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NOTE

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Preface

The Environmental Performance Review of Ukraine started with its preparatory mission in November 1997. This mission resulted in the agreed structure of the review. The team carrying out the review consisted of national and international experts. The national team members were made available by Bulgaria, Finland, France, Germany, Italy, Lithuania, Netherlands and Switzerland. Technical advisers from Germany (on water protection technology) and Italy (on air pollution abatement, waste treatment and measurement technologies) assisted the team in their areas of competence. The Rome Division of the WHO European Centre for Environment and Health, UNEP and the ECE secretariat provided the international experts. The costs of participation of experts from countries in transition, as well as the travel expenses of the ECE secretariat, were covered from extrabudgetary funds provided by France, Germany, Italy and the Netherlands. The Netherlands also bilaterally supported the Ukrainian Ministry for Environmental Protection and Nuclear Safety in its tasks in the project. The successful conclusion of the project would not have been possible without the generous support from all these sources.

The ECE Committee on Environmental Policy established a special procedure for the implementation of the Ukrainian EPR. It included, for the first time, the holding of an assessment mission in Kyiv, in May 1999. The purpose of this meeting was to enable a large number of Ukrainian environmental managers from different institutions to discuss a draft of the present report. The assessment mission made it possible to familiarize these managers, in the presence of the EPR Expert Group, with the gist of the conclusions and recommendations contained in this report, as well as with their foundations. In addition, the adoption process of the EPR recommendations by the ECE Committee on Environmental Policy included a ministerial round-table discussion in Geneva, on 20 September 1999. Denmark, Estonia, Italy, Slovenia and Ukraine participated in this discussion. The Committee adopted its EPR recommendations as included in the present report on 21 September 1999. Also included is a CD-ROM containing a state-of-the-environment report of Ukraine. The report was compiled and edited by the information technology group of the Ministry of Environmental Protection and Nuclear Safety of Ukraine in cooperation with UNEP/GRID-Arendal.

This EPR report highlights the large variety of environmental conditions in different areas of environmental management in Ukraine. They are reflected in considerable differences in environmental performance in different areas of management. The economic and social difficulties of the country in its transition to a market economy add to the challenges for environmental management. The report demonstrates the particular success of environmental management during transition in the area of nature and biodiversity management. It also highlights the great efforts made by the Ukrainian Government to ratify relevant international conventions and honour its resulting obligations. The main focus of environmental management in the near future is on the development of economic instruments in support of more environmentally friendly decisions by economic actors.

The ECE Committee on Environmental Policy and the ECE review team wish the Ukrainian administrations success in their challenging work, including the implementation of the recommendations contained in this report.

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The preparatory mission for the project took place on 28-29 November 1997. The review mission was organized from 4 to 16 October 1998. An assessment mission to discuss a previous draft with Ukrainian environmental managers took place in Kyiv on 17-19 May 1999.

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ABBREVIATIONS

AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
AEWS	Accident emergency warning system
BAT	Best available technology
BSEC	Black Sea Economic Co-operation
BSEP	Black Sea Environment Programme
BOD	Biochemical oxygen demand
CCMS	NATO Committee on Challenges of Modern Society
CFC	Chlorofluorocarbon
ChNPP	Chernobyl Nuclear Power Plant
CHP	Combined heat and power plant
CIS	Commonwealth of Independent States
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CM	Cabinet of Ministers
CNG	Compressed natural gas
CPI	Consumer price index
DDT	Mixture of isomers of dichloro-diphenyl-trichloro ethane
$DeNo_x$	Denitrification
ECU	European Currency Unit
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EECONET	European Ecological Corridor Network
EIA	Environmental impact assessment
EICD	Dnepropetrovsk Environmental Information Centre
EMAS	Environmental Management and Auditing System
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EPA	Environmental Protection Agency
EPR	Environmental Performance Review
ERA	Environmental risk assessment
EU	European Union
EURO-BATS	Agreement on the Conservation of Bats in Europe
FCCC	United Nations Framework Convention on Climate Change
GAI	Road Transport Police
GDP	Gross domestic product
GEF	Global Environment Facility
GOST	Former USSR standard organization
IAEA	International Atomic Energy Agency
ICRP	International Commission for Radiological Protection
IDRC	International Development Research Centre (Canada)
IEA	International Energy Agency
IEC	Information and Emergency Centre
IFRC	International Federation of Red Cross and Red Crescent Societies
IMF	International Monetary Fund
IMO	International Maritime Organization
ISO	International Organization for Standardization
IUCN	World Conservation Union
HACCP	Hazard Analysis and Critical Control Point
HCH	Hexachlorocyclohexane
HDPE	High-pressure polyethylene
HYDROMET	State Committee on Hydrometeorology
LAC	Limits of admitted concentrations
LPG	Liquefied petroleum gas
MARPOL	Convention for the Prevention of Pollution from Ships
MAC	Maximum allowable concentration

MAP	Maximum allowable pollution
MES	Ministry of Emergency Situations and Protection of the Population from the Consequences of the Chernobyl Catastrophe
MEPNS	Ministry of Environmental Protection and Nuclear Safety
MoA	Ministry of Agriculture
MoHP	Ministry of Health Protection
MoT	Ministry of Transport
MoU	Memorandum of Understanding
NATO	North Atlantic Council
NCRPU	National Commission on Radiological Protection of the Population of Ukraine
NEHAP	National Environmental Health Action Plan
NEAP	National Environmental Action Plan
NGO	Non-governmental organization
NMVOCs	Non-methane volatile organic compounds
NPP	National Programme for the Protection of the Environment
NRA	Nuclear Regulatory Administration
NSI	Nuclear Safety Inspectorate
ODA	Official Development Assistance
ODS	Ozone-depleting substance
OECD	Organisation for Economic Co-operation and Development
PCB(s)	Polychlorinated biphenyls
PHARE	Assistance for Economic Restructuring in the countries of Central and Eastern Europe
PM	Particulate matter
POP	Persistent organic pollutant
PEF	Pridneprovye Ecological Foundation
PSEIC	Pridneprovje Scientific-educational and Information Centre for Cleaner Production
REC	Regional Environmental Centre for Central and Eastern Europe
REBs	Regional environmental bureau
SDEP	State Department for Environmental Protection
SEE	State ecological expertise
SIP	Shelter implementation plan
TACIS	Technical Assistance to the Commonwealth of Independent States
TAP	Temporary allowable pollution
TC	Technical Committee
TOMA(s)	Tropospheric ozone management areas
TSP	Total suspended particulates
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Organization for Industrial Development
USAID	United States Agency for International Development
VAT	Value-added tax
VOC	Volatile organic compound
WEC	World Environmental Centre
WHO	World Health Organization

SIGNS AND MEASURES

..	not available
-	nil or negligible
.	decimal point
ha	hectare
t	metric tonne
kt	kilotonne
g	gram
kg	kilogram
mg	milligram
mm	millimetre
cm^2	square centimetre
m^3	cubic metre
km	kilometre
km^2	square kilometre
toe	ton oil equivalent
l	litre
ml	millilitre
min	minute
s	second
PJ	petajoule
m	metre
ºC	degree Celsius
GJ	gigajoule
kW_{el}	kilowatt (electric)
kW_{th}	kilowatt (thermal)
MW_{el}	megawatt (electric)
MW_{th}	megawatt (thermal)
MWh	megawatt-hour
TWh	terawatt-hour
Bq	Becquerel
Ci	Curie
MSv/a	Millisievert per year
y	Year
Cap	Capita
Eq	Equivalent
H	hour
KV	kilovolt
MW	megawatt
Gcal	gigacalorie
Hz	hertz
GWh	gigawatt-hour

CURRENCY

Exchange rates

National currency unit for **1992 to 1995 in karbovanets (KRB)**.
National currency unit **1996 onwards in hryvnia (HRV)**.

Annual average

Year	1 US$
1992	**208**
1993	**4,539**
1994	**31,700**
1995	**147,307**
1996	**1.830**
1997	**1.862**

Source: National Bank of Ukraine.

PART I: THE FRAMEWORK FOR ENVIRONMENTAL POLICY AND MANAGEMENT

Chapter 1

LEGAL INSTRUMENTS AND INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL PROTECTION

1.1 The legal framework

General legal instruments

Ukraine's variety of legal acts has the following hierarchy:

- Constitution (1996);
- Laws, codes and international treaties approved by the Parliament;
- Decrees of the President;
- Decisions/resolutions by Parliament;
- Decrees of the Cabinet of Ministers;
- Regulations of a ministry;
- Regulations of local authorities and local self-government.

According to article 93 of the Constitution, a legislative initiative can be taken by the President, the National Deputies of Ukraine, the Cabinet of Ministers, and the National Bank of Ukraine. The Cabinet can authorize the Ministry of Environmental Protection and Nuclear Safety to draft a law in its field of competence. The draft is discussed within the Ministry, with scientific institutions and – as far as formally authorized and at the invitation of the Cabinet – other ministries. If all ministries in question agree, the draft is passed to the Cabinet, which submits it to Parliament for adoption (usually one or two readings; complex issues might require more readings). Then the President promulgates it. During the whole process, the Parliamentary Committee on Ecological Policy can provide advice.

Environmental legislation

Since its independence, Ukraine has adopted basic environmental legislation and introduced a new environmental policy. In June 1991, the Law on Environmental Protection was adopted. This umbrella law contains general provisions on nearly all aspects of environmental protection and management, often stating rather idealistic goals, but defining few clear targets or enforcement mechanisms.

Modern laws have been adopted in the main sectors of environmental protection, most of them still under the old Constitution. Ukraine is seeking to harmonize its laws with EU legislation. When drafting new laws and regulations, the respective EU legal acts are taken into account. This harmonization is considered a necessity, because Ukraine might at some stage want to accede to the EU. Also, in the near future, Ukraine expects to border new EU members, and it is consequently seen as an advantage to make Ukraine's legal system compatible with that of the EU. However, some 30 per cent of the regulations, mainly concerning standards and methodologies, still date from the Soviet period. The former Soviet legislation remains in force until it is explicitly revoked.

The 15 main environmental laws in force are:

- On Environmental Protection (25 June 1991)
- On Ecological Expertise (9 February 1995)
- On the provision of sanitary and epidemiological well-being of the population (24 February 1994)
- On the animal world (3 March 1993)
- On ambient air protection (16 October 1992)
- On the natural reserve fund of Ukraine (16 June 1992)
- On pesticides and agrochemicals (2 March 1995)
- On the use of nuclear energy and radiation safety (8 February 1995)
- On the handling of radioactive waste (30 June 1995)
- On emergency situations (26 June 1992)
- Land Code (1990, amended in May 1992)
- Water Code (June 1995)

- Forest Code (January 1993)
- Mineral Resources Code
- On wastes (March 1998)

In addition, the Verkhovna Rada of Ukraine (the national parliament) has approved further laws relevant to environmental protection, and ratified several international conventions on this subject (see Chapter 3). The Cabinet of Ministers has adopted more than 40 regulations in relation to these laws. The MEPNS issued 95 corresponding orders, which were registered with the Ukrainian Ministry of Justice.

1.2 The policy framework

Privatization of economic units

The level of privatization is an important indicator of the type of environmental policies and management required. There are approximately 60 000 enterprises in Ukraine. This figure includes farms. About 48 900 units are small (asset value below 1 million hryvnia, often small service shops); 12 000 are medium-sized or large. The privatization programme started seven years ago. Since then, privatization has proceeded in a non-continuous fashion, as the process was politically controversial. As a result, privatization plans kept being revised and deadlines were missed. Likewise, proceeds from privatization systematically fell short of expectations – an illustration of implementation problems, as well as of accompanying problems with creating conditions that were unequivocally attractive for potential investors.

Between the beginning of privatization and autumn 1998, most small enterprises had been privatized, according to government sources. However, privatization does not mean that the entire enterprise passes into private hands. About 10 750 medium-sized and large enterprises were privatized to at least 70 per cent of their asset value. 1 075 incomplete constructions were privatized as well. In all, about 45 per cent of industrial and 55 per cent of agricultural enterprises have been privatized. Privatization is considered finished for collectively used land (collective farms). More than 6 million citizens now own land. The privatization of land for allotments, summer homes, garages and some other purposes will continue. In autumn 1998, it was envisaged to continue the programme in 1999 with the privatization of large enterprises.

The legal bases for the privatization of industrial assets are the 1992 laws on the privatization of State property and large enterprises and on the privatization of small enterprises, as well as annual programmes adopted by Parliament. The laws enable Parliament to set priorities and plan the process over the coming years. They prescribe both the forms of privatization and the procedures to be followed. Initially, privatization was predominantly effected without monetary payments ('coupon privatization'). More than 46 million Ukrainians (92 per cent) availed themselves of the right to a share in the national wealth. For example, workers were entitled to rent an enterprise, with subsequent purchase options. This also implied that, in general, the enterprises concerned did not obtain fresh capital, nor did they necessarily adopt new management practices. The units that are now up for privatization will be auctioned, i.e. monetary transactions will become the rule in future privatization. It is expected that the entire privatization process will take another year to conclude.

The legislation on privatization foresees that a privatization plan should be established for each enterprise and approved by a special commission. The plan should include an assessment of the enterprise's environmental situation. The regulation specifying the contents of this assessment was approved in July 1998. This means that no experience is so far available with this assessment – but as so far primarily small (non-industrial) enterprises have been privatized, this is not a problem. Nevertheless, it is expected that the regulation will be revised in 1999 to permit a more satisfactory assessment procedure. If the commission in question finds it necessary to request a more detailed investigation, then such an investigation will be undertaken. The new owner is not automatically liable for past environmental damage. Problems are being solved case by case– i.e. liability could result de facto. Ukrainian enterprise owners also own the land on which it is located – foreign owners are not entitled to own land.

The privatization of agricultural land followed special procedures. A Reserve Fund was set up with 10 per cent of all land (i.e. 6.7 million ha). The remaining land was given to the collective farms. The members of the collective farms were allotted parcels of the collective farmland. The size of such individual plots is typically 10 to 15 hectares. In principle, the new owners could take

their individual plots out of the collective farms. Otherwise, the land remained in collective ownership and use. More than 50 000 members of collective farms put in claims, and 24 700 took out their plots. There was no legal obligation to share out farm machinery, although in practice this did sometimes happen. Privatized agricultural land could not be sold during the first six years. This period is now over, but no substantial sales of agricultural land are taking place.

A law of 1992 on farming entitles each Ukrainian citizen to 50 ha of arable land as part of a total plot of up to 100 ha of agricultural land, if he wants to become a farmer. Only few have made use of this provision. Citizens who wanted to become farmers, but were not members of collective farms before, received parcels from the Reserve Fund, which was passed from State to municipal ownership.

The Reserve Fund is also used to allocate land for industrial purposes. The allocation is, in general, made by the municipal authorities. A prospective industrial investor will not normally buy a piece of land and then request a building permit, but will be allotted a piece of land for a concrete activity. This does not apply to arable land or land located in protected areas. Any building on such land has, since 1991, to be authorized by the Parliament. Such decisions used to be taken by the Government and it is expected that this practice will be re-established in the near future (also at other levels of territorial administration). The desire to maintain and use agricultural land for (uninterrupted) agricultural activities has also prompted many restrictions on the ownership of such land that are unusual in Europe.

The problem with the privatization process so far is, first of all, its failure to trigger investment. There are too many restrictions on the use of land (e.g. the procedure described above for seeking land for an industrial facility). It is also felt that political considerations too often prevail over economic considerations. The absence of a clear ruling on liability for past environmental damage is seen as an impediment to investment. Another problem is the training of staff at the local level in land-use management in present ownership conditions. The demand for land also outstrips supply, a problem for which there seems to be no easy solution. Finally, the exclusion of potential foreign investors from ownership of land, and the current practices of assessing land value in cities are controversial.

Environmental policy

On the whole, environmental protection plays a subordinated role to economic development in Ukraine. The country's National Environmental Action Plan (NEAP) consists of a set of interrelated documents. The "Principal directions of the State policy of Ukraine in environmental protection, use of natural resources and ensuring environmental safety" of March 1998 constitute the overall basis. They are inspired by the EU Environmental Action Programme, and lay down the following priorities:

- Environmental safety of nuclear installations and protection of the environment and the population against radiation; mitigation of the effects of the Chernobyl accident,
- Environmental rehabilitation of the freshwater reserves and improvement of drinking-water quality,
- Stabilization and gradual improvement of the environmental conditions in the Donetsko-Prydniprovski region (Donets Basin and the downstream stretch of the Dnieper River),
- New construction and reconstruction of communal and industrial sewage treatment plants,
- Protecting the Black Sea and the Sea of Azov against pollution and further improving their environmental status,
- Sustainable management of natural resources and making the main sectors of the national economy environmentally friendly, including waste management,
- Biodiversity and nature protection.

The document aims at integrating environmental concerns into the economic reforms. It strongly relies on increasing centralization and large-scale bureaucratic control over the economy and society to stop environmental degradation. The document being the general umbrella for the NEAP, it does not contain

- clear priorities or measurable targets,
- concrete actions,
- a time schedule for the objectives,
- methods of communication between those affected by environmental policy.

