
- Djurička Ravan: 150 trees, covering an area of about 0.5 ha, were damaged. Rehabilitation and monitoring programmes are planned.

A fourth site, Pančić peak (2,017 m), was not visited, but 5 ha were reported to have been damaged, and the area has not been cleared of unexploded cluster bombs. This is a key area for Kapaonik's three endemic plants: *Sempervivum kapaonicense*, *Viola kapaonicensis* and *Cardamine pancicii*, making it the most sensitive part of the National Park. These endangered species occur in small populations and occupy extreme habitats where regeneration is difficult. The remaining craters will be filled and rehabilitation and monitoring programmes implemented.

Zlatibor, Serbia

Zlatibor is an upland area (altitude approximately 1,000m) proposed for designation as a National Park or Nature Park. The landscape is dominated by open grassland,

with sheep and cattle grazing. One of Serbia's only two colonies of griffon vulture (*Gyps fulvus*) occurs here.

BTF experts visited four sites:

- Tornik: 15 craters, covering around 1.5 ha; some showing signs of small fires
- Ribnica tourist centre: skiing infrastructure destroyed, killing three people; some tree damage in nearby coniferous forest.
- Gradina: hill-top pine forest and meadows. Damage to 0.25 ha of meadow, and 0.9 ha of forest. 5 craters visible.
- Čigota (seen from distance of 1 km); open limestone grassland and beech (*Fagus*) forest. Damage to 2 ha; some craters.

Skadar Lake, Montenegro

BTF experts visited part of this transboundary lake (shared with Albania), but did not see any direct evidence of damage. The following additional information was provided orally concerning possible damage to this and other protected areas in Montenegro:

- Telecom tower in Lovchen protected area hit by cluster bombs, no significant damage reported;
- Bridge in Skadar National Park targeted by cruise missile which missed and landed outside protected area;
- No air strikes reported in Durmitor World Heritage Site;
- Belgrade is said to have raised the issue of Skadar lake with the 'Ramsar' Convention on Wetlands (Skadar is designated as a 'Wetland of International Importance' under the Convention);
- Empty NATO fuel tanks jettisoned over Skadar Lake and Podgorica.

General findings

■ Direct effects of air strikes

The physical damage from the air strikes is significant within limited areas, but of relatively minor importance when seen in relation to the overall size of the protected areas and the ecosystems which surround the hit sites. Fires started by the air strikes were localized, and nothing approaching a significant forest fire was seen. It was not within the capacity of the team to measure the possible chemical residues in and around craters. Fragile ecosystems, such as the alpine grassland in Kopaonik, are likely to take longer to recover than more robust forest ecosystems.

Unexploded ordnance is both an immediate safety issue (risk to staff working in protected areas) and a possible long-term constraint to future tourism in and around

protected areas. A decrease in tourism could reduce income for conservation management activities, as well as threaten the livelihoods of local people involved in traditional harvesting and use of natural resources.

■ Indirect effects

Social, economic and administrative disruption are likely to cause an increase of pressure on natural resources, both within and outside protected areas (e.g. increased use of wood for cooking and heating, due to loss of electricity supplies). Tourism, and the income it generates will also be reduced, though, it should be recalled that development of skiing infrastructure in Kopaonik had been reported as a conservation problem. Experience from reconstruction activities in other Balkan countries shows that future reconstruction in Yugoslavia will place heavy demands on raw materials (e.g. gravel, rock, wood products, water). The Federal authorities responsible for telecommunications facilities within protected areas formerly paid rent to the protected areas concerned (though reportedly not for facilities located in Montenegro). The future of these financial contributions is unclear.

■ General conclusions about effects of air strikes on biodiversity

Genetic effects: at this time, there is no evidence indicating that biodiversity in the protected areas visited is significantly affected at a genetic level. However, this issue was not specifically addressed by the BTF mission.

Species effects: at this time, there is no evidence indicating that biodiversity in the protected areas visited is significantly affected at a species level. The status of several endangered plant species on mountaintop sites damaged during the air strikes may have to await a multiple-season assessment.

Ecosystems effects: at this time, there is no evidence indicating that biodiversity in the protected areas visited is significantly affected at an ecosystem level. No riverine protected areas were visited by this team, but effects on riverine ecosystems from conflict-related pollution were covered by the BTF 'Industrial Sites' and 'Danube' missions.

Institutional effects: a general conclusion of the BTF team is that conservation of biological diversity in the FRY has suffered from the consequences of the conflict and the economic embargo. The institutional framework is weak and under-

resourced, whilst increasing isolation from international programmes and mechanisms has severely limited transboundary cooperation.

Special considerations in relation to Kosovo and human settlements

■ Background

The conflict seriously affected human settlement conditions in both the Republic of Serbia and the Province of Kosovo. To a lesser degree, settlements were also affected in neighbouring Albania and The Former Yugoslav Republic of Macedonia, mainly through the over-use and deterioration of infrastructure and services caused by the influx of refugees from Kosovo. While the most visible effects of the conflict were the destruction of housing, public buildings and infrastructure facilities, there were equally dramatic and perhaps more long-lasting effects on the institutional systems responsible for the administration of human settlements and environment, especially in the Province of Kosovo.

The destruction of housing and the complete disruption of public utilities such as water supplies and wastewater disposal contributed to the rapid deterioration of living conditions in the area of the conflict. Failing to improve this situation before the winter arrives will further exacerbate declines in health and environmental conditions. Furthermore, due to the exodus of Serbs from the Province, Kosovo lost practically all of its experienced personnel from local authorities and utilities. The Province is presently confronted with the challenge of rebuilding a minimum system of local administration to undertake emergency activities and move towards environmentally sustainable development.

■ Establishment of the UNCHS (Habitat) team in Kosovo

The United Nations Mission in Kosovo (UNMIK) is the body established by the UN Secretary-General to administer the Province of Kosovo on an interim basis. UNMIK has four pillars of operation: Humanitarian Activities (UNHCR), Civil Administration (UN), Institution Building (OSCE) and Reconstruction (EU). UNCHS (Habitat) activities are being developed primarily under the umbrella of the Civil Administration pillar.

An initial rapid assessment was carried out by UNCHS (Habitat) in June-July 1999. The mission focused its analysis on: damage to housing and settlement infrastructure; municipal administration; property rights and regularization; and property registries/cadastre.

The BTF carried out a thorough assessment of the environmental policy, legal and institutional framework in Kosovo.

At the time of the mission the EU, US –AID (OFDA), UNHCR and UNDP had already begun activities on the evaluation of damage to housing and infrastructure. These organisations also plan to start emergency reconstruction activities. In this regard, it was decided that the UNCHS (Habitat) mission should not duplicate the work of these organisations on the assessment of housing damage. A brief position paper on the reconstruction of urban housing was submitted to the EU for consideration. Further activities in this area will be subject to the co-ordinating institution for UNMIK's Reconstruction 'pillar' requesting UNCHS (Habitat) support.

Following the initial assessment, it was agreed with UNMIK that UNCHS (Habitat) would field a team of experts in the remaining three key areas: municipal administration, property rights regularisation, and property registries/cadastre. The role of UNCHS (Habitat) would be to make detailed needs assessments, provide initial technical support to UNMIK, and develop proposals for longer-term assistance.

UNCHS (Habitat) fielded five international experts (one on municipal administration, three on cadastre/GIS and one on property rights) and two staff members to work on these issues in July-August.

Working under UNMIK's Civil Administration, the team was successful in achieving its objectives. By providing direct technical support to UNMIK and the municipal administration, UNCHS (Habitat) has become the main source of technical expertise on the above-mentioned issues. Habitat is also providing support to and co-ordination with development programmes under the other pillars.

A programme was formulated for the implementation of activities in two phases. Phase I responds to the immediate needs of the Internal Civil Administration for tools and technical inputs. Phase I started implementation at the beginning of September and is scheduled for completion in November 1999.

Products programmed under Phase I include:

- Municipal administration – guidelines and procedures
- Regularization of housing and property rights – procedures and operations
- Development of a Cadastral Information System in Kosovo – development and implementation of a modern cadastral system supported by a geographical information system (GIS).

Phase II comprises activities that require longer periods of implementation. Phase II activities are to be executed under the umbrella of UNMIK. No funding is currently available for Phase II. UNMIK has endorsed Phase II proposals and it is envisaged that it will submit them to the donor community for funding. The start of Phase II is planned for December 1999 and is expected to have a total duration of 12 months.