The State Programmes, part of the NEAP and all to be adopted by Parliament, expand on the general priority areas: e.g. a nuclear safety programme (in the process of finalization), a programme for the rehabilitation of the Dnieper basin (adopted by

Parliament in March 1998, currently being implemented), a programme on waste management (before Parliament, but not yet adopted).

Another part of the NEAP is the annual "Governmental Action Plan", which takes available financial resources into account. However, at present, only half of the expenditures necessary for the priority projects identified in the action plan are being funded. Sometimes, money earmarked for environmental protection is re-allocated in the course of the budgetary year, for urgent economic reasons. Foreign investment and grants can be used for funding.

Each oblast (i.e. administrative region) is expected by the national Government to have an environmental plan – another part of the NEAP. The national Government coordinates the oblast activities. They are funded from oblast and municipal budgets, but the national Government can participate in funding, if the funded activity supports one of the priorities specified in the "Principal directions". However, the environmental plans at oblast level are not sufficiently prioritized and are more often than not mere wish-lists. The need to clarify priorities in relation to available financial resources at all levels of administration is a recurrent theme and certainly a problem in Ukraine.

Sustainable development is not a priority in Ukraine. It is often seen as too vague a concept, secondary to economic development. However, a State programme, approved by the Government, for economic development ("Ukraine 2010") includes some principles of sustainable development. Nevertheless, the Ministry of Environmental Protection and Nuclear Safety received little support from the Government during the – continuing – process of developing a strategic "Concept on Sustainable Development". This strategic document has been discussed with some ministries, the Academy of Sciences, regional authorities and some NGOs. It was presented to the Cabinet of Ministers and has been transmitted to Parliament for adoption (but is not adopted yet). According to the document, basic means to achieve sustainable development are the introduction of effective regulations and a technological reconversion of production in an environmentally friendly way, as well as economic mechanisms for environmental protection. As principal tasks, it mentions economic development, environmental protection, social harmony, rational use of national resources, education, international cooperation and public participation. Priorities for sustainable development are social policy and social protection, healthcare, education, information, culture, technological development and housing development in selected regions or human settlements.

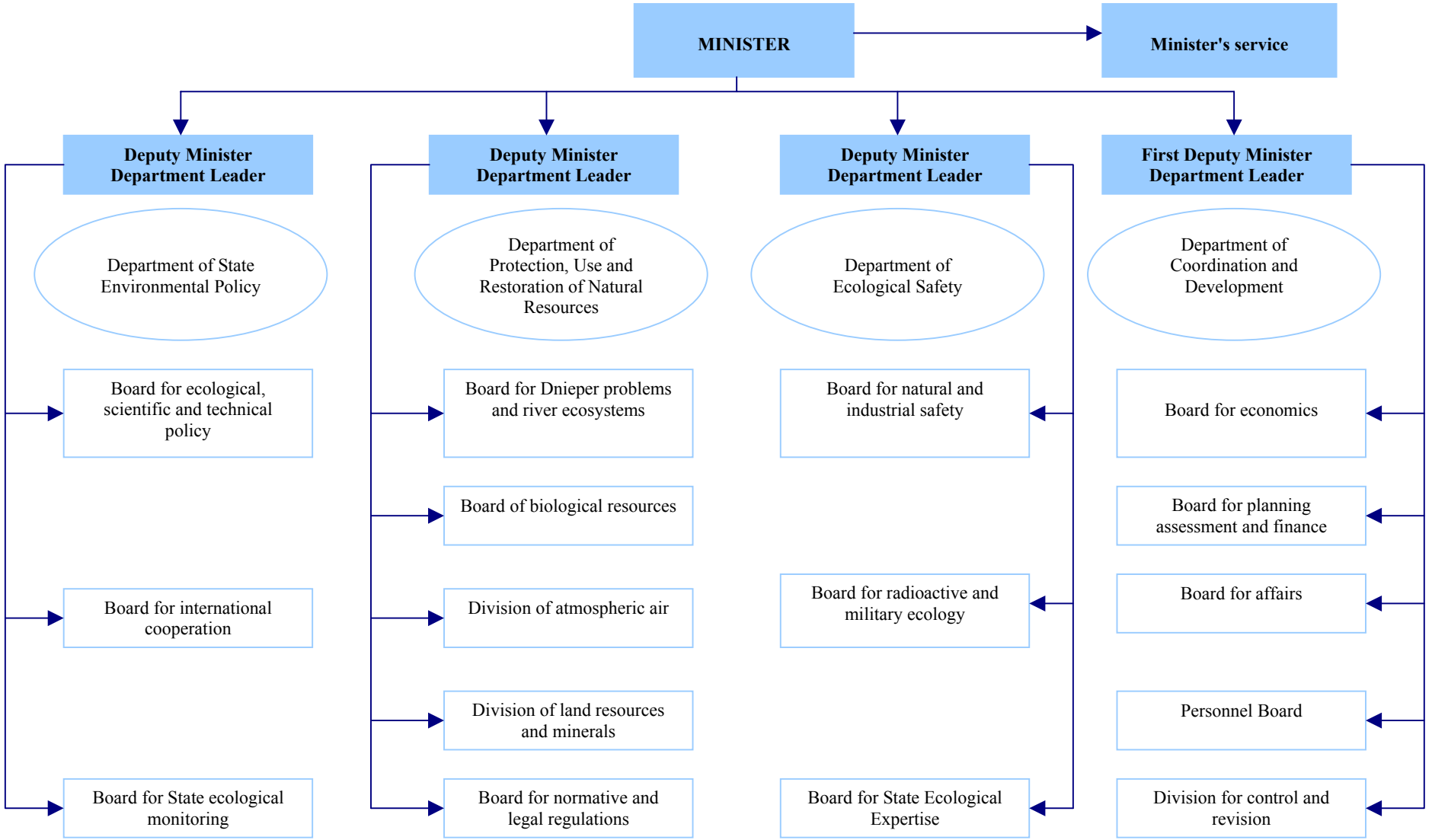
1.3 Basic structure of environmental management

The structure of the Ministry of Environmental Protection and Nuclear Safety

The Ukrainian Ministry for Environmental Protection was established in August 1991, building on the former State Committee for the Protection of the Environment established in 1967. The new Ministry was merged with the State Committee on Radiation Safety. The Ministry of Environmental Protection and Nuclear Safety (MEPNS) was reorganized in October 1998. In April 1999, the structure of the Ukrainian Government was again reviewed, and the MEPNS was given the draft structure as shown in Figure 1.1. The major purpose of the latest restructuring was the streamlining of government, which was achieved by the introduction of new reporting requirements for hitherto independent entities. Regarding MEPNS, the main draft changes are the corresponding subordination of four committees or commissions to the Ministry (water management, geology and mineral deposits, hydrometeorology, pesticides and fertilizers), and the upgrading of nuclear management to a new, subordinated legal entity for the administration of nuclear regulations. As a result, the Ministry now oversees all questions of natural resource use and of environmental pollution in terms of policy development and budget.

The Ministry of Environmental Protection and Nuclear Safety was mandated to deal with broad environmental issues and to draw up and supervise State policy on the environment. It has its own statute for the planning and application of laws within its area of competence. On behalf of the State, it specifies environmental legislation requirements and verifies compliance with environmental legislation. It conducts ecological expertise, organizes environmental monitoring and operates the State's environmental information system. It makes sure that the country fulfils its international commitments and coordinates international cooperation. It also participates in the development of new laws and regulations.

Figure 1.1: Structure of the central body of the Ministry for Environmental Protection and Nuclear Safety



The Ministry's competencies, as specified in the Law on Environmental Protection, include the following:

- Provide for the organization and enforcement of environmental policy in Ukraine and for the safety and protection of natural surroundings and life.
- Provide for the protection of the environment and public health from the effects of pollution and towards the goal of a harmonious relationship between nature and society.
- Provide for the establishment and enforcement of ecological safety standards and the organization of effective and complex measures for environmental protection, rational use of natural resources and the coordination of actions of State and public organizations to protect the environment.

One important task of the Ministry is to coordinate the activities of the different governmental bodies of Ukraine and the Autonomous Republic of Crimea, 24 provinces, Kyiv and Sevastopol. It is responsible for environmental inspectorates in the regions, cities and districts, the State agencies for ecological inspections, analytical control and research into the environment and the protection of the Black Sea and the Sea of Azov. It also coordinates various research and education institutions.

The Main State Environmental Inspectorate of Ukraine, the State Inspectorate for the Protection of the Black Sea, the State Inspectorate for the Protection of the Sea of Azov, the Main Department of National Natural Parks and Protected Areas, and the Base of the Ukrainian Fleet of the Ukrainian Scientific Centre of Marine Ecology, all come under the supervision of the Ministry.

Other public administrations with environmental competencies

The Ministry for Emergency Situations and Protection of the Population from the Consequences of the Chernobyl Catastrophe (MES) was established in 1991. It originated from a former USSR State Committee that was in charge of the clean-up and the resettlement of people after the Chernobyl accident. Its activity is no longer limited to the Chernobyl plant, but is country-wide. In particular two departments – radioactive contamination protection and radioactive waste clean-up - are directly involved in environmental issues.

Other ministries also deal with environmental questions, like the ministries of agriculture and forestry. At present, there is no strict delimitation of the responsibilities of the Ministry of Environmental Protection and Nuclear Safety, the MES, the State Committee of Forestry, the Ministry of Agriculture, and various Committees and State Committees (Water Resources, Land Resources, etc.). For example, the State management and control of land use is shared between the Ministry of Environmental Protection and Nuclear Safety (all environmental aspects) and the State Committee on Land Resources (all economic aspects). State Committees are not subordinated to the Ministry, hence not instructed. At present, according to the Order of the President of Ukraine of 13 March 1999, No 250/99 "On changes of Ukrainian executive power bodies", the Cabinet of Ministers directs the (1) Administration for Nuclear Safety, (2) the Committee for Water Resources Management, (3) the Committee for Geology and Mineral Resources Exploration, (4) the Committee of Hydrometeorology and the Committee for Chemical Protection of Plants through the Ministry for Environmental Protection and Nuclear Safety of Ukraine.

Parliament and further commissions

The Parliament's Standing Commission on Environmental Policy and Chernobyl develops and reviews draft legislation regarding environmental management and natural resources use. It also executes parliamentary control over activities of ministries, agencies and local branches of the State environmental protection administration.

Recently, a National Commission on Sustainable Development has been established. It is headed by a Vice-Prime Minister. The Commission includes 21 members, chosen either for their function or their personal capacity (e.g. scientific standing). The Commission is expected to meet regularly, but has so far met only once.

The Commission on Nuclear Policy and Ecological Safety is part of the National Security Council. The Commission's main objectives are to:

- define national policy regarding nuclear power, ensuring nuclear and ecological safety,

- analyse ecological problems and develop mechanisms to improve the ecological situation, and
- provide national expertise on issues of nuclear safety and treatment of radioactive wastes.

Within the Cabinet of Ministers, a State Commission on Technological Safety and Emergency Situations was established to make decisions and implement programmes in response to technological and environmental catastrophes, and to coordinate government emergency response efforts at the provincial level. There is also the State Committee for Nuclear Energy, attached to the Cabinet of Ministers, which is responsible for the full cycle of the nuclear power plant operation.

State Departments for Environment Protection and local authorities

The State Department for Environment Protection (SDEP) is the central State management body for the environment in each of the 24 provinces, Kyiv and Sevastopol. Each local SDEP, as the local branch of the Ministry, is guided by instructions from the Ministry of Environmental Protection and Nuclear Safety for planning and applying environmental law within its territory and area of competence. The main tasks of the SDEP are:

- Enforcing Ukraine's environmental policy and protecting the natural surroundings from the effects of pollution at oblast or local level,
- Promoting compliance in the respective oblast,
- Carrying out ecological inspections,
- Applying State policy on the use and control of soils, groundwater and surface waters, mineral deposits, atmosphere, etc.,
- Protecting nature reserves at oblast level,
- Applying State standards, rules and regulations for the protection of the environment and the rational use of natural resources at the local level,
- Reviewing the information about the plant operations and emissions and issuing appropriate permits,
- Drawing up local environmental protection programmes,
- Testing and assessing new economic mechanisms in environmental protection.

In the Autonomous Republic of Crimea, these tasks are fulfilled by the Committee for Environment and Nature Resources of Crimea, which reports to the Government of Crimea on questions that concern Crimea. On other questions, it reports to the MEPNS.

In addition to the regional and local branches of the MEPNS, local authorities may also involve institutions that are independent of the national government in environmental management. The respective competencies of local authorities are primarily specified in a law on local self-government.

1.4 Environmental impact assessment

Scope and functions

The assessment of environmental impacts is regulated by the Law on Ecological Expertise of 1995. It states that the aim of ecological expertise is "to prevent the negative impact of anthropogenic activities on the environment, and evaluate the level of environmental safety of economic activities and environmental situations in individual territories and facilities".

Ecological expertise applies to individual, potentially harmful activities – they are enumerated in Decree 554 of the Cabinet of Ministers of 27 July 1995 and include nuclear power plants, biochemical and biopharmaceutical production, oil and gas refining, electricity and heat production, sewage treatment – as well as strategies, such as legislation introducing new technologies, materials, products or economic and territorial development.

Assessments are carried out by

- The Ministry of Environmental Protection and Nuclear Safety and its local agencies as well as special institutions and commissions established by them,
- public organizations of an ecological nature,
- other institutions and natural persons, including foreign ones, involved in environmental expertise,
- and individual persons as foreseen by the laws.

State, public and other types of environmental expertise are carried out. Only the conclusions of State environmental expertise are binding, those of public and other environmental expertise are recommendatory. Public environmental expertise may be carried out for any type of activity that requires ecological substantiation, at the initiative of public organizations. Other environmental expertise may be carried out at the initiative of

interested legal entities or natural persons, on the basis of contracts with specialized environmental expertise agencies.

Procedure

A developer for whose project an environmental expertise is needed has to file an application with the local authorities/oblast. In a "declaration of intentions", he has to specify the type of production, the material to be used, and he – or a company specialized in environmental expertise - has to assess what the impacts on air, water, soil and waste will be. The local authorities establish a special commission where all interested entities are represented, e.g. commissions on land use, agriculture, industry, water, local representatives from the environment and health ministries, inspectors, environmental protection specialists. This commission decides if and where the project may start, and this decision is confirmed by the head of the oblast. The developer then draws up the "terms of reference" in which he describes various alternatives, e.g. different ways of construction. Also, the impacts on the environment are assessed. These documents are then sent to the local services such as the Committee on Saving Resources, the fire department, the representatives of the environment and health ministries. Every entity gives its conclusion separately on the basis of these two documents, and the services agree on one alternative. After completion of the project, the special commission has to confirm that the project was carried out according to its requirements.

Article 11 of the Law on Environmental Expertise provides for public participation. The conclusions of the environmental expertise have to take public opinion into account. There are, however, no procedures in place for organizing public participation – which means that in practice public participation is the exception. This severely limits the usefulness of environmental impact assessment for the promotion of public participation.

If the possible environmental impact of a project concerns an area beyond the borders of a single oblast, the Ministry of Environmental Protection and Nuclear Safety may order a supplementary State environmental expertise. If a project is of national importance, e.g. building of an airport or a major road, the expertise is conducted by the Ministry itself.

Carrying out projects or activities requiring an expertise without having first obtained a positive expertise is prohibited (art. 39 of the Law). If the assessment is negative, the developer has to undertake additional work in accordance with the environmental expertise's conclusions, and submit material for a supplementary State environmental expertise.

Interested legal entities have one month to appeal to a higher agency against decisions taken on the basis of State environmental expertise. If there is a discrepancy between the decisions of agencies, they can start a judicial procedure.

1.5 Enforcement

According to the Law on Environmental Protection, the Ministry of Environmental Protection and Nuclear Safety exercises State control over the use of land, mineral resources, surface water and groundwater, atmospheric air, forests and other vegetation, fauna, the sea and its natural resources. This control is carried out and enforced by its State Ecological Inspectorate.

The State Ecological Inspectorate is headed by Ukraine's Main State Inspector, who is also a First Deputy Environment Minister. He coordinates State control over the protection of the natural environment. The Main Inspectorate instructs the inspectors at oblast level, and they, in turn, supervise the inspectors in the rayons (usually, two or more rayons have some three or four inspectors together). There are 26 oblast inspectorates and a Committee of Environmental Inspection in Crimea. In total, there are around 2 650 environment inspectors, 235 of them within the Ministry. In addition, there are around 100 000 health inspectors and some 27 000 forest inspectors.

The Inspectorates verify the operation of enterprises and other facilities; they verify their pollution-control equipment for water, dust and gas. They check the emissions of mobile sources, the storage, transport and use of, for instance, fertilizers, toxic and radioactive substances. They also exercise State control over compliance with State standards and norms related to environmental protection and the use of natural resources, and with ecological safety requirements. Moreover, the Main Ecological Inspectorate provides methodological support to regional and territorial State ecological inspection authorities. The comprehensive rights and duties of the inspectors include:

- Inspecting industrial facilities,

- Limiting or suspending activities that violate environmental laws, including the operation of industrial and other facilities,
- Making proposals to cancel permits.