■ Findings of UNCHS (Habitat) team in Kosovo

According to assessments carried out in Kosovo (see bibliography no:2), 120,000 houses were damaged in the 29 municipalities of the Province. Estimates for Serbia put the damaged units in the range of 50,000. Most of the damage to housing and buildings in Kosovo has been caused by fire but also by gunfire and artillery. The levels of destruction vary considerably from area to area. It is estimated that over 40,000 units are beyond repair and need complete replacement.

In addition, facilities for public services such as education, health-care, water supply, waste management and electricity have also suffered damage although of lesser magnitude. Roads have not suffered much in direct damage but they have been degraded due to lack of maintenance in recent years and during the conflict. IMG estimates that the damage to housing amounts to EUR1.1 billion. The cost of the damage to basic infrastructure (education, health, energy and water) is estimated at EUR40 million. Most of the reconstruction effort now is focused on emergency repairs to provide a minimum of shelter during the winter. Broader post-emergency housing and infrastructure rehabilitation strategies are currently under development by the United Nations Mission in Kosovo (UNMIK) in collaboration with other national and international organisations.

Environmental and human settlement issues are closely inter-related, since aspects of environmental management (e.g. waste treatment, sanitation) rely to a large extent on efficient municipal administration and a functioning system of property registration. Hence, there has also been great damage through the collapse of the administrative systems that enable environmental services to function. The assessment of conditions in Kosovo indicate that issues such as the administration of the housing sector and property transactions and ownership; property registries and cadastre; spatial planning and municipal administration are at the core of the continuous deterioration of conditions in Kosovo. Between 1995 and June 1999, public administration in the Province was controlled by Serbian personnel and excluded the full participation of Albanians. This contributed to the overall deterioration of administrative and physical conditions.

According to the former Co-ordinator of the Cadastre Centre in Kosovo, 80% of the cadastral information was removed from the Province prior to or during the conflict. However, the initial assessment carried out by UNCHS (Habitat) covering information on over half of the 29 municipalities in the Province indicates that there is a large body of information on property registration and associated records. The assessment has shown that only a few municipalities have a functioning digital cadastral system. No digital maps are available and only a few copies of printed cadastral maps are to be found. There are other documents/records related to the cadastre that can be used to verify and correlate information on ownership and boundaries; these documents are, however, dispersed in several locations and need to be classified and inventorised.

Most municipal cadastral offices are presently not operating due to the lack of records, staff and equipment. In the absence of access to this information it is impossible to conduct normal transactions in real estate and, more importantly, to target assistance for housing reconstruction. Urgent action is required to start the development of a comprehensive and modern cadastre that will be vital to support UNMIK in resolving property-related disputes, bring the real-estate market back into operation, and provide a basis for sound environmental management.

On the issue of property tenure and transactions, the assessment has found that the Province lacks a legislative and policy framework on housing and property consistent with accepted international standards. There is a large number of irregular housing and property transactions brought about by the application of discriminatory legislation. This is compounded by the rapidly growing number of unlawful housing occupations and forced property sales.

As serious as these problems are, the people of Kosovo have no formal legal remedies allowing the regularization of housing and property transactions and relations. The housing and property sectors are currently almost unregulated and this must change if democracy and the rule of law are to prevail in the Province. While the local judiciary and municipal governments may eventually be able to provide some of the required solutions, their capacity appears insufficient and the establishment of an ad hoc mechanism to deal with these issues is considered necessary.

Regarding the municipal administrations, the assessment found that management structures in the province need urgent revision. There is not much clarity on the responsibilities of the municipalities and there are many overlapping functions within their structures. Their capacity for effective coordination and setting priorities is weak, and accountability too diffuse. The same vertical model structures are currently being proposed through Kosovo regardless of the size of the municipality or of actual staffing requirements. There are no municipal revenue-generation mechanisms in place. The current lack of charges for utilities will potentially create a non-payment culture the longer it continues. The lack of a functioning licensing system means that the municipalities totally lack an income base and control over illegal behaviour.

Lack of effective local administration also affects environmental management. In addition to there being a lack of local expertise on this issue, UNMIK has yet to develop effective capacity, linked with other levels and sectors of the civil administration, in this field.



Recommendations

The following recommendations are aimed at highlighting activities that are urgent to halt or mitigate the further degradation of the state of the environment in FRY, and diminish the risks to human health.

The main responsibility for clean-up efforts rests with the FRY authorities. Nevertheless, the international community must be ready to take action when urgent humanitarian needs are in question, or when and where the democratic development of the entire region could be enhanced.

An unhealthy and dangerously polluted environment does not provide a sound basis for the well-being of human populations or for business and trade. However, the implementation of the recommendations will not only depend on the availability of funds; political concerns related to the international embargo of Serbia will also have to be taken into account. In the current context, international assistance for reconstruction will only be available for the Republic of Montenegro and Province of Kosovo. However, the hot spots of special environmental concern identified in Serbia will require immediate action from a humanitarian point of view.

The recommendations made by BTF are based on the findings of the technical field missions, Desk Assessment Group, and extensive discussions within an international network of individual experts and organisations. They also take into account ongoing initiatives, such as the projects implemented by FOCUS.

The recommendations distinguish between short-term actions aimed at immediate clean-up, and longer-term recommendations, also taking institutional strengthening, reconstruction and resumption of industrial activities into account. Normal economic activities, including production at some of the contaminated sites, have begun to resume. This could aggravate the situation, and the BTF emphasises that clean-up and careful handling of contaminated material has to be given a particularly high priority at these sites.

Industrial Sites

■ Immediate Action

The first four paragraphs refer to all of the heavily-contaminated industrial sites; specific recommendations for the major hot spots follow.

- 1 Detailed groundwater studies and monitoring of drinking water should be conducted to determine whether pollution has contaminated sources of drinking water (this recommendation should be implemented for all of the hot spots - Pančevo, Kragujevac, Novi Sad and Bor - and other sites potentially at risk).
- 2 Surface soil contaminated with heavy oil, PCBs, heavy metals and other hazardous substances should be given remedial treatment and, if necessary, removed from all industrial sites (i.e. Pančevo, Kragujevac, Bor, Novi Sad, Barić, Kraljevo, Niš, Novi Beograd, Obrenovac region, Prahovo and Priština), and securely stored (see below).
- 3 A detailed waste disposal plan should be developed and implemented for every site, and for the FRY as a whole. Immediate action should be taken for the secure storage of hazardous waste (including medical waste), even if facilities for its final treatment or disposal are not yet available (see also page 80).
- 4 Monitoring of air, water, soil, agricultural products and human health, as well as communication of the results of such monitoring to the population around all industrial 'hot spots', should be continued, and, if necessary, increased.
- 5 **Pančevo:** urgent remedial action should be taken at the wastewater canal heavily contaminated with EDC and mercury. Immediate clean-up of the mercury spill at the petrochemical factory should also be implemented. Detailed recommendations are to:
 - a) consider the wastewater canal as an environmental hot spot, with special risk to the aquatic environment of the Danube, and implement the following



Damaged VCM tank at the petrochemical plant in Pančevo

Photo: BTF

measures as soon as possible:

- complete isolation of the canal water and sediments from the Danube by construction of a physical barrier (alternative wastewater facilities to be implemented at the same time);
- removal of oil attached to the banks and vegetation along the canal and around its confluence with the Danube (to be done before next Danube flood period);
- detailed mapping of EDC, oil and mercury distribution in the canal;
- use of a suction dredger to remove the bottom sediments contaminated with EDC (based on the results of EDC mapping) ;
- secure disposal of the contaminated sediments.

- b) remove and securely store the metallic mercury on the floor of the petrochemical plant; recover as much of the main spillage as possible by suction, and use chemical binding to assist with removal of residual quantities.
- c) implement in situ remedial actions to clean up the groundwater which is highly contaminated with chlorinated solvents.
- d) clean collector channels at the oil refinery to prevent further potential contamination of the Danube with oil and oil products.

6 Kragujevac: at the Zastava car plant, action should be taken to improve storage of the significant quantities of hazardous waste generated by operation of the factory, as well as by the air strikes. Immediate steps should be taken to clean up PCB and dioxin contamination. Specific recommendations are to:

- a) inform the managers of the site about the contaminated areas and associated risks, in particular with regard to the security of workers conducting the clean-up operations;
- b) remove the concrete floor of the paint works with extreme care and as thoroughly as possible to a depth of at least 5cm;
- c) place the PCB- and dioxin-bearing deposits and the broken concrete in secure, dry storage. Ideally, the material would be taken to a hazardous waste treatment facility;
- d) empty the water tanks before any major clean up and reconstruction of the paint shop is considered. Carry out a more detailed study to gain additional information about the pollutants present in the different tanks. Do not

release the water from the tanks into the river or wastewater system. Take urgent measures to prevent rainwater from increasing the volume of the tanks or causing them to overflow;

- e) use available techniques to treat the polluted water in the tanks, for example through some type of filtration or through adsorbing materials (like active carbon or a peat bed).

7 Novi Sad: detailed studies should be carried out to determine whether oil and oil product pollution has contaminated the groundwater. Specific recommendations are to:

- a) carry out further investigations within the refinery compound. Soil contaminated with heavier oils should be removed and disposed of under controlled conditions, using recovery technologies wherever possible. Soil and groundwater contaminated by lighter, more volatile oil products should be treated using in situ methods;
- b) drill an observation well to confirm that free-phase gasoline is floating on top of the groundwater. Any floating gasoline should be removed using in situ methods, contaminated groundwater should also be cleaned up using in situ treatment;
- c) continue abstraction from the well which was closed (well test and water quality sampling should also be carried out periodically), so that contaminating substances (oil, etc.) are also withdrawn, thereby reducing the risk of contaminating adjacent wells (hydrological barrier);
- d) carry out appropriate tests to assess the hazard posed to the drinking water supply of Novi Sad through location of wells close to the oil refinery.

8 Bor: immediate action should be taken to prevent further releases of large amounts of sulphur dioxide gas in the atmosphere; damaged transformers and capacitors containing PCB oils should be removed and stored securely. Specific recommendations are to:

- a) resume the production of sulphuric acid, thus binding the sulphur dioxide now released into the atmosphere;
- b) treat the leaking capacitors and transformers, together with contaminated soil, as hazardous waste and deal with it accordingly.



Environmental impacts on the Danube

The result of laboratory analysis of samples taken from the Danube sediment and biota revealed significant chronic pollution, both upstream and downstream of the sites directly affected by the conflict. It is therefore strongly recommended that:

- 9 Follow-up monitoring be carried out with extension of the sampling to the confluence of major tributaries, e.g. Drava, Sava, Tisa and Morava rivers, as well as to the upstream (Hungarian) and downstream (Romanian – Bulgarian) reaches of the Danube.
- 10 An appropriate monitoring programme should be developed and implemented. This should be based on existing programmes but designed to be fully compatible with the ICPDR's TransNational Monitoring Network for the Danube River Basin (also see page 81).
- 11 Significant long-term efforts should be made to reduce both acute, point-source pollution and chronic pollution from industrial and urban effluent through investment in appropriate production and waste management processes.

Depleted Uranium

■ Immediate Action

- 12 It is necessary to obtain information from NATO confirming if, how and where DU was used during the Kosovo conflict. This is a prerequisite for verifying initial risk assessments, making necessary measurements, and taking precautionary actions.
- 13 Further measurements should be organised as soon as possible to identify possible contamination and verify assumptions. Highest priority should be given to finding pieces of depleted uranium, heavily contaminated surfaces and other 'hot spots'. Measures should be taken for the secure storage of any contaminated material recovered.
- 14 A thorough review of the effects on health of medium- and long-term exposure to depleted uranium should be undertaken under the auspices of the World



Health Organisation.

- 15 At places where contamination has been confirmed, measures should be taken to prevent access. The local authorities and people concerned should be informed of the possible risks and appropriate precautionary measures.

■ Monitoring

- 16 Appropriately designed health examination programmes should be established in areas where use of DU is confirmed.

Biodiversity

■ Immediate Action

- 17 Clearance of unexploded ordnance remaining in protected areas (primarily cluster bomblets) should be undertaken and measures implemented to issue warnings and restrict access to certain areas.
- 18 There is an urgent need to rebuild the nature conservation infrastructure and management system in Kosovo; as a first step, efforts should be made to recover all relevant information on biodiversity in the province.



Bomb craters in Fruška Gora National Park Photo: BTF

■ Management and Monitoring

- 19 Management plans should be prepared and implemented for each of the damaged sites. The planning process should take environmental risks of reconstruction activities into account. The threats to national parks posed by tourism, changes in traditional land management practices and other legal and

illegal economic activities should be assessed.

- 20 Priority should be given to establishment of the proposed Prokletije National Park, both because of its exceptionally high biodiversity and its significant potential role as a transboundary ‘peace park’ (Kosovo-Montenegro-Albania). Preparations and research on the Kosovo and Montenegro sectors were well advanced prior to the conflict.
- 21 Long-term monitoring of the impacts of the conflict on protected areas, including the effects of reconstruction activities, should be conducted.

Human Settlements Priorities for Action in Kosovo

- 22 Medium-term housing rehabilitation strategies should be developed in close consultation with local stakeholders. Given the particular conditions of Kosovo, such strategies should enable the recovery of local capacities in the construction industry, building materials production and the operation of financial systems. Establishing traditional programmes of assistance that will prolong Kosovo’s dependence on external support.
- 23 An assessment should be made of the resources available within Kosovo, including the income due to remittances and trade, that can be put at the service of rehabilitation activities. Such assessments are absolutely necessary before a credible rehabilitation strategy is in place, both to ensure the maximum use of local capacities and to target such programmes to the most needy sectors of the population.
- 24 As part of BTF/UNCHS (Habitat) on-going support activities to UNMIK, medium-term technical support programmes should be developed in the areas of:
 - production of guidelines and procedures for municipal administration;
 - the regularisation of housing and property rights and the establishment of an independent mechanism to deal with these issues;
 - the development of a cadastral information system and the upgrading of

property registries and documentation.

Long-Term Institution Building

- 25** The capacities of the environmental administration in the FRY, the Republic of Serbia, the Republic of Montenegro and the Province of Kosovo, as well as at the municipal level, should be strengthened by providing sound economic frameworks and targeted training activities.
- 26** The environmental Monitoring System in the FRY should be redesigned and strengthened at both the federal and local levels, focusing on water, air, biodiversity and human health, and, in particular, targeting environmental hot spots. The environmental information network should be strengthened by establishing an internationally (i.e. EEA, UNEP, international environmental conventions) compatible system.
- 27** The potential benefits of FRY participation and full integration, when political circumstances permit, in the work of international organisations and regional environmental processes (Environment for Europe, Danube Convention, etc.) should be recognised (see pages 80-81 for information on Basel and Danube Conventions, of special relevance to BTF findings).
- 28** The private sector (business, industry) should be more involved in environmental planning and take environmental considerations into account during reconstruction and when taking up industrial activities.
- 29** The non-governmental sector should be strengthened; for example, by raising environmental awareness, improving access to environmental information and promoting greater involvement in environmental policy-making locally, nationally and internationally. This will strengthen civil society and contribute to greater stability of the entire region.
- 30** The United Nations Mission in Kosovo (UNMIK) should develop capacity on environmental issues and integrate environmental considerations into other components of its activities.



Basel Convention on the control of transboundary movements of hazardous wastes and their disposal

The Basel Convention, which was adopted in 1989 and entered into force in 1992, is a global legal instrument developed by UNEP in collaboration with the international community to ensure the protection of human health and the environment against harmful effects caused by exposure to hazardous wastes. The Convention is not only an instrument for the control of the transboundary movements of hazardous wastes, but also for the environmentally sound management of such wastes. At the time of writing, there are 130 Parties to the Convention.

The Balkans Task Force has identified hazardous wastes as defined under the Basel Convention in several places in Yugoslavia, including both Serbia and Kosovo. These wastes include inter alia mercury, PCBs and soil contaminated by oil products. Military waste may contain hazardous wastes according to the definition of the Basel Convention if it is explosive, flammable, ecotoxic or liable to cause liberation of toxic gases in contact with air or water, and provided that it belongs to one or more of the categories of wastes listed in Annex I of the Convention.

In order to dispose of such wastes in accordance with the provisions established under the Convention, the treaty aims to ensure that disposal is undertaken as close as possible to the source of generation of the wastes, so that transboundary movements are minimised. In relation to the wastes identified by the BTF, it is evident that some were already in the area before the conflict started, though people and the environment might have been exposed to them as a result of the conflict. Other wastes related to military activities could have emanated either from within or from outside the region.