Big industrial facilities are inspected by the Main Inspectorate, enterprises operating at the regional or local level by the respective Inspectorates. The 120 most critical enterprises are inspected at least once or twice a year. If an enterprise, agency, organization or other facility violates environmental legislation or exceeds the pollutant emission or discharge limits, the Inspector will, apart from imposing a fine, draw up instructions on what has to be improved to comply with the legal requirements. If the enterprise does not take the necessary measures and the harmful activities continue, its activities can be limited, suspended or terminated. The applicable procedure and the legal grounds are specified in a resolution of the Parliament.

For breaches of environmental laws, both individuals in their official capacity and enterprises can be fined. The amount of fines is calculated on the basis of the code on administrative offences. The fines for individuals range from 10 to 100 US dollars, a substantial amount of money taking into account the average wages. In 1997, 43 257 persons were fined a total of UAH 2.4 million, of which 1.4 million were paid; the application of some 600 laws and regulations in all sectors of environmental protection were controlled. Fines on enterprises were considerably higher. They added up to UAH 78 million in 1997 (mainly infringements of legislation in the water sector). These infringements are partly a result of the economic crisis – treatment facilities worsen and old or broken equipment is often not replaced.

State ecological inspection is included in the State budget. The Main Ecological Inspectorate and the Black Sea's and the Sea of Azov's inspectorates form independent legal and budgetary entities. Partly, the Inspectorates are financed through the collected fines, of which they may keep a certain percentage for business trips, necessary equipment, etc. The money collected from fines is distributed to the different organizational levels. In addition to the State Ecological Inspectorate, similar but independent inspection institutions exist for land resources, underground resources, fishing, forestry and hunting. Criticism is voiced about the coordination of these institutions, pointing to possibly uneconomical use of laboratories and other equipment or practices that could be commonly used or applied.

1.6 Liability

The Ukrainian legislation provides for administrative, criminal and civil liability. Article 69 of the Law on Environmental Protection provides for compensation for damage resulting from a breach of environmental protection legislation. It does not indicate a time period for liability. Therefore, action may apply to past environmental damage. However, there are no procedural rules for liability in cases of past environmental damage, so that the matter is not clearly regulated. If a company buys land that is contaminated or otherwise environmentally damaged, any necessary repair is decided by the competent authorities, case by case.

In the case of on-site and off-site pollution, the Inspectorate assesses the damage. The assessment is done on the basis of methods developed at the environmental research institute in Kharkov. The methods are registered with the Ministry of Justice and are available at State Environment Protection Departments in the regions. Work is currently under way to complete the set of such methods (i.e. for pollution resulting from transport). The compensation is to be paid by the polluter into the general State budget, after deduction of 20% for the budget of the Inspectorate. If the polluter is a public authority, the payment is reduced to 30% of the amount assessed – a practice which is set to disappear with the current reform of the compensation system. As payment is into the general budget, the amounts paid are not normally used for actual rehabilitation of the damaged site.

The Law on the Legal Status of the Area under Radioactive Contamination Resulting from the Chernobyl Disaster, the Law on the Status and Social Protection of Citizens Who Suffered from the Chernobyl Disaster provide for governmental liability for the damage resulting from the Chernobyl disaster. The Government assumes liability for the corresponding health damage and material damage.

1.7 Monitoring

The monitoring activities of the large number of monitoring stations are organized and coordinated by the Ministry of Environmental Protection and Nuclear Safety. The stations were inherited from

the Soviet Union and their equipment is beginning to date. Monitoring activities are undertaken by a variety of institutions and ministries, e.g. environment, health, and State committees or committees, e.g. hydrometeorology, water management, building, architecture and housing policy, geology. Each has its own monitoring network. It is difficult to exchange their data, because every ministry or department organizes its data bank in its own way, and often the formats are incompatible.

1.8 NGOs, public awareness and participation, education and information

Various laws foresee public participation, but mostly there is no procedure to actually let the public participate. A frequently mentioned example is article 11 of the Law on Environmental Expertise, which calls for public participation without providing for an adequate procedure (see above). Significant concerns regarding public participation in the environmental expertise process have also been raised in connection with the controversial K2/R4 Nuclear Reactor Completion Project. Despite repeated requests for information, Ukrainian officials have not involved the public and shown a lack of understanding and interest in what public participation in environmental decision-making actually means. Ukraine has ratified the Espoo Convention.

Although court proceedings on environmental and health questions are free of charge, very few people take legal steps if they feel that their rights are infringed.

There are around 100 environmental NGOs in Ukraine. The majority act locally. There is a Council of NGOs at the MEPNS. It has an advisory function and comprises 18 NGOs that are active at the national level, i.e. having representatives in at least 14 oblasts. Since members of the former scientific centres, like the Geodesic Institute, the Plant Biologists Society, the Hydroecology Society, the Bird Protection Society, etc., are members of these NGOs, and since they are often supportive of MEPNS policies, it is sometimes felt that the Council is not fully independent of the Government. Furthermore, the Council is also seen as thwarting contacts between the MEPNS and NGOs not members of the Council, thereby undermining NGO influence on legislative and policy decisions.

Pursuant to the decision of the 1995 Conference of European Environment Ministers in Sofia, a Regional Environmental Centre is being set up in Kyiv. Its objective is to foster public participation and promote international as well as inter-regional cooperation on environmental issues. The Aarhus Convention was submitted for ratification to Parliament in May 1999 (see Chapter 3).

Due to the Chernobyl catastrophe, public environmental awareness is still comparatively high in Ukraine, although public interest in environmental protection issues is dwindling in view of the severe economic situation. The press regularly covers environmental issues.

According to recent polls (TACIS-funded), 21 per cent of Ukrainians think that the quality of life is "very bad"; 39 per cent think it is "somewhat bad". 80 per cent, the highest number in central and eastern Europe, feel that the quality of life has become worse over the past five years. Among the most important issues, 'environmental protection' ranks fifth in the polls, after health, crime, poverty and food prices. At the same time, 95 per cent find environmental protection "important", 80 per cent even "very important".

The most commonly mentioned environmental problems are air pollution (86 per cent), pollution of drinking water (86 per cent), nuclear safety (83 per cent), waste (81 per cent), deforestation (81 per cent), endangered animal species (68 per cent), and global warming (50 per cent). Pollution of drinking water (85 per cent), nuclear issues (82 per cent), and pesticides in food raise the most concern. This shows that, while the general public in Ukraine is more concerned about a wide range of environmental issues than in other newly independent States, their attention is mainly focused on problems that could affect public health.

According to the Law on Environmental Protection, nature-friendly attitudes and specialist environmental training will be improved through general compulsory and comprehensive environmental education, from pre-school establishments, to general secondary, vocational and higher education, and refresher courses and advanced training. Ecological knowledge will be obligatory for all officials whose activity is related to the use of natural resources or has an impact on the environment. Specially appointed higher and vocational educational establishments will train

specialists in environmental protection and the use of natural resources with due account of public needs.

There are many activities at the local level, in schools and pre-schools, often initiated or supported by NGOs. For example, scientists and practising specialists of Poltavska oblast have developed an integrated natural history educational course "The Environment", experimental manuals and study aids that cover ecological issues. This course is taught at 28 schools in the oblast. The yearly all-Ukrainian school competition "My motherland" is also a success. In 1996, 20 oblasts and Sevastopol took part.

Free access to ecological information, including information about the quality of food and consumer goods, is guaranteed under the Constitution, as is the right to disseminate such information. The Ministry of Environmental Protection and Nuclear Safety is obliged to submit every year to the Parliament a National Report on the State of the Environment (the report is also translated into English) and to provide ecological information to the interested public and private institutions. Moreover, the Ministry publishes a monthly ecological bulletin "Living Ukraine" on questions of environmental protection, which contains a summary in English.

1.9 Conclusions and recommendations

Since its independence, Ukraine has put considerable efforts into enacting modern environmental laws and regulations in the main sectors of environmental protection. There are, however, still quite a few regulations from the Soviet period in force, and it is not always clear which regulations apply in a specific case. Moreover, some laws have been enacted before the new Constitution came into force. Therefore, legal certainty as to the validity of old Soviet regulations and the accordance of the pre-constitutional laws with the new Constitution is lacking. With regard to the old Soviet regulations, a deadline, i.e. the setting of a precise date after which they will no longer be valid, would increase legal certainty – which is an important requirement for all (economic) actors in the country. Moreover, countries that have followed this practice of setting deadlines have also found that establishing convenient priority schedules for the development of legal instruments yields additional benefits. If and where necessary, these regulations should be replaced before such a date by new, Ukrainian regulations.

Recommendation 1.1:
A deadline should be set for the former Soviet regulations to be replaced or abolished. The laws that were drafted before the new Constitution was adopted should be re-examined critically. The harmonization between laws and their effective enforcement should be regarded as a priority.

With the set of documents constituting the NEAP, in particular the "Principal Directions", as well as with the establishment of the National Commission on Sustainable Development, important steps to promote environmental policy and its integration into other policies have been taken. However, priorities for funding the programmes must be defined, to prevent that only half of the required "priority" funds are available. In other words, priority lists at all levels of government, also the national levels, should be realistic in terms of available finances. There seems to be a significant lack of communication and cooperation between the Ministry of Environmental Protection and Nuclear Safety and the other ministries, State committees and committees concerned. As a result other institutions are not very interested in the process of sustainable development and do not sufficiently take the effects of their policies on the environment into account. The National Commission on Sustainable Development has a great potential in this sectoral integration of environmental and socio-economic policies.

Recommendation 1.2:
The National Environmental Action Plan should be revised and refined in close cooperation with other ministries and social groups concerned, to set clear priorities, targets and time frames in the different sectors of environmental protection. *See also Recommendations 3.1 and 7.4.*

There is a significant lack of cooperation within the Ministry of Environmental Protection and Nuclear Safety, between this Ministry and other ministries, State committees, committees and parliamentary committees, and between the Ministry of Environmental Protection and Nuclear Safety and the regional and local levels. Complicated and lengthy procedures hinder cooperation in legislative projects.

Recommendation 1.3:
There should be a continuous exchange of views

between the different administrations and interest groups involved throughout the law-making process; substantive contacts and cooperation between ministries and with other institutions should be possible without the authorization of the Cabinet of Ministers.

Permits are issued for the single media air and water, but there are no waste permits. Such a system, as compared with an integrating permitting system, does not encourage comprehensive solutions to the environmental problems of a site. The introduction of environmental management and audits can be a convenient tool to promote such solutions. Regarding enforcement, an investigation into the efficiency of the parallel operation of several inspecting services should be undertaken, possibly resulting in economic gains from some streamlining.

Recommendation 1.4:
Environmental auditing of industrial enterprises should be considered a suitable basis for gradually developing an integrated permitting system, covering air, water and waste at the same time. The organization of the various inspecting services should be reconsidered with a view to improving their combined economic efficiency. See also Recommendation 13.6.

The existing monitoring system is too scattered: too many institutions monitor too many pollutants and ageing stations use insufficiently comparable methodologies. Often different institutions have to gather the same data because they are not exchangeable, as their databanks are incompatible.

Recommendation 1.5:
The Ministry of Environmental Protection and Nuclear Safety should strengthen its coordinating activities regarding environmental monitoring. A coherent and comprehensible national monitoring system should be developed, for which the harmonization of data systems and methodologies is a prerequisite. The data should also be systematized, integrated and processed for management decisions. The European Environmental Agency should be provided with comparable data. The work on the development of an adequate environmental information system should be accelerated in order to assist in the strengthening of public and governmental awareness of environmental problems. See also Recommendations 4.7, 7.6, 8.2, 9.5, 10.5, 11.6.

The NGO community comprises not only independent organizations but also former scientific institutes supported by the State. The present Council of NGOs does not appear to be representative enough to remain the Ministry's only partner for public consultation. Due to the Chernobyl accident, public environmental awareness and interest are still relatively high in Ukraine compared to many other central and east European States, although environmental protection is not seen as the top priority, due to the worries arising from the economic crisis. It is highly likely that the MEPNS could raise its public standing, if it succeeded in satisfying better the still high public interest in environmental issues. Although some laws foresee public participation, in environmental issues it is insufficient, as adequate procedures are lacking. The pending ratification of the Aarhus Convention is a step in the right direction, but cannot replace the procedural basis for public participation.

Recommendation 1.6:
The Ministry of Environmental Protection and Nuclear Safety should improve public access to environmental information in accordance with the Aarhus Convention and should seek more contact with the entire NGO community, particularly when preparing legislation and developing policies or action programmes. Suitable methods for improving public participation should be adopted after consultation with the NGO community. Environmental impact assessment should be seen as one tool for strengthening public participation in environmental decision-making. The Ministry should intensify its contacts with the press. The public should be encouraged to pursue its environmental rights, and procedures for public participation in environmental decision-making should be put in place speedily.

Chapter 2

ECONOMIC AND REGULATORY INSTRUMENTS

2.1 Economic instruments for integration

The following economic instruments are available in Ukraine for the integration of economic and environmental decisions:

- Taxes on land, mineral resources, and water use
- Fees for geological explorations;
- Charges on the discharge of pollutants into water, air, and soil;
- Charge and tax incentives (reduced basic rates) that are limited in time and constitute subsidies for energy, mineral resources production, and water use;
- Sanctions for exploring or mining minerals and discharging pollution without authorization, for exceeding established limits for resource use and discharge of pollutants, and for violating environmental legislation and damaging the environment;
- User charges for water, sewerage and sewage treatment, and municipal waste collection and disposal;
- Grants to undertake environmental training, education, feasibility studies, research, or to start projects;
- Excise and customs duties on mineral resources, fuels, and cars.

In the short term, the authorities are considering applying the following measures, which will affect economic instruments:

- Withdrawal of subsidies for the use of resources such as energy, mineral resources and water.
- An environmental audit aiming at identifying practices that are potentially hazardous to the environment. The environmental audit is expected to become obligatory during the privatization of industrial enterprises.
- Environmental insurance for the consequences of environmental accidents and disasters, as well as for the rehabilitation of areas when mining or quarrying is discontinued.
- Pollution charges and fines are to be paid into the State Environmental Fund The Fund will have the legal, financial, administrative and managerial capacity to manage domestic contributions.

Land tax

The *Law on Supplements and Amendments* (13 May 1992) *to the Land Code* (1990) of the Ukrainian SSR introduced an annual fee (either as a land tax or as a leasing fee), which is determined by the quality and location of the plots, as included in the land register, following the categories specified in article 36 of the supplements. The Law also includes some land tax exemptions. For example, newly established commercial farms are exempted from the land use tax for a period of three years. The Rada of the Autonomous Republic of the Crimea, regional (oblast), Kyiv, and Sevastopol Radas may establish a partial exemption for a limited period, deferred payments, or a reduction in the tax rate.

The land tax pursues several aims. It seeks to ensure the rational use and protection of land (fertility of soils), to equalize conditions for the management of land of different quality, to finance operations of the land cadastre, to monitor land, and to develop the infrastructure for human settlements. The procedure of assessing taxes, average land tax rates, and minimum and maximum rates are determined by the *Law on Payments for Land Use* (1996). It differentiates the land tax according to its use: agricultural, industrial or human settlements purposes.

Like in many other countries, Ukraine's land tax is a major source of income for local budgets. Until recently (according to the 1992 version of the Law), 30 per cent of the land tax revenues accrued to the State budget, 10 per cent to the regional budget (including special accounts of the cities of Kyiv and Sevastopol, and the Crimea) and 60 per cent to the special local budget accounts. The latest version of the Law (1996) stipulates that all funds go to the accounts of local budgets (and since 1998, to the special budget account of the State Committee on Land Resources).

Taxes on the use of natural resources

The *Law on Environmental Protection* introduced an obligation to pay for the use of natural resources. Its article 43 laid down rates of payment for the use of natural resources. The procedure of payment was to be established by the Cabinet of Ministers (CM). It also required the tax payment to be calculated on the basis of resource use limits. Those resource use limits and procedures are defined by the appropriate Radas (of the Crimea, regional, or municipal authorities). When natural resources are of national importance, the Cabinet of Ministers sets the use limits. The framework Law on Environmental Protection specifies that payment for resource use within established limits shall be part of production costs, while payment for amounts exceeding use limits shall be paid out of profits after tax.

The specific laws on natural resources (mineral resources, water, and land) make a difference between resources of national versus local importance. This difference determines who will benefit from the tax revenues. In addition, it influences the setting of limits on resource use (see taxes on the use of mineral and water resources). Another feature is that the permits to use resources include tax clauses.

Taxes on the use of mineral and water resources

The *Mineral Resources Code* established the obligation for mineral resource users to pay tax for this use and fees for geological exploration funded by the State budget. *CM Resolution 85* (of February 1994) introduced a temporary procedure to collect taxes on the commercial use of mineral resources. This resolution prescribed a 1 per cent tax rate (0.5 per cent for coal) on the mineral resource sales price (excluding the value-added tax) of extracted commercial minerals. *CM Resolution 1014* of 12 September 1997 prescribed the definitive basic tax rates for mineral resource use. It changed the uniform rate of Resolution 85 to a rate schedule per unit (tonne, m^3) of mineral extracted. The new basic rates have been applied since 1998.