In view of the above-mentioned obligations and provisions of the Basel Convention, the first task in relation to the treatment and disposal of those wastes is to decide whether there might be any possibility to do this within Yugoslavia in an environmentally sound way.

If this is not possible, it will be necessary to transport the hazardous wastes to another country, which has appropriate facilities for environmentally sound disposal. This is likely to be the case for PCBs and mercury, for example. If transboundary movement is required, the distance should be minimised. States such as Finland, France, Germany, the Netherlands, Switzerland and the UK might have facilities for the treatment of some of these wastes. However it should be noted that any transboundary movements of hazardous wastes are subject to approval by importing and transit states through a notification procedure in accordance with the provisions of the Basel Convention. In this connection, it should be noted that Yugoslavia is not a Party to the Convention. Therefore, in order to export waste to a country which is a Party of the Convention (e.g. any of the above-mentioned countries), a bilateral agreement would have to be concluded with the recipient country, in accordance with the provisions of Article 11 of the Convention.



The Danube River Protection Convention (DRPC)

In June 1994, in Sofia Bulgaria, eleven of the Danube Riparian States and the European Union signed the Convention on Co-operation for the Protection and Sustainable Use of the River Danube (known for short as the Danube River Protection Convention or 'DRPC'). The Convention is aimed at achieving sustainable and equitable water management in the Danube basin. The signatories have agreed:

- on "conservation, improvement and the rational use of surface and ground waters in the catchment area";
- "control of the hazards originating from accidents involving substances hazardous to water, floods and ice-hazards"; and
- to "contribute to reducing the pollution loads of the Black Sea from sources in the catchment area" (Article 2.1.)

The signatories have also agreed to co-operate on fundamental water management issues by taking:

- "all appropriate legal, administrative and technical measures to at least maintain and improve the current environment and water quality conditions of the Danube river and of the waters in its catchment area and to prevent and reduce as far as possible adverse impacts and changes occurring or likely to be caused." (Article 2.2.)

For this purpose, the Convention calls for regional co-operation in the fields of: prevention, control and reduction of transboundary impacts, specific water resource protection measures, emission limitations, water quality objectives and criteria, emission inventories, action programmes, progress reviews, and monitoring (Articles 5 – 9).

The main bodies established under the DRPC are: the Conference of the Parties; International Commission for the Protection of the Danube River (ICPDR); Permanent Secretariat to the Commission; Expert Groups; ad-hoc Groups, and a special supporting body – the Programme Management Task Force (PMTF). The Conference of the Parties, which will convene every few years, is the highest-level body established by the DRPC, and provides the overall policy framework for activities under the Convention.

In May 1998, the last of the nine ratifications required under Article 27, triggered the entry into force of the DRPC with effect from 22 October 1998. As of 5 October 1999, ten Danube States (Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Romania, Slovak Republic and Slovenia), together with the European Communities, had become Contracting Parties to the Convention. The ICPDR is the main decision-making body under the Convention. It meets either in Plenary (which approves the annual work programme and budget) or as the Steering Group (which provides the management of technical activities). The first meeting of the ICPDR took place in Vienna from 27 to 29 October 1998.

7

Annex I

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The following is a comprehensive listing of documents received and used by the BTF during its work. Many of the documents are not specifically referenced in the text of this report, but may be of use to readers wishing to obtain further information.

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Annex II

Annotated Glossary

Ammonia (NH₃) – Ammonia is a chemical that is formed in nature, for example, from the natural breakdown of manure and dead plants and animals. It is present in water, soil and air and acts as a source of nitrogen for plants and animals. Ammonia is also produced industrially, largely for use as a fertiliser. A smaller proportion is used to manufacture plastics, synthetic fibres and explosives. It is not persistent in the environment, but unusually high levels in the environment, such as at hazardous waste sites, are associated with anthropogenic activities. Ammonia is a gas and is also soluble in water where it forms ammonium. Exposure to very high levels of ammonia gas is fatal. Death may occur immediately or from secondary complications after a few weeks. High exposure may cause burns to the skin, eyes, throat and lungs, which, if serious, may cause permanent blindness, lung disease or death. Short-term exposure to lower levels of ammonia causes nasal and throat irritation. In laboratory animals, long-term exposure to low levels of ammonia causes inflammation and lesions of the respiratory tract.

Angiosarcoma of the liver – On repeated exposure to vinyl chloride vapour, usually over many years, some workers have developed a type of cancer of the liver called angiosarcoma (ASL). ASL is rare among the general population.

Arsenic (As) – Arsenic is a naturally-occurring element. There are different forms of inorganic and organic arsenic. Arsenic is produced during copper and lead smelting and is used in the chemical industry, for example in pesticides. If released into the environment, arsenic does not break down but may change to a different form. If released into the aquatic environment it becomes bound to sediments, and some fish and shellfish build up arsenic in their tissues. Arsenic has been known as a human poison since ancient times, and large ingested doses cause death. Workers exposed to inorganic arsenic dusts in air experience irritation to mucous membranes of the nose and throat. Long-term exposure of workers to inorganic arsenic increases the risk of dying from cardiovascular disease and contracting lung cancer. Arsenic is classified as a human carcinogen.

Benzene (C₆H₆) – Benzene is found in the environment due to both human activities and natural processes. It is mostly produced from petroleum sources and it is used in the manufacture of many other chemicals. Short-term exposure to high levels of benzene can cause irritation to mucous membranes, restlessness, convulsions

and depression. Death may follow from respiratory failure. Exposure to lower levels over long time periods can cause bone marrow suppression, which can, albeit rarely, lead to leukaemia. Because of this benzene is listed as a known human carcinogen.

Biota – Collectively, the plants, micro-organisms, and animals of a certain area or region considered as a total ecological entity.

Biological diversity – The variety of different species, the genetic variability of each species, and the variety of different ecosystems that they form.

Bioslurping – Technique applied for groundwater cleanup. Bioslurping involves the simultaneous application of vacuum enhanced extraction/recovery, vapour extraction, and bioventing to address light non-aqueous phase liquid (LNAPL) contamination. Vacuum extraction/recovery is used to remove LNAPL along with some groundwater, vapour extraction is used to remove high volatility vapours from the vadose zone, and bioventing is used to enhance aerobic biodegradation in the vadose zone and capillary fringe.

BTF – The Joint UNEP / UNCHS (Habitat) Task Force on the Balkans (BTF) was established on 5 May 1999 by UNEP's Executive Director, in order to monitor the environmental and human settlements impacts of the ongoing Balkans conflict.

Cadastre – a registry of real estate property in a given administrative area. A cadastre provides information on a property and its ownership. It is used for municipal administration purposes, including property transactions, taxation, and urban/land use planning and management.

Cadmium (Cd) – Cadmium is a heavy metal. Small amounts of cadmium enter the environment from the natural weathering of minerals, but most is released through human activities. The most often mentioned sources entering the aquatic environment are industrial effluents and sewage. Cadmium has no biological function, and is highly toxic to both animals and plants. The low concentrations of cadmium usually encountered in the environment do not cause acute toxicity. However, elevations above background concentrations can have deleterious effects on plant and animal health. For humans, eating food or drinking water with very high cadmium levels can severely irritate the stomach, leading to vomiting and diarrhoea. Eating lower levels of cadmium over a long period of time can lead to a build-up in the kidneys causing kidney damage and weakening of bone. The US Environmental Protection Agency has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

Capacitor – an electrical circuit element consisting of two conducting surfaces separated by a dielectric or insulating material, such as glass, ceramic, mica, or other non-conducting material, for storing electrical energy. Also called a condenser.

CBUs – cluster bomb units.

Chlorinated Solvents – Chlorinated solvents are organic compounds containing chlorine. The majority are volatile. They are manufactured for a number of uses

including the manufacture of chemicals, as degreasing agents, and as solvents for oils, fats, varnishes, rubber, tars, waxes and resins. Some are also produced as by-products of the manufacture of PVC.

Chlorine (Cl₂) – Chlorine is a gas that is produced by industry by passing electricity through a salt solution. The chlorine industry manufactures chlorine primarily to combine with petrochemicals to produce organochlorine products such as solvents, pesticides, plastics (especially PVC) and many other chemicals. A much smaller proportion of the chlorine gas is sold outside the chemical industry, primarily as bleach in the production of paper and a very small proportion for drinking water disinfection. Chlorine gas was used as a chemical weapon in the First World War. Exposure can be rapidly fatal. There have been numerous releases of chlorine from industrial facilities, many of them resulting in deaths. Long-term exposure to lower levels of chlorine is reported to cause respiratory complaints and corrosion of the teeth. Chlorine is a potent irritant to the eyes, lungs and skin. Chlorine is not carcinogenic in animals or humans. However, chlorination of drinking water results in the formation of other chlorinated organic substances in the water which are reported to increase the risk of bladder and rectal cancer.

Chromium (Cr) – Chromium is a heavy metal for which there are different forms in existence, for example, chromium (III) and chromium (VI). Chromium (III) is an essential nutrient that is required for normal energy metabolism, whereas chromium VI is non-essential and toxic. Information on the effects of elevated environmental levels on aquatic organisms, fish and wading birds is limited. In humans, ingesting higher than recommended levels (both III and VI forms) over long periods of time, for example from contaminated fish, can result in adverse health effects including gastro-intestinal irritation, stomach ulcers, kidney and liver damage. Chromium (VI) is classified as a human carcinogen. Exposure to high levels of chromium (VI) in the workplace over long time periods can cause irritation of the nasal and respiratory membranes, and is believed to cause an increased incidence of lung cancer.

Cluster bombs is a generic term for a number of different cluster bomb units (CBUs). Cluster bombs are used as anti-tank or antipersonnel weapons. Each cluster bomb contains many small bomblets. These bomblets are dispersed when the cluster bomb breaks open, at a predetermined height above the ground. This has the effect of blanketing a large area with shrapnel-spewing explosive ordnance.

Copper (Cu) – Copper is a heavy metal. Some intake of copper is necessary for good health. However, very large single or daily intakes of copper, or prolonged exposure to lower levels, can have adverse effects on human health. Consumption of food or drinking water containing elevated levels of copper can result in vomiting, diarrhoea, stomach cramps and nausea.

Depleted Uranium (DU) – Uranium having less than the natural 0.7% U-235. A by-product of uranium enrichment, the most common chemical form of which is

depleted uranium hexafluoride (DUF6). It generally has 0.25-0.30% U-235, the rest being U-238.

Desk Assessment Group (DAG) – An inter-agency ‘Desk Assessment Group’, involving UNEP, WHO, IAEA and the Swedish Radiation Institute and working under the umbrella of the BTF, has been looking into the issue of the possible use of depleted uranium and impacts thereof in the Kosovo conflict.

Dioxins – The terms ‘dioxin’ or ‘dioxins and furans’ generally refers to a group of 210 chlorinated pollutants, the polychlorinated dibenzo-p-dioxins and dibenzofurans. Dioxins are organochlorines (substances based on carbon and chlorine) and are regarded as the world’s most toxic organic pollutants. They are produced as by-products of industrial processes involving chlorine, and all types of incineration. They are very persistent (long-lived) in the environment and build up in the bodies of animals and humans and remain there for many years. In the general population, the greatest intake of dioxins occurs through the consumption of fatty foods including meat, fish and dairy products. The most toxic of the 210 dioxins and furans, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is used as the toxicological model for the group and has been extensively researched. It is classified as a human carcinogen. In addition to causing cancer, animal studies have shown that it causes damage to the nervous system, the immune system, the reproductive system and malformations in the unborn. A draft review of TCDD by the US Environmental Protection Agency concluded that some of the more sensitive effects could be occurring at the levels of exposure that are experienced by ordinary men and women. In particular, there is concern that dioxins may cause adverse effects during development in the womb in humans and animals that are irreversible.

DU – see Depleted Uranium.

EC – European Commission.

ECHO – European Community Humanitarian Office.

EDC (C₂H₄Cl₂) – Full chemical name 1,2-dichloroethane. It is used in the manufacture of PVC. It has toxic effects on aquatic organisms including many species of fish, algae and water fleas at concentrations of about 100 mg/l. Some more sensitive species may die as a result of exposure to lower concentrations of only 1 mg/l. The earthworm is also sensitive to EDC toxicity. EDC has a number of different toxic effects on experimental animals. EDC is highly volatile and in humans, inhalation of high concentrations can upset the nervous system and gastrointestinal system causing dizziness, nausea and vomiting. The liver, kidney and adrenal gland may also be damaged.

EEA – European Environment Agency.

Endemic – Indigenous to, and restricted to, a particular area; as, for example, an endemic plant or animal.

EPDRB – Environmental Programme for the Danube River Basin.

EU – European Union.

EU Phare – The European Union's Phare programme provides grant finance to support its partner countries in Central and Eastern Europe (CEE) to the stage where they are ready to assume the obligations of EU membership. These countries are Albania, Bosnia-Herzegovina, Bulgaria, Czech Republic, Estonia, FYROM, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia. Apart from the CEE co-operation with the European Environment Agency, the multi-country environment programme of Phare supports projects in a wide number of areas including the Black Triangle, the Danube Basin, the Black Sea and the Baltic.

FOCUS – 'Focus' is the name given to the joint humanitarian aid operation mounted by the Russian Federation, Greece and Switzerland on 28 April 1999. These countries decided to unite their efforts to bring aid to all victims of the conflict in the Federal Republic of Yugoslavia (Serbia – incl. Kosovo - and Montenegro). On June 5, 1999 Austria joined Operation 'Focus'.

FYROM – Former Yugoslav Republic of Macedonia.

FRY – Federal Republic of Yugoslavia.

Furan – See dioxins.

GIS – A geographic information system (GIS) is a computer-based tool for mapping and analysing features and events on the earth's surface. GIS technology integrates common database operations such as query and statistical analysis with the unique visualisation and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

GRID – UNEP's Global Resource Information Database, a network of information centres providing decision-makers and the public with improved access to high-quality environmental information. There are currently 16 GRID centres operational world-wide, the European nodes being Arendal, Budapest, Geneva, Moscow, Tbilisi, Warsaw and the MAP/Blue Plan Office.

Heavy Metals – Heavy metals is a group name for metals and metalloids that have atomic densities of greater than 6 grams per cubic centimetre. Many of these metals are toxic at very low concentrations. They are also persistent in the environment and have the potential to build up (bioaccumulate) through the food chain. Heavy metals discharged into the aquatic environment will bind predominantly to suspended material and finally accumulate in the sediment. The two most direct potential routes of exposure to humans following such discharges to a river would be consumption of the water or of fish or other food derived from the river.

Hydrochloric acid (HCl) – Hydrochloric acid has many industrial uses. Exposure via inhalation in the short-term may cause chest pain, coughing, inflammation and ulceration of the respiratory tract, and higher exposure can cause a build-up of fluid in the lungs, which can lead to death. Skin contact may produce severe burns, ulceration and scarring. Exposure of workers to hydrochloric acid over long

time periods has been reported to cause chronic bronchitis, dermatitis, gastritis and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion.

Hot spots – sites of special environmental concern.

IAEA – International Atomic Energy Agency.

ICPDR – International Commission for the Protection of the Danube River. On 29 June 1994, in Sofia, eleven of the Danube Riparian States and the European Union signed the Convention on Co-operation for the Protection and Sustainable Use of the River Danube. The Convention is aimed at achieving the sustainable and equitable water management in the Danube basin. The key goals of the Commission are effective implementation and enforcement of the Convention through: legal enforcement; policy support; and economic incentives. The operational aim of the Commission is to avoid duplication among the Danube-oriented development projects, by applying the principle: one convention, one implementation, one programme, one priority-setting, one information management.

IMG – International Management Group.

Kerosene – An intermediate fraction obtained in refining, mid-way between gasoline and gas oil. It is used as fuel for jet and turbo jet engines and also as heating fuel and fuel oil for lamps and stoves. It is composed of a large number of different chemicals. If released into the environment, some of the chemicals in kerosene persist in water, soils and sediments for a long time. Very little is known about the human health effects of kerosene. Repeated contact with fuel oils can cause skin cancer and liver cancer in laboratory mice. It has been determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic.

KFOR – The NATO-led international military force charged with maintaining peace and security in Kosovo.