According to the Mineral Resources Code, the proceeds from taxes on mineral resources of national importance are divided between the State and regional budgets. For mineral resources of local significance, all these tax revenues go to the budgets of the regions. The revenues from the tax on prospecting and exploration of commercial mineral deposits are split between the State budget (40 per cent) and the budgets of the regions (60 per cent). The revenues from the tax on the use of mineral resources on the continental shelf and within the boundaries of the maritime economic zone go entirely to the State budget.

Fees for geological exploration work that is funded by the State budget is channelled fully to the State budget, and earmarked for the development of mineral raw materials and resources. *CM Resolution 645* (September 1995) is the current legislative act prescribing the procedure to levy the fees. It also specifies the tax base as the sales price excluding the tax on mineral resources, rent and value-added tax. The basic rates are fixed by the Ministry of the Economy, in its *Resolution 187* (December 1995). They apply to oil, natural gas, solid fuels including peat, ferrous and non-ferrous metals (excluding radioactive metals), various other raw materials and mineral and thermal waters. The basic rates vary from 0.4 per cent for peat to 11.6 per cent for oil.

Similarly, the *Water Code* (6 June 1995) established the obligation to pay for water use. *CM Regulation 75* (February 1994) had put in place a provisional procedure to make payments for the commercial use of freshwater resources and provisional rates for such use. The following legal acts amended the resolution: (1) *CM Resolution 247* (April 1994) on water use for agricultural purposes, (2) *Resolutions 615* (September 1994), *185* (March 1995) and *67* (January 1996) on Raising Tax Rates for Water, and (3) *Resolution 520* (May 1996) on Water Tax Procedure.

The current water resource tax rates are prescribed by *CM Resolution 164* (February 1997) on the Basic Rates for Economic Use of Freshwater Resources. The rates are differentiated according to the source (ground or surface and basin), and to the use (for drinking, for hydropower plants, for water transport needs, agricultural irrigation, fish farming, for thermal power plants, and for bathing). The surface water tax ranges from 0.0144 hryvnia per m^3 in the Danube basin to 0.0864 hryvnia per m^3 for rivers flowing into the Sea of Azov. The groundwater tax ranges from 0.0288 hryvnia per m^3 in the Kyiv region to 0.09 hryvnia per m^3 in the Ivano-Frankovsk region. Hydropower plant pay 0.007 hryvnia per 100 m^3 used. Ships pay 0.0014

hryvnia per passenger-day and 0.0125 hryvnia per tonne-day of cargo. The tariff for drinking and bathing water supply does not include the water resource tax.

The actual tax is calculated by multiplying the extracted amounts (including losses) by the basic rates. If established limits for resource use were exceeded or resources were extracted without a permit, penalties apply (see stumpage fee and taxes on the use of flora and fauna). The revenues from the tax on the use of waters of national importance are divided between the State (80 per cent) and regional budgets (20 per cent). The tax on water use from waters of local significance goes entirely to local municipal budgets.

Stumpage fee and taxes on the use of flora and fauna

The State owns 76 per cent of all forests, the rest being owned by associations of forestry enterprises. Forest resources are subdivided into those of national and those of local importance. National forest resources are those that are commercially used, the other forests are considered local resources. The Law on Forests stipulates that while the non-commercial use of forests is free, commercial users of the forest resources and of the Forest Fund for hunting, for cultural, health, recreational, sports and research purposes, as well as for tourism, have to pay.

Payment for logging takes the form of a stumpage tax. *CM Resolution 44* (January 1997) specifies tariffs by tree species. The tariffs are differentiated according to two forest categories in each region and five categories of transport distance between the cutting plot and the logging or storage places. In addition, the stumpage depends on tree quality and is calculated per m^3. The taxes on the use of forest resources of national importance are divided between State (80 per cent) and regional budgets (20 per cent). The budgets of the cities of Kyiv and Sevastopol and also of the Crimea receive 20 per cent for forests of national importance and 100 per cent for forests of local importance on their territory.

The *Law on Fauna Protection* (March 1993) established the obligation to pay for the commercial use of fauna and fish resources. *CM Resolution 1073* (5 September 1996) introduced a procedure to fix fishing limits and tax rates for commercial fishing by fish species. *CM Resolution 123* (January 1996) did the same regarding hunting limits and tax rates per hunted species or plant collected. Taxes on the use of fish, flora and fauna are paid entirely to the State budget.

Revenues from taxes on land and resource use

The State tax authorities, in cooperation with appropriate inspectorates (for environment, forestry and geological exploration) administer the taxes on natural resources. Tax authorities check enterprises for tax liabilities and ensure that taxes are paid to the different budgets as prescribed. From 1994 to 1997, the revenue share of taxes on natural resources increased by 1 per cent to 1.6 of per cent of the consolidated State budget (Table 2.1). The data for earlier years are not fully available.

The fee for geological explorations was the major contributor to the aggregate until lately. In 1997, the taxes on water became the major source (41 per cent of all taxes on nature resources). There has been an increase in water taxes. Within the local budgets, the mineral and water resource taxes represent over 90 per cent of revenues from nature resource taxes. The trends in revenue shares from mineral resource, water and forest taxes to the State budget deviate from the shares prescribed by law. Tax collection is a problem, as companies are in dire financial straits. This probably leads to excess pressure on the environment.

Pollution charges

The *Law on Environmental Protection* introduced an obligation to pay for air emissions, waste-water discharges and waste disposal. The charges are calculated on the basis of pollution limits. The pollution limits and payment procedures are defined by the Ministry of Environmental Protection and Nuclear Safety in permits.

CM Resolution 18 (January 1992) on the payment procedure and on an extrabudgetary environmental fund prescribed the charges to be paid for air emissions (including from mobile sources), for surface, ground and marine water pollution, and for waste disposal. The Resolution has been amended by *CM Resolutions 373* (July 1992), *298* (March 1996) and *283* (March 1998). *Resolution 153* of the Ministry of Environmental Protection and Nuclear Safety (December 1995) specifies the current basic charge rates. Charges are calculated per tonne of pollutant taking territorial

Table 2.1: Taxes on nature resources to State budget, 1992-1997

Million US$, current prices

	1992	1993	1994	1995	1996	1997
Total consolidated budget revenue	**5 901.4**	**10 932.3**	**16 501.3**	**14 045.4**	**16 517.5**	**14 582.8**
Excise tax	286.5	553.8	530.5	275.8	353.2	621.8
Customs duties	12.0	23.6	58.1	58.1	95.8	147.9
Land taxes	78.8	171.1	129.9	429.7	439.6	538.1
Taxes on natural resources	36.5	63.1	106.6	99.9	164.9	236.7
As share of the consolidated budget revenues (%)	*0.6*	*0.6*	*0.6*	*0.7*	*1.0*	*1.6*
- Fees for geological explorations	36.5	63.1	92.4	69.4	96.5	90.5
- Taxes on mineral resources	-	-	3.2	11.5	20.7	33.1
- Water taxes	-	-	4.7	14.9	37.7	96.0
- Forest and fauna taxes	-	-	6.3	4.1	10.1	17.1

%

	Share under the law	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
As share of the appropriate item of the consolidated budget							
Total State budget revenue		**52**	**52**	**66**	**58**	**64**	**..**
Land taxes	***30% till 1997***	..	..	17	16	27	00
Taxes on natural resources		..	..	91	81	82	77
- Fees for geological exploration	***100%***	100	100	100	100	100	100
- Taxes on mineral resources	***40%***	..	..	..	47	26	32
- Water taxes	***80% of State importanc***	..	..	33	41	70	71
- Forest and fauna taxes	***80%***	..	..	..	..	74	76

Sources: Statistical Yearbooks, Ministry of Statistics; National Bank of Ukraine.

Notes: Consolidated State budget comprises State budget and budgets of regions and municipalities.
Annual average exchange rate is used.

environmental peculiarities into account through differences in basic rates and weight coefficients. When emissions fall within established limits, a pollutant-specific charge is calculated by applying the basic rate. Decree No 303 of the Cabinet of Ministers of 1 March 1999 has simplified the system of fees for environmental pollution and established a list of the major polluting substances. According to the Decree, the State Tax Inspectorate is responsible for ensuring that fees are paid in full and on time. Currently, the basic rates are available for 25 major air and 9 major water pollutants. For chemicals that are not in the list, the basic rates are specified according to their toxicity class. The rates for mobile sources differ for leaded petrol, unleaded petrol and diesel fuel. The basic rates for waste depend on toxicity (Table 2.2). Charges for air pollution from mobile sources are calculated by the polluters themselves, as are the limits for waste generation and disposal since August 1998 (CM Decree No. 1218). They are imposed only if the polluters fail to calculate them. A proposal to replace this charge by a tax on motor fuels is under consideration.

The basic charge rates are based on estimates of the monetary damage associated with each pollutant, applying the 1989 USSR methodology, which was based on 1985 total cost figures. The temporary basic rates were introduced in 1989. After inflation surged, the rates were multiplied by a factor of 92 (column '1993-1995' of Table 2.2, *MEPNS Resolution 46* of April 1993). The second adjustment came in 1995, when the charge rates were multiplied again, this time by an average factor of 50.2 (the columns '1996-1997' and 'Charge changes' of Table 2.2, *MEPNS Resolution 153* of December 1995).

Inflation had, by the end of 1997, eroded the increase in charges. A 40-fold increase of charges would presently be necessary, if the increase in charges were to match that of consumer prices. The pollution charges are meant to be a penalty for

Table 2.2: Basic charge rates for selected pollutants, 1993-1997

Pollutant	Charge rates 1993-95	Charge rates 1996-97	Charge changes	Charge changes relative to inflation
	(UAH per tonne)		*(times)*	
Charges for pollution from stationary sources depend on its hazardousness				
Hazard category I	7.6	381.0	50.1	0.023
Hazard category II	1.7	87.0	51.2	0.023
Hazard category III	0.3	13.0	43.3	0.020
Hazard category IV	0.1	3.0	30.0	0.014
Pollution from mobile sources				
Diesel	0.007	0.3	42.9	0.019
Leaded petrol	0.008	0.4	50.0	0.023
Unleaded petrol	0.005	0.2	40.0	0.018
Charges for water pollution, including sea pollution				
Suspended solids	0.03	1.0	33.3	0.015
Bio-chemical oxygen demand	0.3	14.0	46.7	0.021
Nitrogen ammonia (NH^{+})	0.1	35.0	350.0	0.158
Orthophosphates	0.5	28.0	56.0	0.025
Sulphur- carbon containing compounds	0.7	35.0	50.0	0.023
Oil products	4.1	206.0	50.2	0.023
Chromium (Cr^{+3})	0.7	35.0	50.0	0.023
Arsenic	39.7	1,995	50.3	0.023
Lead (Pb^{+2})	39.7	1,995	50.3	0.023
Charges for waste landfilling				
Hazard category I	1.1	55.0	50.0	0.023
Hazard category II	0.04	2.0	50.0	0.023
Hazard category III	0.009	0.5	55.6	0.025
Hazard category IV	0.005	0.2	40.0	0.018
Average change of charges and correspondence to inflation			*50.2*	
Consumer price index (times)	*1 436.4*	*1.5*	*2 214.1*	

Sources: MEPNS Resolutions 303 (1 March 1999);
Ukraine in Figures in 1997, State Statistical Committee.

Note: Consumer price index was used to link the charges to inflation.

pollution. It would be desirable, if the system could provide an incentive to reduce pollution by introducing cleaner technology. The current basic rates remain low.

According to the law, the Ministry of Environmental Protection and Nuclear Safety enforces the pollution charges. Table 2.3 provides data on pollution charges and fines collected since 1995. The special extrabudgetary accounts of local and regional budgets (combined in the table under 'municipal') accumulate revenue. The State account is managed by the Ministry of Environmental Protection and Nuclear Safety. Again, the drop in the share below that prescribed by law indicates charge collection is poor. Enterprises pay about 25 per cent of the charges due (or about UAH 50 million out of 180 to 200 million.). The pollution charges contribute more than 95 per cent to environmental accounts, whether at the State or the municipal level. The use of the charges paid is partly determined by law. However, enforcement of the legally prescribed use of the funds is poor, particularly at the oblast level.

Incentives and subsidies: tax and charge reductions or privileges for those that are exempted

The *Law on Environmental Protection* describes legal incentives for efficient natural resource use and protection of the natural environment. If

Table 2.3: Environmental budgetary accounts, 1995-1998

Million US$, current prices

	1995	1996	1997	1998
Total revenues to budget accounts	**3.664**	**13.124**	**27.839**	**14.818**
State budget environmental account	**0.218**	**1.134**	**1.906**	**7.609**
" " *as share of the total (%)*	*6.0*	*8.6*	*6.8*	*51.3*
Pollution charges	0.215	1.130	1.883	7.601
Fines	0.003	0.004	0.022	0.008
Local budget environmental accounts	**3.446**	**11.989**	**25.933**	**7.209**
" " *as share of the total (%)*	*94.0*	*91.4*	*93.2*	*48.7*
Pollution charges	3.066	11.395	25.051	6.913
Fines	0.380	0.595	0.882	0.296

Sources: Statistical Yearbook 1996, State Statistics Committee; National Bank of Ukraine.

Note: Annual average exchange rate is used.

enterprises switch to low-waste and resource-saving technologies, install recycling or treatment facilities, or control instruments for pollutant discharges, they qualify for tax privileges. Unfortunately, it is not clear what the legislator had in mind: profit, value-added, or mineral resource tax. Short- and long-term preferential loans are also available for measures that enable efficient natural resources use or protect the natural environment. However, it is not specified what institution should grant these loans. Increased depreciation rates for fixed environmental assets can be granted. Special agreements can be made to release funds for measures reducing pollutant discharges or hazardous physical, chemical and biological effects on the environment, or promoting ecologically sound technologies and industries. None of these possibilities is currently implemented.

The *Ukrainian Mineral Resources Code* provides a standard waiver for charges for the use of mineral resources. The landowners or users do not pay, if they extract minerals of local significance for their own needs. Those who carry out geological, geophysical, surveying work, including exploratory drilling for the general study of mineral resources and for the prospecting and exploration of commercial mineral deposits, can be exempted from the levy, if the work was funded from the State budget, or the budgets of the Crimean Autonomous Republic, oblasts, or the cities of Kyiv and Sevastopol. The forecasting of earthquakes and the study of volcanic activity; geological engineering, geological-environmental research, the monitoring of underground water regimes, and other work that is carried out without disturbing the integrity of mineral resources is not liable to tax. If a concession (see Chapter 10) is granted to extract commercial minerals, the activity is free of mineral resource tax.

Preferential tax rates are also set in *CM Resolution 1014* for the use of mineral resources. They are limited in time (valid until 2000) and do not apply to oil, natural gas or coal production. The basic rate is lowered to 30 per cent of its normal level. 20 per cent of the basic rates are paid, if ferrous metals are mined. According to CM Resolution 164, the water use tax can be cut to 20 per cent of its normal level, if the water is used for agricultural irrigation, and to only 10 per cent for fish farming, pond and lake farming and housing and utilities. Conventional thermal and nuclear power plants pay 50 per cent of the water basic rates.

The *Law on Wastes* (1998) has 42 articles, of which 20 require additional CM resolutions. Currently only 6 such resolutions are in force (e.g. on the procedure to specify limits for waste disposal). The Resolution has an article on incentives with regard to profit taxation for those that reuse or recycle wastes.

CM Resolution 18 (January 1992) on environmental pollution payments entitles mobile sources that are equipped with catalytic converters to pay half the

air pollution charges. Heating energy plants pay only 10 per cent of the pollution charges according to *CM Resolution 298*, amending Resolution 18.

Sanctions, penalties and fines

The *Law on Environmental Protection* specifies sanctions for violations of the law. The Supreme Rada in its *Resolution 2751-XII* (October 1992) approved the procedure to limit, suspend or end operations of any facilities should they violate the Law on Environmental Protection. Suspended industrial facilities can restart only if they receive written permission from the authority (or its superior) that issued the temporary suspension. A decision on temporary suspension or termination of industrial activities can be appealed in court.

The *Code on Mineral Resources* and article 15 of the *Water Code* list sanctions (restriction, suspension, termination) in relation to the use of mineral resources, if environmental requirements are neglected. The departments of the Ministry of Environmental Protection and Nuclear Safety, State Mining Oversight agencies, State Geological Supervision agencies or their specially empowered State agencies have the right to impose sanctions. State Geological Supervision agencies can suspend the operation of enterprises and organizations engaged in the geological study of mineral resources without appropriate legal entitlement. The same powers are granted to environmental inspectorates when no environmental permits were obtained. According to *CM Resolution 1014,* penalties apply if established limits for resource use were exceeded. The penalty rate for exceeding the limits established is double the basic tax rate.

A penalty rate is applied to the amount of pollution emitted above the established limit. It is calculated by multiplying the basic rate with a coefficient of between 1 and 5 (article 11 of *CM Resolution 18)*. The appropriate Rada sets the coefficient that it considers appropriate within this range. The effective difference between the basic and penalty rates exceeds the coefficient because the payments for emissions within the limits can be deducted as production costs for income tax purposes, whereas payments for emissions above the limits cannot. It is difficult to collect the charges when an enterprise does not make any profit. Fines and penalties do not eliminate the liability for damage caused. The violator is responsible for compensating for the damage caused, which is normally assessed by a court.

The *Law on Amendments and Additions to Certain Legislative Acts on Environmental Protection* (March 1996) affected articles 47 (on funds for environment protection) and 48 (stimulus package for the environment) of the *Law on Environmental Protection*. Fines for the violation of environmental legislation and penalty payments for exceeding environmental protection standards are now shared between local, regional and State environmental budgets in the same proportion as fees for pollution of the environment.

The same Law on Amendments also affected article 55 of the *Law on Fauna Protection* (March 1993) authorizing those involved in the protection, use or breeding of animals to check documents and vehicles, and to confiscate hunting and fishing tools. It is also their responsibility to report violators to the offices of the Ministry of the Interior or local authorities.

Finally, the Law also amended the *Law on the Marine Economic Zone* (May 1995), authorizing the Ministry of Environmental Protection and Nuclear Safety to impose fines for violations at sea. The articles of the Criminal and Administrative Codes are stricter in the case of environmental violations.

User charges or tariffs for water

Municipal enterprises handle waste, and treat and supply water. Municipalities set their own tariffs for water and municipal waste treatment, and they vary from one municipality to the next. The supply price of water does not include a component for the water itself, which is free of charge by law. It is calculated to cover the cost of piped supply. The waste-water tariffs appear to be based on the volume of waste water alone. The tariff for water use includes the water tax (as for water abstraction) and the costs to supply the water (as for treatment and transport). In addition, the tariffs are different for 'budgetary organizations', households and other consumers. For budgetary organizations, the tariff varies from 0.21 hryvnia per m^3 in the Zaporizhia region to 1.12 hryvnia in the Chernivtsi region. On average the tariff is 0.43 hryvnia per m^3. For household consumers, the tariff varies from 0.12 hryvnia per m^3 in the Kherson region to 0.42 hryvnia per m^3 in the Chernivtsi region and the national average is 0.21 hryvnia per m^3. The tariff for other water consumers varies from 0.24 hryvnia to 2.15 hryvnia per m^3. The waste disposal tariffs

depend on the class of hazard and the overhead costs for its safe storage (Table 2.2 and Chapter 6).

Excise and customs duties

The *Law on Excise and Customs Duty Rates* (July 1996 with amendments of December 1997) specifies the rates for petrol in ECU. The custom duty is ECU 15 for each tonne of petrol. However, the excise duty is differentiated. The rate for unleaded petrol A-72, A-76 and A-80 is ECU 8, for A-90, A91, A-92, A-93 and kerosene is ECU 20, and for A-94, A-95, A-96 and A-98 is ECU 40 per tonne. The basic rate is multiplied by 1.5, if the petrol is leaded.

Ukraine manufactures a small amount of cars but most registered cars are imported. *CM Resolution 1139* (September 1996) on the import of road vehicles prohibits importing cars without catalytic converters starting from January 1997. Beginning in the year 2003, cars without catalysers will be prohibited and leaded petrol has to be phased out by then too. Both these provisions are currently suspended, so that the import of cars without catalytic converters continues. The *Law on Excise and Customs Duty Rates for Road Vehicles and Tyres* (May 1996) prescribes customs duties in ECU, according to engine type and cylinder volume. For example, vehicles with an engine below 1 000 cm^3 are subject to a customs duty of ECU 0.05 and an excise tax of ECU 0.20 for each cm^3. For engines with a capacity above 1 000 but below 1 500 cm^3, the customs duty increases to ECU 0.10 per cm^3, while the excise rate is the same. For the vehicles with an engine above 1500 but below 2 200 cm^3, the customs duty is ECU 0.10 per cm^3, and the excise rate is ECU 0.30. More powerful vehicles with engines of 2 200 and 3 000 cm^3, pay a customs duty of ECU 0.40 and an excise duty of ECU 0.60 per cm^3. Finally, vehicles with engines above 3 000 cm^3 are subject to ECU 0.80 customs and ECU 1.00 excise duties per cm^3. Vehicle tyres are subject to ECU 15 customs and ECU 5 excise duties per unit.

The custom officials collect the duties at the border. When the products are produced in Ukraine, the State Tax Inspectorate enforces the collection. It is not clear who checks the petrol on the border and the filling stations and whether the equipment needed is available. The phase-out of leaded petrol and vehicles without catalytic converters is delegated to the Ministry of the Interior, the State Customs Department, and the Ministry of Environmental Protection and Nuclear Safety. The excise and customs duties are channelled to the State budget.

2.2 Regulatory instruments

Institutions involved

Numerous institutions are involved in environmentally relevant regulations. The State management and control of land use is shared between the Ministry of Environmental Protection and Nuclear Safety (environmental aspects) and the State Committee on Land Resources (economic aspects). The Ministry of Agriculture plays an important but not a leading role in protecting arable land and water resources. The Committee of Geology and Mineral Resources is responsible for monitoring the geological sphere (including groundwater) and protecting the environment from the effects of economic activities. In rural areas, freshwater quality is under the control of local Sanitary and Epidemiological Services (Ministry of Health Protection). Some aspects of water pollution fall under the Committee of Geology and the Committee on Water Resources. It is difficult to say which body is in charge of the regulation of agricultural waste and related pollution. The State Committee for Building, Architecture and Housing Policy is responsible for a set of construction norms and regulations in civil construction. The Main Sanitary and Epidemiological Department (Ministry of Health Protection) is responsible for setting ambient standards for air, drinking water, noise, etc. The State Committee for Fisheries is responsible for setting ambient standards, safeguarding the reproduction of fish in rivers and lakes.

The Ministry of Environmental Protection and Nuclear Safety's orders and instructions guide the State Departments for Environmental Protection (SDEP) in the 24 regions, the Crimea, and the cities of Kyiv and Sevastopol (for details see Chapter 1). The SDEPs use State standards, rules and regulations for the protection of the environment and the rational use of natural resources at the local level. They review information on a facility's operations and emissions. They also issue permits as required, and they enforce environmental law and verify compliance, and can order sanctions. Furthermore, they may test and evaluate new economic mechanisms and instruments for environmental management.

Environmental licences and permits

CM Resolution 459 (August 1992) requires

environmental licences or permits for the use of the following natural resources: (1) sea water, (2) natural resources of the continental shelf and the marine economic zone, (3) groundwater, (4) surface freshwater located or used in the territory of more than one region, (5) forest resources of national importance, (6) other natural resources of national or local importance, (7) wild species of animals of national importance, and (8) minerals.

Different institutions issue different licences and permits. The SDEPs issue permits for the use of water, natural resources of the continental shelf and the marine economic zone (except minerals and fish). They also issue permits for the use of animal species, other natural resources of national significance, and animal and plant species registered in the Red Data Book of Ukraine. The State Committee on Fisheries and Fishing Industry authorizes fishing and other water industries that use natural resources of national significance. Authorities under the State Committee of Forestry issue hunting licences.

Local Radas issue licences and permits to use local natural resources, on the proposal of SDEPs. The approval of the State Committee of Forestry, the Committee on Geology, and the State Mining Technology Control Service is required for the exploitation of animal, forest, or mineral resources, respectively. The State Veterinary and local Sanitary-Epidemiological Services are involved in permitting when questions concerning their mandate are affected. The validity of the permit is set by the competent authority with the agreement of the local Rada. Each individual source of emissions in each medium requires a permit. The final licence/permit is to be issued within a month, otherwise applicants may address the superior State authority. A negative decision may be appealed in court.

CM Resolution 117 (February 1994) on Measures to Control the Import of Waste (and secondary raw materials) and Its Transit Through Ukraine approved a list of hazardous substances and materials and established a procedure to issue waste import permits. The Ministry of Environmental Protection and Nuclear Safety issues these permits, after approval by the Sanitary Inspector-General. In 1997, about 800 permits for waste disposal were granted.

The *Mineral Resources Code* (1994) stipulates that licences for the use of mineral resources shall be issued to enterprises, institutions, organizations, or to citizens that have appropriate qualifications, material, technical and economic capacities to use mineral resources. The applicant bears the cost associated with issuing the licence. Licences to explore mineral resources are issued by the Committee on Geology and Mineral Deposits with the agreement of the Ministry of Environmental Protection and Nuclear Safety, on a competitive basis (tender). For purposes of geological study, including the experimental or commercial exploitation of deposits of minerals of national significance, a special licence is required, as for the abstraction of groundwater and the exploitation of peat deposits. These licences are issued by the local agencies of the Ministry of Environmental Protection and Nuclear Safety, after consultation with the State Committee for Occupational Safety Oversight and the Ministry of Health Protection.

According to the Water Code, the (commercial) use of water requires a permit. The State environmental bodies issue permits for water bodies of national significance, while permits concerning water bodies of local significance are in the mandate of regional councils, after consultation with State bodies. In addition, the State bodies on water resources, geology and health are asked for their opinion with regard to surface water, groundwater and medicinal water, respectively. The permit specifies limits on water extraction and polluting effluents. The water use permit can be short-term (up to 3 years) or long-term (3 to 25 years). The term can be extended.

The Water Code rules that the use of water for hydro-power generation and water transport does not require a permit, but payment for use is required. The use of water bodies for air transport and fire fighting is free of charge and does not require any permit. The irrigation of agricultural land and the discharge of drainage waters into water bodies are carried out on the basis of a permit for water use. It is issued to the owner of the irrigated land. Measures to prevent land degradation and wind erosion, as well as worsening of the state of water bodies, should be taken when draining agricultural land. This applies also to irrigated and drained forest lands.

The construction of wells for water abstraction is to be carried out by organizations that have appropriate licences. The State bodies for geology and health approve the plans for this work according to an established procedure. The licence

is issued by the State bodies for environmental protection if the said plans are approved and financing is secured.

The Forest Code (1993) demands a permit, effective logging warrant or forest card to use forest resources within allocated plots of forest land. On the allocated plots, only those forest resources to which the permit applies can be used. The permanent forest users apply for permission to a forest authority. The form of the warrants and forest cards, and the procedures for granting them are to be approved by the Cabinet of Ministers.

Limits for resource use and environmental pollution

When a permit is given to use a resource or pollute the environment, appropriate limits are specified. Limits for the use of forest resources of State significance (with regard to felling and pine tar procurement) are approved annually by CM Resolution. In October, the Ministry of the Economy and the State Committee of Forestry draft a resolution, which is circulated to the Ministry of Environmental Protection and Nuclear Safety and regional State administrations. Limits for felling are set separately per type of forest. The authorized volume of pine tar is set according to forest management data and approved felling. The regional State administrations allocate quotas for felling stock and pine tar procurement for the coming year by 15 December.

The Cabinet of Ministers also approves limits (quotas) for mining of minerals (including those of the continental shelf) that are not very common. The quotas are agreed between the Ministry of the Economy, the Committee on Geology, the Ministry of Environmental Protection and Nuclear Safety and regional State administrations.

Limits for the use of fish stock in water bodies of national importance are approved annually by Resolution of the Ministry of Environmental Protection and Nuclear Safety. The State Committee on Fishery and Fishing Industry submits proposals to the Ministry, which is advised by scientific and research institutions. The State Committee on Fishery and Fishing Industry then shares the approved limits among the users and advises about their distribution to applicants not later than one month prior to the start of fishing.

The Ministry, advised by the Committee on Water Management, establishes the limits on the use of surface waters located or used in the territory of more than one region. First, an agreement is reached with the Cabinet of Ministers of the Crimea, regional administrations, and with the SDEP. The SDEP of Crimea and the regions distribute, within the specified limits, the usable amount to district administrations, Executive Committees of Radas of towns, to the other water users and to authorities of the Committee on Water Management.

The limits on regional use of groundwater are approved by the Ministry of Environmental Protection and Nuclear Safety. They can be approved by the Ministry of Health Protection, if they follow SDEP proposals, which are coordinated with the Cabinet of Ministers of Crimea, regional administrations, the Committee on Geology. The procedure following the establishment of limits is the same as that for surface water.

The Ministry approves hunting limits for defined species of game (*Artiodactyla* animals, bears, racoons, forest and stone martens**,** American minks, forest ferrets, beavers, muskrats, gophers and squirrels) by annual resolution. The State Committee of Forestry submits proposals from users of game preserves that are agreed with State forestry associations or regional forest administrations, and with the State Committee on Natural Environment Protection of Crimea and local SDEPs. The State Committee of Forestry informs the Government of Crimea, regional administrations and users of the approved limits not later than one month prior to the beginning of the respective hunting season. The hunting of the other species of game, including birds, is regulated annually by State forestry associations or regional forest administrations.

The MEPNS approves limits to collect animal and plant species registered in the Red Data Book of Ukraine. When numbers are agreed with applicants, scientific institutions and the SDEP in question, a Resolution is issued.

The pollution permit specifies separate pollution limits for each environmental medium. The core of the permit is the maximum allowable pollution (MAP). The methodology for defining MAP has remained essentially unchanged since the Soviet era (1989). For atmospheric pollution, the MAP is the maximum allowable amount of pollutants discharged into the air by a stationary source per time unit that is compatible with the established maximum allowable concentrations (MAC). The MAC in the atmosphere refers to the maximum

allowable concentration of chemical substances or compounds that do not affect respiratory reflexes (in rural locations and within 20-30 minutes). For air, the ambient concentration standards are specified for some 540 pollutants, with more than one type of standard for many pollutants (e.g. daily maximum and 20-minute maximum concentration standards). The new air management law will bring about substantial changes in this procedure – see Chapter 7. For water, both ambient concentrations and waste stream concentration standards are specified for some 4 000 water pollutants (for details, see Chapters 7 and 8). The State Ecological Inspectorate is responsible for the enforcement of environmental standards and the emission limits of the permit.

The maximum allowable pollution (MAP) is normally the enforceable limit, but if an enterprise is not able to meet it, a temporary allowable pollution (TAP) could be used. The source applying for an environmental pollution permit to the regional SDEP describes the characteristics of the enterprise's activities and its pollutant streams.

Standardization and environmental management system

A national system of standardization is emerging. The technical committee (TC-82) for standardization 'Environmental Protection and Sustainable Use of Natural Resources of Ukraine' is developing and is notably responsible for the group of standards called 'Environmental Protection System of Standards: Ecological Management Systems'. The TC-82 incorporates six sub-committees. After adopting the 'System of Standards in Environmental Protection: Basic Provisions' in 1996, a national environmental management system of standards was launched that is harmonized with the ISO 14000 series. However, progress in this respect appears somewhat slow.

2.3 Financing environmental expenditure

Sources of finance

There are few sources of finance for environmental expenditure in Ukraine: budgetary funds, enterprises' own funds, and foreign loans and grants. The State budget finances the administrative expenditure of different ministries at the local and national levels for programmes that are related to the environment. Funding is suffering, as the budget is constantly in deficit, arrears have accumulated, and the State lacks revenue. Competition for funds is correspondingly fierce. Nevertheless, the following governmental bodies provide financing for environment-related programmes: (1) Ministry of Environmental Protection and Nuclear Safety, (2) Ministry for the Protection of the Population from the Consequences of the Accident at the Chernobyl Nuclear Power Plant, (3) Ministry of Agriculture, (4) State Committee of Fishery, (5) State Committee of Forestry, (6) Geology Committee, (7) Hydrometeorology Committee, (8) State Committee on Land Resources, (9) State Committee for Building, Architecture and Housing Policy, (10) Committee on Water Resources. Ukraine is also exposed to extraordinary environmental situations and severe social problems. For these reasons, the Cabinet of Ministers has a reserve fund for extraordinary situations, although it is small. In 1996, UAH 49.3 million were granted to overcome extraordinary situations, and UAH 29.8 million to help special population groups.

Budgetary sources

The State budget finances programmes that target State objectives. Since 1994, Ukraine's State budget has had a special item - "Environmental Protection and Nuclear Safety". This budget item is the main source of finance for environmental measures, foreseen by national programmes, decisions of the Verhovna Rada and the Cabinet of Ministers. It is mainly managed by the Ministry of Environmental Protection and Nuclear Safety, the Committee on Water Resources, the Committee of Hydrometeorology, the State Committee of Land Resources, the State Committee of Forestry, the Committee of Geology and Mineral Resources, the Academy of Agrarian Sciences, and the State Committee for Building, Architecture and Housing Policy.