Lead (Pb) – Lead is a heavy metal. It is not required by animals (including humans) or plants for normal growth and development. It has no known nutritional or biochemical function and if present in sufficient quantities will inhibit animal and plant growth, development and health. In aquatic systems, lead is often heavily bound to suspended particulate and sediment material, but evidence shows that it is available to bottom-feeding species. It is toxic to all aquatic organisms, and organisms higher up the food chain may experience lead poisoning as a result of eating lead-contaminated food. In humans, inhaled or ingested lead can cause irreversible central nervous system damage and decreased intelligence at extremely low doses. At higher levels of exposure anaemia may result, along with severe kidney damage. Children are especially susceptible to lead poisoning because they absorb and retain more lead in proportion to their weight than adults.

MAP – UNEP's Mediterranean Action Plan.

Mercury (Hg) – Mercury is a non-essential trace metal that has no biochemical or nutritional function in the body. Biological mechanisms for its removal are poor

and it builds up in the bodies of animals and humans. It is the only metal known to progressively accumulate through the food chain (biomagnify). It is extremely toxic to both animals and plants even at low concentrations. Therefore any elevation above baseline levels could have a deleterious effect on any animal or plant that is exposed. Once metallic mercury has entered the environment it can be methylated by micro-organisms, residing for example in aquatic sediments, to organic forms of mercury, most commonly methylmercury. The most serious concern about toxic impacts of mercury is in regard to methylmercury. It is able to cross cell membranes easily, and therefore quickly enters the aquatic food chain. It builds up through the food chain such that carnivorous fish at the top of freshwater and salt-water food chains have levels in their bodies that are 10,000 to 1,000,000 times the concentrations found in the surrounding water. The significance of this is that biomagnification of methylmercury in aquatic food chains is considered to be the most important source of non-occupational human exposure to mercury, and since it is highly toxic and persistent, anomalous environmental levels warrant concern. Long-term exposure may be expected to progressively cause severe disruptions in the normal functioning of any accumulating organ. Accumulating organs include the kidneys, liver and central nervous system, and exposure to high levels of metallic, inorganic or organic mercury can permanently damage these organs.

MFG – Swedish Environmental Research Group.

NATO – North Atlantic Treaty Organisation.

NGO – Non-Governmental Organisation.

Nickel (Ni) – Nickel is a metallic element which is hard, yet malleable and ductile. It is a silver coloured metal, capable of taking a high polish, and is mainly used for its hardening, corrosion resistant and decorative properties (many silver coins are made of a 25% nickel and 75% copper alloy). Nickel is considered to be an essential trace element at very low concentrations. It does build up (bioaccumulate) in the tissues of in aquatic organisms, and as such elevations above normal concentrations can result in deleterious aquatic effects. In humans, the most common adverse effect of nickel is an allergic reaction, such as skin rashes to nickel jewellery. The most serious effects of nickel, such as cancer of the lung and nasal sinus, have occurred in people who have breathed nickel dust while working in nickel refineries or in nickel processing plants. Other lung effects include chronic bronchitis and reduced lung function. Some nickel compounds are classified as carcinogens.

Nitrogen dioxide (NO₂) – Nitrogen dioxide is a gas that is produced from the combustion of fossil fuels, that is coal and oil. Acid gases such as nitrogen dioxide can influence the pH of precipitation making it acidic. Over time, the falling of “acid rain” can have deleterious impacts on soil and water quality. In terms of human health, exposure to very high levels of nitrogen dioxide can result in some changes in lung function of individuals with pre-existing respiratory disorder, but does not cause significant effects in normal individuals. It is not certain whether rises in the level of

nitrogen dioxide in air lead to increased mortality because it is difficult to discern the effects from impacts of other air pollutants. It is likely though that long-term exposures may have an impact on chronic effects of respiratory health.

Nitrogen oxides (NO_x) – Covers the gases nitric oxide (NO) and nitrogen dioxide (NO₂). Both can be toxic but nitrogen dioxide is considered to be of most concern for asthmatics. The main source of the gases in urban areas are motor vehicle exhaust and gas cookers and kerosene heaters indoors. The brown haze sometimes seen over cities is mainly nitrogen oxides. These gases are also partly responsible for the generation of ozone, when acted upon by sunlight in the presence of other chemicals.

Organic peroxides – An organic peroxide is any organic (carbon-containing) compound having two oxygen atoms joined together. This chemical group is called a 'peroxy' group. Organic peroxides can be severe fire and explosion hazards. The plastics and rubber industries are the heaviest users of organic peroxides. Organic peroxides and mixtures containing an organic peroxide are used as accelerators, activators, catalysts, cross-linking agents, curing agents, hardeners, initiators and promoters. The main hazard related to organic peroxides are fire and explosion. Organic peroxides may also be toxic or corrosive. Depending on the material, route of exposure (inhalation, eye or skin contact, or swallowing) and dose, they could harm the body. Corrosive organic peroxides can also attack and destroy metals. The main use of organic peroxides is as initiators and catalysts for plastics manufacturing. Their instability and reactivity make them commercially useful.

OSCE – Organisation for Security and Cooperation in Europe

PAHs – Polycyclic aromatic hydrocarbons (PAHs) are a group of compounds formed during the incomplete combustion of coal, oil, gas, wood, garbage or other organic substances. In most cases PAHs occur as a mixture of several compounds, not as a single chemical. Several PAHs are produced commercially to be used in the industrial organic synthesis. Once released into the aquatic environment, degradation by micro-organisms is often slow, leading to their accumulation in exposed sediments, soils, aquatic and terrestrial plants, fish and invertebrates. In terms of human health, prolonged exposure to PAHs can have a deleterious effect, and individuals exposed to mixtures of PAHs, through inhalation or skin contact for long periods of time, have been shown to develop cancer.

PCBs – Polychlorinated biphenyls (PCBs) are organochlorines (substances based on carbon and chlorine) that were manufactured until the mid-1980s after which they were banned due to their toxicity and persistence. There are a group of 209 different PCBs, known as congeners. PCBs were widely used in electrical equipment. Presently they are still found in old electrical equipment and releases into the environment continue from waste dump leakages. PCBs are very persistent in the environment taking years to degrade. In rivers they become bound to sediments. They are fat-soluble and build up (bioaccumulate) in the tissues of animals where they become

stored in fat for many years. Predator animals at the top of food chains, such as fish-eating birds, toothed whales including dolphins, otters, and humans have the highest levels in their bodies. Due to long distance transport on air currents towards polar regions and in water, PCBs have become world-wide pollutants. For example, levels in some polar species such as the polar bear are high. The greatest intake of PCBs for the general population is from fatty food, such as meat, fish and dairy products. In mammals and humans, PCBs are passed via the placenta to developing young in the womb and via breast milk to newborn babies. PCBs are highly toxic. A wide range of adverse effects have been associated with exposure to PCBs in wildlife, including mass die-offs of seals and dolphins, large population declines of European otters, and adverse effects on reproduction and development of young in many species. PCBs cause toxic effects on the nervous system, immune system, reproductive system, and development of experimental animals. PCBs are classified as probable human carcinogens. There is concern that current body levels in some individuals of the general population are sufficient to cause subtle adverse effects on the nervous system and immune systems of developing young in the womb and infants.

Petroleum hydrocarbons – Petroleum is a complex mixture of hydrocarbons that is formed from the partial decomposition of biogenic material over geological time scales. (Note: a hydrocarbon is an organic compound consisting of basic components carbon and hydrogen. Additionally it can contain oxygen, nitrogen, phosphorous, sulphur and halogens). Petroleum hydrocarbons are released into the environment through natural seepage and from anthropogenic activities such as accidentally released oil.

Phenol (C₆H₆O) – Phenol does occur naturally in animal wastes and organic material, but larger quantities are produced industrially mainly for the manufacture of plastics. Phenol is also used as a disinfectant in medical products. It is not persistent in the environment although it will remain in air, soil and water for long time periods if a large amount is released at one time, or if a steady amount is released over a long time. In humans, repeated exposure to low levels of phenol in drinking water has been linked to diarrhoea and mouth sores. Inhalation of phenol over a long time period has been associated with gastrointestinal irritation, liver injury and muscular effects.

Phosgene (CCl₂O) – Phosgene is a widely used chemical that is manufactured for use in the production of various chemicals and to manufacture dyes, insecticides, pharmaceuticals and in metallurgy. In the past it was used as a chemical warfare agent. Exposure to phosgene may occur from direct industrial emissions and by combustion of chlorinated hydrocarbons, including VCM. Exposure to phosgene in the short-term and long-term causes severe respiratory effects.