In 1992, Ukraine started to establish extrabudgetary environmental funds that take a portion of pollution charges, fines and penalties. The funds were created at national, regional and municipal levels. Since 1998, according to the Law on changes and amendments to the Law on environmental protection, environmental protection funds have been included in corresponding budgets. Statistics on these budget items became available only in 1996 (Table 2.4). According to the 1998 State budget, UAH 4.3 million were planned to be collected from pollution charges, and UAH 560.9 million from taxes on natural resources. This

Table 2.4: Environmental expenditure by financing source, 1992-1997

Million US$, current prices

	1992	1993	1994	1996		1997	
				Value	*%*	*Value*	*%*
Total Expenditure	**464.565**	**524.431**	**569.038**	**1 316.873**		**950.062**	
- Capital investment	**34.674**	**71.306**	**63.057**	**126.800**	***100.0***	**78.379**	***100.0***
As share of total expenditure (%)	***7.5***	***13.6***	***11.1***	***9.6***		***8.2***	
State budget	..	..	..	1.480	*1.2*	0.809	*1.0*
Local budgets	..	..	..	0.422	*0.3*	0.502	*0.6*
Enterprises' funds	..	..	..	110.507	*87.2*	76.638	*97.8*
'Extrabudgetary' funds	..	..	..	0.202	*0.2*	0.321	*0.4*
Other sources (including foreign grants)	34.674	71.306	63.057	14.188	*11.2*	0.109	*0.1*
- Current expenditure	**429.891**	**453.126**	**505.980**	**1 190.073**	***100.0***	**871.683**	***100.0***
As share of total expenditure (%)	***92.5***	***86.4***	***88.9***	***90.4***		***91.8***	
State budget	..	..	..	15.578	*1.3*	20.716	*2.4*
Local budgets	..	..	..	2.763	*0.2*	4.023	*0.5*
Enterprises' funds	..	..	..	1 170.106	*98.3*	848.514	*97.3*
'Extrabudgetary' funds	..	..	..	0.136	*0.0*	0.177	*0.0*
Other sources (including foreign grants)	..	..	..	1.489	*0.1*	1.269	*0.1*
Environmental expenditure to GDP (%)	***1.8***	***1.7***	***1.5***	***3.0***		***1.9***	
Gross fixed capital formation to GDP (%)	***27.1***	***24.3***	***23.5***	***21.0***		***..***	
Environmental investments to GFCF (%)	***0.5***	***0.9***	***0.7***	***1.4***		***..***	

Sources:

Environmental payments and environmental expenditure in1996, 1997, Annual bulletins, State Committee of Statistics;
Environmental expenditure in 1992, 1993 and 1994, Ministry of Statistics;
Ukraine in figures in 1997, State Committee of Statistics; National Bank of Ukraine; UN ECE Common Database.

Notes:

Data on investment item 'other sources' for 1992-1994 indicate data only because the split into other items is not known.

includes UAH 30.8 million from forests, UAH 147 million from water, UAH 26 million from mineral resources, and UAH 357 million from geological exploration fees. The pollution charges actually collected in 1998 amounted to UAH 2.1 million, i.e. less than 50 per cent of the budgeted amount.

The collected funds quickly disappear when the State Environmental Fund has urgent needs. When environmental programmes ask for money, they frequently find the State Environmental Fund without resources. Admittedly, well prepared, structured and managed environmental projects are rare, particularly at the local level. The overall problems appear to be the following: (1) inadequacy of resources at local, regional and national level to finance environmental projects, (2) the lack of financial and management know-how to match different sources of financing for project implementation, (3) and lack of political priority to address environmental issues in other ministries and administrations.

Since 1993, the investment share has dropped from 13.6 to 8.2 per cent of total environmental expenditure, which can be expected to lead to a growing backlog in environmental protection in the future. The big fluctuation in the environmental-expenditure-to-GDP ratio over time probably reflects differences in the size of individual programmes and projects due to technical specifications. What is particularly worth noting is the very low ratio of environmental investments to gross fixed capital formation (just around 1 per cent). The data show that environmental investment and current expenditure are primarily financed by the companies' own funds (but see section on enterprise funds below).

Foreign assistance

The contribution of foreign funds to environmental expenditure in Ukraine is difficult to assess. A specific, comprehensive recording or accounting system does not exist. Many institutions involved

Table 2.5: Environmental expenditure by environmental sector, 1992-1997

Million US$, current prices

	1992		1993		1994		1996		1997	
	Value	*%*	*Value*	*%*	*Value*	*%*	*Value*	*%*	*Value*	*%*
Total expenditure	**464.565**		**524.431**		**569.038**		**1 316.873**		**950.062**	
- Capital investment	**34.674**	***100.0***	**71.306**	***100.0***	**63.057**	***100.0***	**126.800**	***100.0***	**78.379**	***100.0***
As share of total expenditure (%)	***7.5***		***13.6***		***11.1***		***9.6***		***8.2***	
Air protection	14.878	*42.9*	29.921	*42.0*	24.185	*38.4*	28.563	*22.5*	27.751	*35.4*
Water protection	19.363	*55.8*	41.260	*57.9*	38.651	*61.3*	62.275	*49.1*	41.628	*53.1*
Waste (municipal and industrial)	..	..	..	..	..	..	31.262	*24.7*	3.697	*4.7*
Land and mineral resources	..	..	..	..	..	..	3.049	*2.4*	1.477	*1.9*
National parks and reserves	..	..	..	..	..	..	202.220	*0.2*	0.190	*0.2*
Other	0.434	*1.3*	0.124	*0.2*	0.222	*0.4*	1.449	*1.1*	3.636	*4.6*
- Current expenditure	**429.891**	***100.0***	**453.126**	***100.0***	**505.980**	***100.0***	**1 190.073**	***100.0***	**871.683**	***100.0***
As share of total expenditure (%)	***92.5***		***86.4***		***88.9***		***90.4***		***91.8***	
Air protection	127.893	*29.8*	101.205	*22.3*	87.871	*17.4*	239.182	*20.1*	141.465	*16.2*
Water protection	246.634	*57.4*	297.182	*65.6*	363.925	*71.9*	637.355	*53.6*	556.217	*63.8*
Waste (municipal and industrial)	50.998	*11.9*	49.552	*10.9*	47.553	*9.4*	252.919	*21.3*	97.030	*11.1*
Land and mineral resources	4.365	*1.0*	5.186	*1.1*	6.631	*1.3*	48.943	*4.1*	63.396	*7.3*
National parks and reserves	..	..	..	..	..	..	9.667	*0.8*	13.576	*1.6*
Other	..	..	..	..	..	..	2.006	*0.2*	3.016	*0.3*

Sources:

Environmental payments and environmental expenditure in1996, 1997, Annual bulletins, State Committee of Statistics;
Environmental expenditure in 1992, 1993, 1994, Ministry of Statistics; National Bank of Ukraine.

have only recently been established, and there is as yet only little coordination in reporting. Normally, foreign contributions take the form of either technical assistance or investments. Grants are also provided, but as a special project management unit does not exist, no particular institutional unit is interested in the accounting of ongoing projects of foreign assistance. The recently created National Agency for Development and European Integration, an institution at ministerial level, deals with international technical and financial assistance, but is not preoccupied with environmental projects.

The Government of Ukraine has reported to the United Nations Commission on Sustainable Development at its fifth session (1 April 1997) that Ukraine, as a recipient of Official Development Assistance (ODA), had received grants for sustainable development from donor countries. The United States had channelled US$ 72 million, Canada US$ 20 million, and the Netherlands US$ 5 million. The Government had received loans worth US$ 855 million from Germany, US$ 172 million from the EU, US$ 25 million from France, US$ 18 million from Italy, and US$ 446 million from the United States. Little is known about the environmental share of these sums.

Enterprise funds

Foreign loans are included in the enterprises' own funds in Table 2.4. However, data on this item perhaps overlap with municipal and State budget allocations. The State Statistical Committee has collected enterprise data on environmental protection expenditures since 1991. The investment data do not reveal what share is spent on changing technological processes versus end-of-pipe measures. Therefore, it is difficult to judge the effectiveness of economic instruments like pollution charges and taxes. In addition, the risk of double counting (the difficulty of matching investment expenditures with sources of finance) is to be overcome also. The reporting is annual, but the number of reporting companies is decreasing significantly. It can be assumed therefore that the data underestimate expenditure for environmental protection.

Environmental expenditure

Expenditure for environmental protection does not keep pace with inflation (see the section on pollution charges above). There has constantly been a question mark over the funds for the environment. The State budget was in arrears and did not transfer the funds to the municipal budgets

on time. From 1993 to 1996, an interim currency (the karbovanets) was in circulation. The national currency hryvnia (UAH) was introduced on 2 September 1996, replacing the karbovanets at an exchange rate of 1:100 000.

If the environmental-investment-to-total-gross-fixed-capital-formation ratio (Table 2.4) appears quite alarming for environmental policy makers, Table 2.5 provides additional insight into the existing and emerging problems. The data show that expenditure on water and air protection take up almost 90 per cent of both current and investment expenditure. Clearly, the country has a problem with waste treatment and disposal, as the current expenditure on this item stood at around US$ 97 million and new investments only at US$ 3.6 million in 1997. The funds for land and mineral resources protection did not exceed even the levels for waste management.

2.4 Conclusions and recommendations

Integrating environmentally related economic instruments into economic development policies is a difficult issue for Ukraine. The first attempts were made in 1993 with the Annual National Economic Policy Plan, which had a section on 'environmentally sound economic policy'. Measures to protect the environment had to have funding and were preferably backed up with economic instruments. The macroeconomic situation has since been characterized by high inflation, budgetary arrears, foreign debt servicing problems, the development of barter trade, and overall policy uncertainty. The situation is further complicated by the fact that many institutions accord a relatively low priority to environmental protection. Therefore, the weak institutional capacity has to be overcome. There is thus an urgent need for capacity building for environmental protection at all levels, starting with the responsible ministries.

Funds available for environmental policies are extremely scarce. The proceeds from charges and fines could be a source of funding. In addition, the State budget is by law supposed to finance environmental agencies that monitor the environment, enforce regulations or carry out public environmental projects. The fact, however, is that the State (or oblast) budgets are not always in a position to finance even legally prescribed expenditures, and the competent environmental authorities are not in a position to enforce payment of environmental charges, fines and penalties. Firstly, enforcement requires inspection and monitoring. That, in turn, depends on the availability of funds. Secondly, the existing laboratory equipment needs to be modernized. In such a situation, it is difficult to argue the introduction of new economic instruments to protect the environment. The basic strategy should therefore be to adapt the already existing instruments to the reality of transition in the country in such a way that their efficiency is optimized.

This means that more attention and analysis efforts have to be devoted to studying the efficiency of economic instruments. Environmental payments need to be set at such levels that they effectively stimulate the intended protection of the environment – in other words, the polluter-pays principle needs to be introduced also in practice. To fix such levels so that they produce this result, but do not make economic activities impossible altogether, large-scale economic investigations appear necessary, as the development of an efficient policy mix enabling a sustainable development is obviously extremely complicated. Nevertheless, this is an urgent requirement.

The environmental charge and tax rates aim at curbing pollution. They are not incorporated into a larger concept of rendering production more environmentally friendly. The legal instruments should therefore be revised, to spell out their targets in a comprehensive manner and add funding plans to them. In addition, the slow restructuring of the industrial sector does not seem to have raised the necessary understanding and interest at the enterprises – particularly the exporting industries -- in simultaneously increasing productivity and improving environmental performance. Apart from regulatory means, pilot projects illustrating the synergy of environmentally friendly and economically sound solutions might be a good start (see also Chapter 5).

It can be expected that the outcome of investigations would show (a) the need for informing producers in the export sectors of the environmental aspects of production that actually condition export success, (b) the need for increasing the levels of environmental payments, and (c) the need for introducing environmental management (i.e. EMAS or ISO 14000) into industrial enterprises on a large scale.

Recommendation 2.1:

The necessary and sufficient economic instruments needed for the introduction of the polluter-pays principle should be identified. Investigations are necessary in preparing decided moves towards an unequivocally market-oriented fiscal and economic policy. They should clarify what levels of environmental charges etc. are both sufficient and feasible, and determine the time frame for their introduction. *See also Recommendations 7.3, 8.7 and 10.3.*

There are clearly too many ambient standards - virtually thousands, which cannot be monitored, for both technical and economic reasons, and thus remain unenforced. It would therefore be beneficial from all points of view, if the legal and organizational steps were taken to introduce practical considerations more prominently into the setting and enforcing of standards. This requirement should be relatively easy to meet, as there are practically no costs attached to it. On the contrary, it would cut costs.

Recommendation 2.2:
The system of ambient standards for pollutants that are most significant for environmental health and ecosystem protection should concentrate on the pollutants that can be monitored and for which the standards can actually be enforced, including those for which Ukraine has assumed international obligations. The standards should be simple, clear and controllable. *See also Recommendation 8.5.*

The past accumulation of industrial wastes constitutes a major problem for environmental management. To solve the problem, decisive and considerable efforts appear to be required. Encouraging recycling and reuse should be seen as a major strategy. Economic incentives seem to be both necessary and possible, and they could stimulate the recycling industry. For example, some part of the environmental funds available could be transferred to licensed recycling enterprises, operating in accordance with technological and environmental protection requirements. The scheme could draw on relevant experiences elsewhere. Also, if an enterprise collects, handles, recycles or reuses wastes, goods or packaging material, its related charges could be refunded.

Recommendation 2.3:
A special mechanism should be designed to help create a market for secondary products. The waste disposal charges could be increased, and clauses for refunding could be introduced for recycling and reuse.

The implementation of the preceding recommendations and the enforcement of the measures involved require statistical information, notably financial information. Any economic analysis needs to include an assessment of the environmental expenditures concerned. The task involved is particularly difficult, and the ongoing transition of the statistical information system in the country complicates the matter further. Nevertheless, the task should be tackled with priority, in a joint project of the institutions involved (State Committee of Statistics, Ministry of Finance, Ministry of the Economy and Ministry of Environmental Protection and Nuclear Safety). Particular attention should be paid to reliable information on environmental investments and their sources of funding, as well as on the coverage of foreign financial assistance to environmental projects.

Recommendation 2.4:
The statistics on environmental expenditures should be improved, indicating the source of funding.

Major problems exist in the area of funding environmental protection expenditures. The fundamental issue of creating a viable system of public revenues in a country in transition is further complicated for environmental protection expenditures because of other more urgent priorities. Furthermore, the approach to the problem that consists of earmarking certain public income categories for environmental protection is difficult to enforce, thereby creating insufficient transparency. In these circumstances, and for the time needed, it may therefore be worthwhile considering the introduction of (a) a national environmental fund, and (b) regional environmental funds (in Crimea, each oblast, Kyiv and Sevastopol), for the management of both revenues and expenditures for environmental protection with the help of appropriate supervisory councils. The regional funds could be created from a consolidation of local funds, and they should also be used to finance local protection expenditures. The revenues of the funds could primarily come from environmental taxes, charges, fees etc., but also from foreign assistance.

The tight financial situation of the Ukrainian Government makes foreign assistance all the more important. Experience in other countries in transition has shown that the management of

environmental projects that have a foreign assistance component often greatly benefits from more specialized and efficient administrative approaches. A special unit in the environmental management structure generally succeeds in strengthening environmental components of general assistance programmes or projects. It also gives a better overview of international assistance for the protection of the environment, and is therefore more useful for the process of setting national priorities in environmental policy. The unit should be coordinated with the National Agency for Development and European Integration. It should collect, among other things, the funds generated by environmental charges, operating in a transparent and efficient.

Recommendation 2.5:
A national environmental fund and regional environmental funds should be created with clear and transparent management systems. The purpose of the funds would be to improve the difficult funding situation of environmental activities during the transition period.

Chapter 3

INTERNATIONAL COOPERATION

3.1 General objectives for international cooperation

Since its independence, Ukraine has established many links with its neighbours as well as with other countries in Europe and elsewhere and with a number of international organizations for environmental cooperation. Ukraine has become a member of the United Nations, the Council of Europe, the International Atomic Energy Agency and several other organizations. Its involvement in multilateral environmental cooperation and organizations develops mainly through the signing and ratification of agreements, including many international agreements on nuclear safety. The main environmental problems with a transboundary impact or concern are: nuclear safety, water quality, waste, air quality and regional problems connected to heavy industry.

At present, the main policy objectives in international cooperation are:

- participation in the international legislative and policy process and cooperation with international organizations;
- implementation of modern international environmental policies, standards and norms, and science and technology;
- attracting foreign assistance for environmental protection, nuclear safety and rational use of natural resources;
- solution of problems connected with the closure of Chernobyl;
- bilateral cooperation with neighbouring countries, other important partner and donor countries;
- participation in regional nature conservation (Black Sea and Sea of Azov, Dnieper and Danube rivers, Carpathian Mountains, etc.)

Four priority areas for cooperation are particularly relevant in the regional context:

- accession to the European Union;
- the "Environment for Europe" process;
- the Black Sea and the Sea of Azov;
- nuclear safety.

In June 1994, the EU signed a Partnership and Cooperation Agreement with Ukraine, granting trade preferences and providing cooperation in 25 areas, including nuclear energy, industry, finance, transport and agriculture. Ukraine is interested in participating in all European environmental frameworks, conferences and agreements, it aims to bring its own legislation in line with European practices, and it would like to conclude more bilateral agreements with EU member States on environmental protection. However, the general economic and political issues are considered more important in the process of possible accession to the EU than the environmental ones. The harmonization in environmental legislation still requires a substantial effort and additional international assistance. In 1998 the National Agency of Ukraine for Development and European Integration was set up. All important ministries cooperate within this Agency. Also, by Presidential Decree, all bodies of executive power have to create special units for European integration. A Special Presidential Decree was published on 24 February 1998 concerning the implementation of cooperation agreements between Ukraine and the EU.