PVC - Polyvinyl chloride (PVC) is a plastic that is used for many purposes. In the production of PVC, chlorine gas is used to make EDC, which in turn is used to make VCM. VCM is polymerised to make PVC. Various additives, such as plasticisers, lead

and cadmium are added to PVC to make it usable. Almost every stage of this PVC lifecycle can create pollution problems, for example, environmental contamination with mercury, chlorinated solvents and dioxins. In terms of health, PVC dust can damage the lungs of workers. A recent study showed that individuals who had worked with PVC had a greater chance of contracting testicular cancer, although further research is needed to confirm the findings.

Pyrite (FeS₂) – The natural sulphides of certain metals. The most common is iron pyrite, which is iron disulphide, a brittle mineral that is brassy yellow in colour with greenish-black streaks found in coal mines. Iron sulphide minerals may oxidise during the combustion process to generate sulphur oxide gases.

REC – The Regional Environmental Centre for Central and Eastern Europe (REC) is a non-advocacy, not-for-profit organisation with the mission to assist in solving environmental problems in Central and Eastern Europe. The Centre fulfils its mission through encouraging co-operation among non-governmental organisations, governments and businesses, supporting the free exchange of information and promoting public participation in environmental decision-making. The REC was established in 1990 by the United States, the European Commission and Hungary. Today, the REC is legally based on a Charter signed by the governments of 25 countries and the European Commission, and on an International Agreement with the Government of Hungary. The REC has its headquarters in Szentendre, Hungary and Local Offices in each of its 15 beneficiary CEE countries, which are: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, FYR Macedonia, Poland, Romania, Slovakia, Slovenia and Yugoslavia.

Red Data Book – A catalogue that lists rare or vulnerable species of flora and fauna and those in danger of extinction, for a given country or region. The World Conservation Union (IUCN) has developed internationally accepted standards.

SECI – Southeast European Cooperative Initiative. A U.S. government initiative, SECI is a self-help program that seeks regional solutions to common, practical problems such as transborder crime and international transport laws and practices. It is headquartered in Vienna. Members are Albania, Bosnia, Bulgaria, Greece, FYROM, Hungary, Moldova, Romania and Turkey. The supporting states are Austria, Italy, Switzerland, the United Kingdom and the United States.

SEEDS – South Eastern European Development of Environmental Society Initiative on the development of civil society and the role of environment in South Eastern Europe. This five years initiative was launched by REC to support environmental civil society in the Balkans.

Soot – Soot particles arise during combustion of organic substances and are composed of elementary carbon. With regard to oil fires, the soot particles produced are associated with high-molecular weight hydrocarbons, such as the PAHs.

SFRY – Socialist Federal Republic of Yugoslavia.

SRSB – UN Special Representative of the Secretary General in Kosovo. The

SRSO, Dr. Bernard Kouchner, is the head of UNMIK, and therefore the highest international civilian official in Kosovo.

Stability Pact For South Eastern Europe – This initiative, signed by 27 states, seeks to stabilise, transform, and eventually integrate the region into the European and Trans-Atlantic communities by promoting co-operation and multi-ethnic democracy. The Pact was formally launched at a Summit in Sarajevo on 30 July 1999 which was attended by more than 40 leaders from across Europe and North America.

Styrene (C₈H₈) - Low levels of styrene occur naturally in a variety of foods. Styrene is produced on a large scale by industry to make products such as rubber, plastic and fibreglass. If released into the environment it is quickly broken down in the air and surface waters, but takes weeks or months to break down in groundwater. It does not accumulate easily in soils and sediments, and is not expected to build up in animals. Exposure to high levels over several weeks in laboratory animals caused liver and kidney damage. In humans, breathing high levels of styrene adversely affects the nervous system causing effects such as depression, muscle weakness, tiredness and nausea. Studies on workers have shown that breathing in styrene may cause leukaemia. It is classified as possibly carcinogenic to humans.

Sulphur dioxide (SO₂) – Sulphur dioxide is a gas that is produced from the combustion of fossil fuels, that is coal and oil, and from the production of sulphuric acid and roasting of sulphide ores. Acid gases such as sulphur dioxide can influence the pH of precipitation making it acidic. Over time, the falling of ‘acid rain’ can have deleterious impacts on soil and water quality. In terms of human health, there is evidence that sulphur dioxide has an effect on lung function, particularly in asthmatic individuals. Rises in levels of sulphur dioxide have been associated with increases in hospital admissions and in mortality. The increased deaths are evident in individuals who already have pre-existing disease, particularly respiratory disease.

Taxa – (taxon; plural taxa) The named classification unit to which individuals, or sets of species, are assigned, such as species, genus, order, etc.

TDI – Toluene-diisocyanate (2,4-Di-isocyanato-1-methyl-benzen) is used as a chemical intermediate in the production of polyurethane products such as foams, coatings, and elastomers.

Transformer – Extensively used by electric power systems to transfer power by electromagnetic induction between circuits and the same frequency, usually with changed values of voltage and current.

Transformer Oil – A high quality insulating oil in which windings of large power transformers are immersed, providing high dielectric strength, high insulation resistance, high flash point, freedom from moisture and oxidation. In the past, oils that were used in transformers often contained PCBs, and electrical equipment containing PCB, is still in use.

UNCHS – The United Nations Centre for Human Settlements (Habitat) was established in 1978, two years after the United Nations Conference on Human

Settlements held in Vancouver, Canada. The Centre serves as the lead agency for the human settlements' development activities of the United Nations family, as well as for the global exchange of information about human settlements, conditions and trends.

UNDP – United Nations Development Programme.

UN-ECE – The Economic Commission for Europe (UN/ECE) is the forum at which the countries of North America, Central and Eastern Europe and Central Asia come together to forge the tools of their economic co-operation.

UNEP – The United Nations Environment Programme was established as one of the consequences of the 1972 Stockholm Conference on the Human Environment. UNEP provides an integrative and interactive mechanism through which a large number of separate efforts by intergovernmental, non-governmental, national and regional bodies in the service of the environment are reinforced and interrelated. UNEP was established as the environmental conscience of the United Nations system, and has been creating a basis for comprehensive consideration and co-ordinated action within the UN on the problems of the human environment.

UNHCR – The United Nations High Commissioner for Refugees, which was created by the U.N. General Assembly and began work in 1951.

UNMIK – This is currently the highest legal and executive authority in Kosovo; it is, therefore, the acting government of the province. On 10 June 1999, the UN Security Council authorised the Secretary-General to establish in Kosovo an interim international civilian administration. The Council took its action by adopting resolution 1244 after NATO suspended its air operations following the withdrawal of security forces of FRY from Kosovo. Two days later, Secretary-General Kofi Annan presented to the Council an operational concept of what since has come to be known as the United Nations Interim Administration Mission in Kosovo (UNMIK). On 12 July, in his follow-up report to the Council, the Secretary-General presented a comprehensive framework of the UN-led international civil operation in Kosovo.

UNSCEAR – United Nations Scientific Committee on the Effects of Atomic Radiation.

Uranium (U) – Uranium is the principal fuel for nuclear reactors and the main raw material for nuclear weapons. Natural uranium consists of three isotopes: uranium-238, uranium-235, and uranium-234. Uranium isotopes are radioactive. The nuclei of radioactive elements are unstable, meaning they are transformed into other elements, typically by emitting particles (and sometimes by absorbing particles). This process, known as radioactive decay, generally results in the emission of alpha or beta particles from the nucleus. It is also often accompanied by emission of gamma radiation, which is electromagnetic radiation like X-rays. These three kinds of radiation have very different properties in some respects, but are all ionising radiation; i.e., each is energetic enough to break chemical bonds, thereby possessing the ability to damage or destroy living cells.

USAID (OFDA) – The U.S. Agency for International Development (USAID)

is the foreign assistance and humanitarian relief agency of the US federal government. The agency is working closely with numerous non-governmental organisations (NGOs) to provide relief in the Kosovo region. When disasters strike in foreign countries, the response within USAID is led by the Office of U.S. Foreign Disaster Assistance (OFDA), which is part of the Bureau for Humanitarian Response (BHR).

Vascular plant – A higher plant with tissues which conduct water, mineral salts and synthesised food, and provide mechanical support.