The institutions generally involved in international environmental cooperation are the Department of International Relations of the Ministry of Environmental Protection and Nuclear Safety, the Cabinet of Ministers, the Presidential Administration, the Ministry of Foreign Affairs, the National Agency of Ukraine for Development and European Integration, and, depending on the subject, other ministries such as the Ministries of Finance, Economy, Justice, Health Protection and the State Committee of Fisheries. The process of signing and ratifying multilateral environmental agreements is determined in the Vienna Convention on the Law of Treaties.

Ukraine is already party to some 26 global and regional conventions or agreements on environmental protection and nuclear safety and to

3 related protocols and 1 agreement. It has signed or is considering ratifying another 20 international and regional conventions, protocols and agreements. The Ministry of Environmental Protection and Nuclear Safety actively participates in the drawing-up of new international documents.

Compliance with and enforcement of the multilateral environmental agreements that Ukraine has already ratified is often problematic because of:

- a lack of financial commitment;
- a lack of institutional and human capacity and experience;
- the limited priority of environmental issues in general social and economic policy;
- problems related to the structure and organization within the Ministry of Environmental Protection and Nuclear Safety as well as cooperation with other ministries.

Despite the compliance and enforcement problems, Ukraine considers the signing and ratification of multilateral environmental agreements to be a priority, because this provides incentives for harmonizing national legislation with international practices. When Ukraine ratifies such agreements, they automatically become part of its national legislation. If its national norms are stricter than the international standards, the national norms prevail.

3.2 Regional cooperation in the framework of UNECE

Convention on Long-range Transboundary Air Pollution

Ukraine ratified the Convention on Long-range Transboundary Air Pollution in 1980 and its Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) in 1985. It is meeting the targets of the first Sulphur Protocol, which it ratified in 1986, due to the economic recession. It ratified the Protocol on Nitrogen in 1988. It has signed another four abatement protocols: 1991 Geneva Protocol (VOC emissions), the 1994 Oslo Protocol on Further Reduction of Sulphur Emissions, and the two 1998 Aarhus Protocols on Heavy Metals and on Persistent Organic Pollutants (POPs). It has not yet designated Tropospheric Ozone Management Areas (TOMAs) under the VOC Protocol. Work on the ratification of the protocols is expected to start in the near future. An action plan will be developed and priorities established.

Ukraine exports more air pollution than it imports. The main sources of air pollution are stationary, although increasing road transport is a growing source of pollution. Not all abatement targets laid down in the above-mentioned Protocols are being met. Also, newer substances such as NOx, POPs and heavy metals are not yet monitored, and for some substances Ukraine does not have the necessary monitoring equipment. The Ministry of Environmental Protection and Nuclear Safety holds that other ministries should be involved in implementation.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes

Ukraine has 22 000 rivers with a total length of 170 000 km. Most drain into the Black Sea basin and the Sea of Azov. The most important transboundary waters are the Black Sea and the Sea of Azov, the Danube basin, the Dnieper basin, the West Bug, the Dniester and the Siversky Donets. The main water-quality problems are related to municipal waste, diffuse sources of pollution and eutrophication. 75 per cent of Ukraine's rivers are transboundary and it is therefore an important area for regional cooperation. Ukraine has specific agreements on transboundary waters with the Republic of Moldova, the Russian Federation, Belarus, Poland and Slovakia.

Ukraine acceded to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes in July 1999.Priorities for improving transboundary waters include: reducing pollution by building treatment facilities, better identification of the problems for different rivers and waters with the use of modern technology, improving assessment systems and databases to assist decision makers, and developing financial mechanisms to meet protection goals for different water bodies. Ukraine receives substantial foreign assistance for solving its problems with transboundary watercourses.

Convention on Environmental Impact Assessment in a Transboundary Context

Ukraine signed the Convention in 1991 and ratified it in March 1999. Its 1995 Law on Environmental Expertise regulates EIA and has been developed in accordance with international standards (see

Chapter 1 for details). It incorporates the main provisions of the ECE Convention, including provisions for public participation. However, environmental norms for EIA in a transboundary context have not yet been developed (sanitary and hygiene norms are being used at present).

Convention on the Transboundary Effects of Industrial Accidents

Ukraine is still considering whether or not it will ratify the Convention on the Transboundary Effects of Industrial Accidents. However, a new law that is based on the EU Directive on this topic and that takes the provisions of the Convention into account is currently being drafted. Work in this area is still in its early stages, for instance no emergency information systems have been established yet. A list of hazardous substances whose handling requires permission has been drawn up.

Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters

Ukraine signed the Convention during the Ministerial Conference "Environment for Europe" in Aarhus, Denmark, in June 1998 and ratified it in July 1999.

"Environment for Europe" process

Ukraine has participated in the "Environment for Europe" process since the second Ministerial Conference in 1993 in Lucerne, Switzerland. For Ukraine, the endorsement of the Environmental Action Programme for Central and Eastern Europe at that Conference served as an important impetus for the development of its National Environmental Action Plan (NEAP) -- as it did for most central and east European countries (more on NEAP in Chapter 1).

The 1995 Conference in Sofia endorsed the Pan-European Biological and Landscape Diversity Strategy. Ukraine has made a strong commitment to this Strategy and its implementation, especially regarding grassland management. The Sofia Conference also approved a declaration on new regional environment centres in the newly independent States, as a result of which a new centre is being established in Kyiv, with support from the United States.

Ukraine will host the next Ministerial Conference in 2002 and is now taking the lead in this process, which will have a strong focus on the newly independent States.

3.3 Other regional cooperation

International cooperation with regard to the consequences of the Chernobyl accident is included in Chapter 4, and that on environmental issues of the Black Sea and the Sea of Azov in Chapter 9.

Biodiversity

International cooperation is considered to be the most important tool in resolving national and international problems in biological and landscape diversity. Ukraine's priorities regarding international cooperation for nature protection are:

- participating in the governing bodies of the conventions to which Ukraine is a party, implementation of international commitments already made and accession to other important ecological treaties and agreements;
- broadly involving both governmental and non-governmental organizations in the implementation of international commitments aimed at resolving global and European problems related to nature protection;
- improving the exchange of information, technical assistance for creating computer networks, an information centre and publishing;
- supporting the establishment and operation of the national and regional systems of protected areas and their further integration into the European Ecological Network;
- promoting international scientific centres related to nature protection in Ukraine;
- systematically analysing international experience in biodiversity, conducting scientific workshops and meetings together with foreign colleagues, training Ukrainian specialists abroad in ecological management, ecological education and public awareness raising;
- developing eco-tourism.

Currently, several projects benefit from foreign assistance. Some are supported by the GEF:

- Conservation of the Trans-Carpathian Biodiversity: cost US$ 585 000, 1993-1997. This GEF project aimed at conserving Carpathian ecosystems in and around the biosphere reserve;

- Biodiversity conservation in the Ukrainian Danube Delta: cost US$ 1.5 million, 1994-1998. The goal is to optimize the management of natural resources and enlarge the territory of the Dunaiski Plavni natural reserve with a view to transforming it into a biosphere reserve;
- Preparation of the national biodiversity strategy/action plan and national report on biodiversity. Cost US$ 112 000, 1997-1998;
- Development and financing of the Conservation of Biodiversity in the Azov-Black Sea Ecological Corridor to which GEF is contributing up to US$ 1.8 million.

Some projects are implemented jointly with international partners:

- With IUCN, Ukrainian experts participate in the projects on Conservation and Wise Use of Forests in Central and East Europe (1995-1996) and Sustainable Agriculture and Biodiversity Conservation in the Steppe Zone of Russia and Ukraine (1996-1998);
- With TACIS, the Carpathian Transfrontier Environmental Network was scheduled to start by the end of 1998;
- With Wetlands International, a Cooperation Programme for the Conservation of Wetlands and Wetland Species in the Azov-Black Sea region started in 1997;
- With the World Wide Fund for Nature, a 3-year, US$ 1.5 million project for the restoration of wetlands in the Danube Delta will start soon;
- With the Netherlands for the implementation of the Bern and Ramsar Conventions (Memorandum of Understanding, 1997).

Water problems

The *Danube basin* in Ukraine includes the downstream part of the Danube river, the Prut river in the south-west, and the Tizsa, Latoritza and Uzs rivers in the transcarpathian area. The three parts have different natural conditions, different economic conditions and different administrations (in total 5 oblasts are involved), complicating the management of basin protection. Integrated management for the basin as a whole does not exist (see also Chapter 8). Ukraine signed the Danube Convention (which entered into force on 22 October 1998) in 1994, but has not yet ratified it, mainly because of the financial obligations that ratification will entail. The Ministry of Environmental Protection and Nuclear Safety considers ratification of the Convention to be very important, as it would show Ukraine's readiness to cooperate internationally, and might provide better access to technical assistance. Together with all other Danube countries, Ukraine also signed the Declaration on Cooperation of the Danube Countries in the Field of the Danube River Water Infrastructure, Especially Protection against Pollution, in Bucharest in 1985. Within the framework of the Declaration, the Rules of Water Quality Monitoring on Border Rivers were adopted. Monitoring stations were designed, a list of test indicators was drawn up, methods for water quality were laid down, etc. The State Environmental Inspectorate is responsible for ensuring compliance with all obligations under the Declaration. Once a year, experts from Danube countries meet in Romania, the coordinating country. However, since 1993 Ukraine has not participated in these meetings due to a lack of funds.

Ukraine receives assistance from EU/TACIS for the Danube basin. In January 1998, the two-year project on "Accident emergency warning system (AEWS) and monitoring, laboratory and information management for Ukraine and Moldova" was started. Another four separate projects for Ukraine and the Republic of Moldova will start by the end of 1998 with a large TACIS grant. One will focus on new technology for pollution reduction for wood-processing enterprises in the Tizsa basin; the second on international water management in Ukraine. The third project aims at developing cooperation on wetlands and the Danube lakes between the Republic of Moldova and Ukraine, and the fourth will improve the monitoring and emergency system in the Danube basin.

Two GEF projects for the reduction of pollution in the Danube basin, and the reduction of nutrient input from the Danube into the Black Sea are currently under preparation. Investments for all Danube countries under the former will be determined in 1999.

In 1994, a project on environmental management in the *Dnieper river basin* was started, in very close cooperation with and funded by the Canadian Government. The first phase (5 million Canadian dollars, of which half was spent in Ukraine) of this project was completed in 1997 and mainly focused on research into the ecological conditions of the Dnieper basin and problems for regeneration. As part of this research, in 1995, international researchers from the Netherlands, Canada and Slovakia carried out a survey, which identified 7

directions for future action. The second phase (Can$ 4.2 million, of which 2.6 million will be spent in Ukraine) started in 1997 and will be completed in 2001. It has a more practical focus and builds on the results of the first phase.

In 1997 preparations for a GEF project for the Dnieper basin started, based on pre-feasibility studies carried out by UNDP. The project involves Ukraine, the Russian Federation and Belarus and focuses on the remediation of serious environmental effects of pollution, the sustainable use of resources and the protection of biodiversity. Transboundary pollution and its effects on the Black Sea are also a priority. The project was expected to be approved in the beginning of 1999 and aims at ensuring coordination and cooperation as stipulated in the 1992 agreement between the three countries on the Dnieper basin.

A TACIS project for the *West Bug, Latoritza and Uzs* on transboundary analysis and monitoring systems was started in 1998 and involves Ukraine, Belarus, Poland and Slovakia. Another project proposal on monitoring and assessment of water resources in the *Seversky Donets River Basin* was submitted to TACIS in 1998. Much is expected from this project as the river is one of the most polluted in Europe (from industry, mining, chemical industry and steel production) and there is no real assessment of this river. All these projects are expected to improve monitoring and assessment of transboundary river quality.

Contamination of former military sites

The investigation of former military sites, including sites that contained nuclear arms, started in 1996. Data and mechanisms to assess the impact of contamination of former military sites need to be further developed. There is no list of chemicals stored at former military sites, nor are there procedures in place to assess the risk of defence-related waste. The Ministry of Defence has established cooperation with the NATO Committee on Challenges of Modern Society (CCMS) and participates in its annual meetings and conferences. In 1996, a pilot project was launched on the ecological aspects of the regeneration of demilitarized zones. Ad hoc qualitative and quantitative assessments of contaminated lands were undertaken along with studies to identify the most effective regeneration technologies and approaches.

Cooperation with central and east European countries

In September 1997, representatives of Belarus, Bulgaria, Estonia, Latvia, Lithuania, Poland, Republic of Moldova, Romania, Slovakia and Ukraine signed the Torun Declaration on Cooperation in the Field of Environmental Protection Among Central and Eastern European Countries. The countries committed themselves to cooperating in various fields of environmental protection, including climate change, energy and health issues, environmental impact assessment, monitoring, general and organizational issues of environmental policy, and promotion of regional sustainable development strategies. The Signatories to the Declaration will meet annually to share information and experience. Ukraine is not a member of the Commonwealth of Independent States, but has observer status in the Interstate Ecological Council and attends its meetings.

3.4 Bilateral cooperation

The Ministry of Environmental Protection and Nuclear Safety is responsible for cooperation under 44 bilateral agreements and treaties. Priority is given to cooperation with the neighbours, and framework and/or sectoral agreements were signed with Poland, the Republic of Moldova, Hungary, the Russian Federation, Belarus and Slovakia. The agreement in the framework of the Bucharest Convention is currently the only agreement with Romania and Bulgaria. Ukraine has bilateral agreements with Poland on the transboundary transport of hazardous waste (1994) and with the Russian Federation on cooperation on mercury-containing waste (1997).

In 1993, Ukraine signed a general agreement with the Republic of Moldova on environmental cooperation and the two States signed a specific agreement in 1994 on the Joint Use and Protection of Transboundary Water Bodies. The two agreements are potentially important for the Dniester river. A joint working group was intended to examine mitigation of the negative impacts on that river.

Ukraine's cooperation with the United States, the Netherlands, Denmark, Canada, Germany, Switzerland and the United Kingdom are most significant. Ukrainian-Netherlands cooperation on environmental protection involves general ecological management, the development of nature

reserves, water resource management and, since recently, climate change. Bilateral agreements with the Netherlands and with Switzerland concern waste-water treatment projects in Odessa and at various sugar factories, as well as the rehabilitation of pumping stations in Mariupol at the Sea of Azov. Cooperation with Denmark has, *inter alia*, resulted in a project for pilot toxic waste treatment plants in the industrialized regions of Ukraine, a project on "Clean Technologies in the Ukrainian Machine-Building Industry" and work on regenerating former military sites and on energy-related issues. Cooperation with Canada includes extensive and successful cooperation on the Dnieper river basin, consisting of a 2-phased project aiming at improved ecological conditions and restoration of the water basin.

Active cooperation with the United States, mainly coordinated by its Agency for International Development (USAID), started in 1993 with the Environmental Policy and Technology Project (see also below). In addition to the work on the Programme to Promote Sustainable Development in Ukraine, an important part of that project was geared towards water infrastructure. One sub-project provided efficient pumps and a model prepared by the United States Environmental Protection Agency on leakage prevention to assist the water utility to be prepared for a World Bank loan in 1999. The model will also be used in other regions. Another big USAID programme concerns energy efficiency (total of US$ 15 million). An industrial energy efficiency project has been carried out under the programme. 12 enterprises have been audited, and 8 engineers have been trained in auditing. Another project concerned municipal energy efficiency in the city of Lviv, aiming at energy conservation in public buildings. Other issues that USAID has been involved in are industrial waste management, dealing with consequences of the Chernobyl disaster, the setting-up of a new Regional Environment Centre, biodiversity in Crimea, and as of 1999, climate change. The USAID budget was US$ 4.5 million for environment and US$ 900 000 for energy efficiency.

3.5 Global cooperation

Implementation of Agenda 21

Ukraine signed the Rio Declaration on Environment and Development and is committed to implementing the concept of sustainable development. The Ukrainian "Concept on Sustainable Development" is now under consideration in Parliament. Its main aim is to raise the political and economic profile of sustainable development and to integrate environmental concerns in overall social and economic development. The National Committee for Sustainable Development was set up in 1997 and has started its work (see Chapter 1).

Under the 1993 Environmental Policy and Technology Project (see above), USAID set up the Programme to Promote Sustainable Development in Ukraine. A commission was created. It has five working groups:

- Urban water
- Sustainable agriculture
- Industry and environmental management
- Energy efficiency
- International environmental treaties

The working group on international environmental treaties covers five topics: climate change, transboundary watercourses, international approaches to environmental management, environmental information and public awareness raising, and biodiversity. This project produced several positive results: it provided training for the people involved; professionals, including participants from NGOs, shared information; and the major bottlenecks in the area of international treaties were identified. The USAID project was completed in August 1998, but US$ 200 000 has been made available through UNDP to continue for one more year.

Climate change

Ukraine signed the United Nations Framework Convention on Climate Change in 1992 and ratified it in 1996. It signed the Kyoto Protocol in March 1999. As an Annex I Party to the Convention, Ukraine produced its first national communication within six months of the Convention's entry into force for Ukraine, with assistance from the United States Country Programme Initiative.