VCM – Vinyl chloride monomer (VCM) is used in the production of PVC. It is not persistent in the environment but it is hazardous and causes a wide variety of toxic effects in humans and animals. It is classified as a human carcinogen. Numerous studies on workers exposed to high levels of VCM for long periods of time show that it causes angiosarcoma of the liver (liver cancer). It has also been associated with an increased incidence of other cancers in workers such as cancers of the brain, nervous system and lung. Other adverse effects in workers are reported on the immune system, nervous system and blood circulation. In the case of a VCM fire, various substances would be expected to be released including hydrochloric acid, carbon dioxide, carbon monoxide, dioxins, PAHs and possibly phosgene.

VOC – volatile organic compound.

Volatile hydrocarbons - Hydrocarbons are organic compounds having as their basic components carbon and hydrogen. Additionally, hydrocarbons can contain oxygen, nitrogen, phosphorous, sulphur and halogens. Volatile hydrocarbons are those compounds that have one or more substituted halogens (eg. chlorine, bromine or fluorine).

WFP – United Nations World Food Program.

WHO – United Nations World Health Organisation.

Zinc (Zn) – Zinc is a heavy metal that occurs naturally. However, environmental releases of zinc from anthropogenic sources far exceed the releases from natural sources. Anthropogenic releases include those resulting from electroplating, smelting and ore processing, as well as acid mine drainage, effluents from chemical processes (textiles, pigment and paint, fertiliser and PVC production). Although zinc is not regarded as being especially toxic, it is sometimes released into the environment in appreciable quantities, and can have deleterious effects on certain aquatic species at specific concentrations. Regarding human health, zinc is an essential trace element, but ingestion of higher than recommended levels even for a short time can have adverse effects on health including stomach cramps, nausea and vomiting. Ingesting high levels for several months may cause anaemia and damage to the pancreas.

Units of measurement

mg milligramme (10^{-3} g)

mSm millisiemens per metre

µg microgramme (10^{-6} g)

ng nanogramme (10^{-9} g)

Annex III

List of Contributors to the Balkans Task Force

The Joint UNEP/UNCHS Balkans Task Force was established in early May 1999 and headquartered within the UNEP European Regional Office in Geneva. Each BTF mission was composed of a group of international and independent scientists, each specially involved with the issues being addressed. The teams were completed by rapporteurs provided by UNEP (or UNCHS).

Balkans Task Force Staff:

Pekka Haavisto	Chairman
Henrik Slotte	Head of Chairman's Office
Pasi Rinne	Senior Advisor to the Chairman
Diana Rizzolio	Information Officer
Tim Jones	Report co-ordinator/editor
Ljerka Gosovic	Executive Assistant
Julian Rouche	Assistant
Claudio Gagliano	Driver and responsible for logistics

Gertrud Attar	UNEP/Geneva
Lars Ludvigsen	UNCHS (Habitat)
Vladimir Sakharov	UNEP/OCHA
Milad Salem	UNEP Chemicals
Otto Simonett	GRID Arendal
Ron Witt	GRID Geneva

Robert Bisset	UNEP/Nairobi
Rob De Jong	UNEP/Nairobi
David Dunn	UNEP/Nairobi

Bakary Kante	UNEP/Nairobi
Takehiro Nakamura	UNEP/Nairobi
Marceil Yeater	UNEP/Nairobi

Jorge Gavidia	UNCHS (Habitat)
John Hogan	UNCHS (Habitat)
Sylvie Lacroux	UNCHS (Habitat)

Cartography and Remote Sensing:

Dominique Del Pietro	GRID/Geneva
Pascal Peduzzi	GRID/Geneva
Philippe Rekecewicz	GRID/Arendal
Frederic Vogel	GRID/Geneva
Benaz Zand	GRID/Geneva

Industrial Sites Mission:

Michelle Allsopp	Greenpeace Research Laboratories, United Kingdom
Robert Atkinson	Regional Environmental Center, Hungary
Ralf Donau	Landesumweltamt Brandenburg, Germany
Josef Haider	Landesumweltamt Nordrhein-Westfalen, Germany
Benny R. Hansen	Krüger International Consult, Denmark

Alexander Juras	Regional Environmental Center, Hungary
Kirsten S. Jørgensen	Finnish Environment Institute, Finland
Frank Lehmann	Landesumweltamt Brandenburg, Germany
Birgitte Marcussen	NIRAS Consulting Engineers and Planners A/S, Denmark

Volker Mohaupt	Umweltbundesamt, Germany
Magnus Nyström	Finnish Environment Institute, Finland
Elizabeth Salter	World Wide Fund for Nature (WWF), United Kingdom
Arne Semb	Norwegian Institut for Air Research, NILU, Norway
Kenn Skjorringe	Krüger International Consult, Denmark
Bernard Wronski	Landesumweltamt Brandenburg, Germany
Solveig Würtz	Krüger International Consult, Denmark

Danube River Mission:

Joachim Bendow	International Commission for the Protection of the Danube River, Austria
Claudia Canevari	European Commission DG XI
Bertrand Charrier	Green Cross International, Switzerland
Bela Csanyi	VITUKI, Hungary
Jonas Fejes	Swedish Environmental Research Institute IVL, Sweden
Peter Literathy	VITUKI, Hungary
Petr Obrdlik	World Wide Fund for Nature (WWF), Germany
Peter Roncak	Slovak Hydrometeorological Institute, Slovakia
Irina Semenova	Institute of Experimental Meteorology, Obninsk, Russia
Aurel Varduka	ICIM Research and Engineering Institute for Environment, Romania

Biodiversity Mission:

Robert Brunner	National Park Thayatal, World Conservation Union (IUCN), Austria
Kent Cassels	World Conservation Monitoring Centre (WCMC), United Kingdom
Mira Mileva	IUCN Regional Environment Centre, Biodiversity Secretariat, Hungary
Berit-Forbord Moen	Directorate for Nature Management, Norway
Johannes Skov	National Forest and Nature Agency, Denmark
Ivan Voluscuk	Tatra National Park, Slovakia

Human Settlements Assessment:

Sue Charteris	Municipal Administration
John Haward	Municipal Administration
Colin Roberts	Municipal Administration
Hans Das	Property Rights
Scott Leckie	Property Rights
Claudia de Cesare	Property Registration/Cadastre
Pertti Onkalo	Property Registration/Cadastre

Leea Vikman	Property Registration/Cadastre
Larry Truman	Property Registration/Cadastre
Mark Sorensen	Property Registration/Cadastre

Desk Assessment Group on Depleted Uranium:

Gustav Akerblom	Swedish Radiation Protection Institute (SSI), Sweden
Rolaf van Leeuwen	World Health Organisation (WHO), ECEH, Bilthoven, Holland
Jenny Pronczuk de Garbino	World Health Organisation (WHO), Switzerland
Carol Robinson	International Atomic Energy Agency (IAEA), Austria
Peter Stegnar	International Atomic Energy Agency (IAEA), Austria
Jan Olof Snihs	Swedish Radiation Protection Institute (SSI), Sweden

The work of the Balkans Task Force was made possible by the generous contributions of the following governments:

Federal Republic of Austria

Denmark

Finland

France

Germany

The Netherlands

Norway

Sweden

United Kingdom

Further Information

Copies of this report may be ordered from:

SMI (Distribution Services) Limited

P.O. Box 119

Stevenage

Hertfordshire SG1 4TP, UK

Tel: +44 1438 748111

Fax: +44 1438 748844

E-mail: customerservices@earthprint.demon.co.uk

UNEP also has an online bookstore at: <http://www.earthprint.com>

Further technical information may be obtained from the Balkans Task Force website maintained by GRID Geneva: <http://www.grid.unep.ch/btf/>

The Joint UNEP/UNCHS (Habitat) Balkans Task Force was established in early May 1999 when the Kosovo conflict was still ongoing. In addition to the unfolding humanitarian crisis there was growing concern about the environmental and human settlement consequences of the conflict.

To address these issues, the Balkans Task Force mobilised an international and independent scientific team to work within Kosovo and at targeted industrial sites in Serbia. Similar teams visited pollution sources along the Danube River, as well as targets within National Parks and other protected areas.

This report presents the findings of the Balkans Task Force.

Immediate action is recommended at the 'hot spots' of environmental concern found in four cities. Conscious of the need for urgent action, the United Nations Environment Programme and the United Nations Centre for Human Settlements have acted to make the facts available as rapidly as possible. The result is a major contribution to environmental assessment of modern warfare.

UNEP/UNCHS (Habitat) Balkans Task Force