In 1998, a task force for the preparation of the national implementation strategy of the Framework Convention as well as inter-agency coordination was created within the Ministry of Environmental Protection and Nuclear Safety. A national action plan targeting anthropogenic source emissions and consumption of all greenhouse gases that are not regulated by the Montreal Protocol will be

developed on the basis of the strategy. The plan, according to article 5, paragraph 1, of the Kyoto Protocol, has to be ready no later than one year before the first period of obligations takes effect. The main goal of the strategy will be to follow the provisions of the Convention and to try to reach the basic scenario.

In 1998, Ukraine received assistance from the Government of the Netherlands (US$ 2.5 million) for joint implementation projects in three different sectors. This is Ukraine's first joint implementation agreement, but more of these projects are expected in the future as it is one of the priority issues in the area of climate change for the coming years.

Other priorities in that area are: better harmonizing national policy with international policies, restructuring industry towards environmentally sound management and energy efficiency, improving the national system for monitoring, collecting, processing and verifying data to create a better basis for decision-making, developing legislation to carry out joint implementation or other joint activities like emissions trading, developing a domestic system of emission trading, and taxing mobile sources of carbon emissions. USAID is planning to focus an important part of its future work (starting in 1999) in Ukraine on climate change and energy efficiency.

Protection of the ozone layer

In 1994 consumption of ozone-depleting substances stood at 3 310 tonnes, which represents a decline from 7 061 tonnes in 1991, largely due to the economic recession. In 1996 consumption dropped even further. Refrigeration accounts for approximately 67 per cent of this consumption, followed by aerosols (28 per cent), and solvents (5 per cent).

Ukraine ratified the Vienna Convention in 1986 and the Montreal Protocol in 1988. It ratified the London Amendment in 1997. It is considering ratifying the Copenhagen Amendment, but this might be a difficult procedure as the domestic production of methyl bromide is currently a "guarantee product" in Ukraine's economy.

A national Ozone-Depleting Substances (ODS) Phase-out Country Programme was developed in 1996 (with the help of the Danish Government and a small grant from the GEF). It aims to phase out regulated substances by the year 2000 according to the London Amendment's schedule. Ukraine did not commit to fully ending the use of ozone-depleting substances, but to gradually reducing their use. Inventories of ozone-depleting substances were made in 1997, including inventories of locally significant types of industry linked to ozone depletion.

Most imported ozone-depleting substances come from the Russian Federation. Until now, such substances have been covered by a tax exemption agreement for products produced in the Russian Federation, and ozone-safe substances are therefore more expensive. This will change with the introduction of import duties for ozone-depleting substances, probably in 1999.

The GEF approved a grant worth US$ 23.3 million in 1997 for the reduction of the use of ozone-depleting substances. Under this project, electronic, machine-building, construction and selected chemical enterprises will receive financial and technical support. Implementation was planned to start before the end of 1998. The project will also provide needed technical assistance for the phase-out of the halon sector; technology transfer associated with refrigerants with a low global warming potential for domestic refrigeration; and institutional strengthening of the Ozone Office, which will be subordinated to the Ministry of Environmental Protection and Nuclear Safety and act as the implementing unit for the proposed project.

In 1998 Ukraine received assistance from UNIDO for a project on servicing the refrigeration sector implemented in cooperation with the Czech Republic. Under this project, 35 servicing centres will be provided with equipment to collect and recycle used ozone-depleting substances.

Ukraine monitors ozone-depleting substances through a system of regional authorities that control all the bodies that use the substances. The import and export of ozone-depleting substances and of the goods containing them are subject to licensing. Voluntary agreements between users and producers exist as well, and in 1998 the All Ukrainian Association of Users of Refrigerants was created. This Association is, *inter alia*, a forum for sharing information on international standards and technologies.

Ukraine's priorities regarding ozone depletion are to develop an adequate national system to recover used substances and to change its regulations in

accordance with its international obligations. Another priority is to draw up an inventory of the health effects related to ozone depletion and develop a national strategy on this subject.

Transboundary movement of hazardous waste

Ukraine ratified the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal in July 1999.

During the first years of transition, problems arose from the import of hazardous substances marked as common secondary raw materials, or from attempts to import toxic waste to Ukraine for disposal. To prevent uncontrolled import, the Cabinet of Ministers issued a decree in 1994, and a new law on hazardous waste is being drafted in line with EU Directives. It takes all provisions of the Basel Convention into account, including the principles that waste should be disposed of at the source and that the generation of waste should be minimized at all levels. The import of hazardous waste for storage or landfilling is prohibited, and, since 1994, permits are needed for the transboundary movement of any waste, not only hazardous waste. Ukrainian customs officers assist with control. The illegal import of hazardous (as well as unauthorized transport of normal) waste is punished.

Convention on Biological Diversity

Ukraine ratified the Convention on Biological Diversity in 1994. Ukraine does not yet have a special law on conservation and biodiversity. Its activities on biodiversity conservation are based on its Constitution (adopted in 1996) and are implemented in accordance with its environmental and conservation legislation. They are in line with international standards as well as the Pan-European Biological and Landscape Diversity Strategy (signed in 1995 at the Ministerial Conference "Environment for Europe").

The Concept for Conservation of Biological Diversity (i.e. the strategy) in Ukraine, prepared with help from GEF, was officially adopted by the Government by decree of the Cabinet of Ministers No 439 in May 1997. A draft national action plan for 1998-2015 has been prepared and is now before Parliament for discussion. All involved ministries, such as the State Committee for Forestry, Ministries of the Agro-Industrial Complex, Education, Finance and the Economy and the National Academy of Sciences, have approved the integration of biodiversity into sectoral policies and have promised to make financial commitments accordingly. The Inter-agency Coordination Commission, working under the supervision of the Ministry of Environmental Protection and Nuclear Safety, was established to assist with implementation. This Commission already assisted in the development of the first national report that was prepared for the fourth conference of the Parties to the Convention on Biological Diversity in Bratislava, Slovakia. Ukraine is also taking part in the discussions on a biosafety protocol to the Convention and developing amendments to its own biodiversity legislation. Ukrainian experts are included in the roster of experts under the Convention, especially for issues such as marine, wetland and grassland ecosystems.

Ukraine aims to obtain international certification of nature reserves. Two biosphere reserves were registered with UNESCO in 1999, one in Eastern Carpathia, covering parts of Poland, Slovakia and Ukraine, the other in the Danube basin.

Other conventions related to nature protection

Ukraine acceded to the *Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat* in 1996 and recognizes responsibility for the conservation of 22 water and wetland areas of international importance (total surface of 678 000 ha, certification received). In relation to this Convention, Ukraine is developing a National Action Plan following the Strategic Action Plan for Wetland Protection 1997-2002, and established a regional branch of Wetland International for the Black Sea region in Kyiv in 1997 (funded by the Netherlands Government) and the Ukrainian Office for Coastal Conservation in Odessa.

Ukraine acceded to the *Bern Convention on the Conservation of European Wildlife and Natural Habitats* in 1996. One of the first steps it took to implement it was to analyse the current status of the species of plants and animals included in the appendices to the Convention in Ukraine (more than 150). Their status was assessed in the framework of the Memorandum of Understanding between Ukraine and the Netherlands. The data obtained will be included in the National Report on implementation of the Bern Convention. A special publication has been prepared to inform governmental bodies and NGOs about the provisions of the Bern Convention. Emerald

Network criteria will be finalized in the near future and some protected areas will be selected for inclusion in the Network. The TACIS project "Carpathian Transfrontier Ecological Network" and the GEF project "Conservation of the Biodiversity in the Azov-Black Sea Ecological Network" also contribute to the implementation of the Bern Convention.

Ukraine ratified the *Bonn Convention on Migratory Species* and the *Agreement on the Conservation of Bats in Europe* (EUROBATS) in early 1999. The *Agreement on the Conservation of African-Eurasian Migratory Waterbirds* (AEWA), the *Agreement on the Conservation of Cetaceans in the Black and Mediterranean Seas and Contiguous Atlantic Area*, which are regional agreements under the Bonn Convention on the Conservation of Migratory Species of Wild Animals, have been translated into Ukrainian. Ukraine has recently signed AEWA and its ratification procedure will start soon. Ukraine is located on one of the large migratory flyways of international importance. Birds migrate through Ukraine from Eurasia to Asia and Africa. There are more than 100 migratory bird species on the appendices to AEWA in Ukraine. Some are endangered and on the IUCN Red List, the European Red List and in the Red Data Book of Ukraine. There is no special national legislation on migratory animals, but there are special provisions on them in the Law on Fauna Protection. Also, a special act concerning the regulation of nature conservation during agricultural activities is being drafted. It will include specific articles concerning migratory species.

Ukraine is a Party to the *World Heritage Convention* (since 1988), but at present only sites of cultural importance fall under this Convention. The inclusion of natural sites is under consideration.

Furthermore, Ukraine ratified the *Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)* in May 1999. A Ukrainian CITES management authority will now be established. The next steps will have to be the drawing-up of instructions and guidelines for customs officers and ecological inspectors, and their training.

3.6 Conclusions and recommendations

Ukraine is actively developing international environmental cooperation in many areas and directions with countries, international organizations and institutions. In addition to having signed and/or ratified a number of global and regional environmental conventions, Ukraine has established many bilateral and multilateral partnerships and has concluded numerous framework and sectoral agreements with its partners.

In most areas, Ukraine is harmonizing its legislation with international and European norms, in accordance with the requirements of the international conventions that it has ratified as well as in view of its interest in acceding to the European Union. To further meet its international obligations, Ukraine has drawn up general and specific policy and action plans and sought foreign assistance to assist in programme formulation and implementation. Now the concepts of its many initiatives and plans need to be coordinated. The principles of sustainable development are a good basis for integrating a large variety of related issues. To make the most of these principles, it is essential that the work of the National Committee for Sustainable Development assumes a more regular rhythm.

Recommendation 3.1:
The National Committee for Sustainable Development should intensify its work and meet at regular intervals to make it an effective tool for intersectoral cooperation regarding environmental issues. *See also Recommendation 1.2.*

Ukraine is already a party to a number of important international conventions, but there are several conventions that it has not yet ratified, such as the Convention on the Transboundary Effects of Industrial Accidents, the Convention on Cooperation for Protection and Sustainable Use of the Danube River and some of the protocols to the Convention on Long-range Transboundary Air Pollution. Ratification of these agreements could become a tool to further develop and strengthen overall environmental policy and legislation and international cooperation in those areas. While Ukraine should aim for the earliest possible ratification of these conventions, a full and realistic assessment of their implications is a precondition.

While the Ministry of Environmental Protection and Nuclear Safety attaches importance to international legal instruments, implementation of and compliance with the new norms and action plans have not been a priority for all institutions concerned. A sound needs analysis will provide

clearer goals and ultimately ensure a stronger commitment from the ministries involved. To improve the situation, strategic plans for implementation should be developed as soon as ratification is proposed. They should go beyond the mere translation of international commitments into national legislation and include funding commitments for implementation and compliance. Policies should focus on preparing achievable objectives, instead of elaborate but unrealistic programmes.

Recommendation 3.2:
Implementation, compliance and enforcement of environmental norms and action plans following existing international commitments should be a priority for all actors in Ukraine's environmental policy. Plans for the ratification of new international legal instrument for environmental protection should include an assessment of the cost of its implementation, and Ukraine should continue to work towards the ratification of all major international environmental conventions, in accordance with its national priorities. See also Recommendation 7.9.

Implementation of international environmental norms and conventions is mainly the responsibility of the Ministry of Environmental Protection and Nuclear Safety, but, in many cases, a number of other ministries, such as the Ministries of Foreign Affairs, Finance, Economy, Agro-Industrial Complex, the National Agency for Development and European Integration, are or should be involved, too. In addition, an overview of international assistance for the protection of the environment is missing. A special unit for the management of environmental projects could also be an instrument to obtain at least some of this valuable information. It could also be instrumental to improved project management. Cooperation with the National Agency for Development and European Integration would be essential.

Recommendation 3.3:
The coordination and cooperation between all institutions involved in the development of policies and the management of internationally funded projects should be improved. A special project management unit for environmental projects receiving foreign financial assistance should be established. A voluntary international task force could also be created, composed of partner countries willing to assist Ukraine in its environmental protection activities. A clear orientation towards market-oriented measures and approaches is needed also for international cooperation.

Ukraine will host the next "Environment for Europe" Conference in the year 2002. The work required should not be underestimated, even if all relevant experiences from the previous conferences can be fully incorporated. Furthermore, the preparation of the Conference should be seen as an occasion for raising awareness by involving a large number of ministries, other State bodies, NGOs and scientific institutions.

Recommendation 3.4:
The preparations for the "Environment for Europe" Conference in 2002 should start early, and involve all governmental and non-governmental institutions concerned.

In times of economic depression, international environmental cooperation is not usually among the top priorities in national policy-making. Also in Ukraine, for many decision makers as well as for the public, awareness about environmental issues and international environmental cooperation, and especially their impact on other areas ranging from economics to health, still needs to be further raised. Awareness raising about international environmental issues, conventions and policies and their interlinkages with many social and economic issues at the national level should be given a higher priority. Once awareness raising objectives are achieved with special programmes that ought to be specific to the intended audience, the integration of international environmental norms, contained in the numerous conventions that Ukraine has ratified, into national socio-economic policies will be facilitated.

Recommendation 3.5:
Awareness about international environmental conventions and policies and their importance for social and economic issues at the national and regional levels should be raised with special programmes targeting decision makers as well as the public.

Finally, many actions are under way to protect nature and conserve biodiversity as both are considered valuable assets in Ukraine (see Chapter 11). However, protecting species is a task that deserves increased efforts, even if the shortage of means drastically restricts any type of action, starting with monitoring. The ratification of CITES should be kept high on the agenda, as the illegal traffic in rare animal and plant species is a genuine

problem. Thorough administrative reforms are necessary before Ukraine can ratify CITES. In the meantime, it would be wise to cooperate with neighbouring countries to protect threatened species, contain illegal trade and prevent the import of alien species.

Recommendation 3.6:
The development of bilateral and multilateral agreements, projects and action plans to conserve threatened species and migratory species should be encouraged; in particular, measures should be taken to prevent the import of alien species and the illegal traffic in wildlife specimens, in particular those covered by CITES in order to prepare for its implementation.

PART II: MANAGEMENT OF POLLUTION AND OF NATURAL RESOURCES

Chapter 4

MANAGEMENT OF NUCLEAR SAFETY

4.1 Environmental concerns related to ionizing radiation in Ukraine

Natural and anthropogenic environmental radioactivity

Exposure of man to natural ionizing radiation occurs via external and internal irradiation from cosmic as well as from terrestrial radiation. The cosmic component is essentially dependent on the altitude above sea level, roughly doubling the dose every 1.5 km. The terrestrial contribution varies with the geologic-mineralogical situation of the subsoil, i.e. its contents of natural radionuclides, especially those of uranium and thorium producing radioactive isotopes of the noble gas radon. While the average external irradiation of a Ukrainian resident from cosmic and terrestrial radiation corresponds to that of the global mean exposure of about 0.7 mSv/a, internal doses due to the inhalation and ingestion of natural radioactivity is more than twice as high: 4.2 mSv/a compared to the global mean of 1.6 mSv/a. This is due to the high amount of radon isotopes (mainly Rn-222) emanating from building materials and from the ground. However, the average total effective dose of 4.9 mSv/a for individuals in Ukraine is well within the typical global range of 1.5 to 6.0 mSv/a with a mean of 2.4 mSv/a.

In Ukraine, by far the most severe sources of environmental and population exposure to ionizing radiation continue to be the consequences of the 'beyond-design-basis accident' at Unit 4 of the Chernobyl Nuclear Power Plant (ChNPP): the radioactive material released into the environment between 26 April and 6 May 1986, the hastily and improperly established dumping sites of contaminated soil and debris and the ruins of the destroyed reactor itself. Considering only the most dose-relevant radionuclides, the following portions of the reactor inventory and activity amounts were released during the accident: 50 per cent of I-131 (6.5×10^{17} Bq, half-life: 8 days; half-life = time needed for radioactivity to fall to half its original value), 33 per cent of Cs-134 (5.0×10^{16} Bq, half-life: 2 years), 33 per cent of Cs-137 (8.6×10^{16} Bq, half-life: 30 years), 4 per cent of Sr-90 (8.0×10^{15} Bq, half-life: 29 years), 3.5 per cent of Pu-239 (3.4×10^{13} Bq, half-life: 24 065 years) and 3.5 per cent of Pu-240 (5.3×10^{13} Bq, half-life: 6 537 years). As a result of the accident, 238 people suffered from acute radiation syndrome, 29 of them died during the acute phase in 1986. The highest effective equivalent doses, H_{eff} as defined by the International Commission for Radiological Protection (ICRP), were received by the 200 000 'liquidators' involved in clean-up work in 1986/87 (maximum: 6 Sv, average: 0.1 Sv). Within 10 days, about 130 000 people were evacuated from the so-called 'exclusion zone', defined as a roughly circular area of 30 km radius around the ChNPP. Actual average radiation doses to people before evacuation were about 15 mSv. Temporary dose limits for the population were set at 100 mSv/a in 1986 and gradually lowered to 25 mSv/a in subsequent years.

For the exposure of the general population, the main source of radiation exposure is the deposit of the radioactive fallout from the release plumes, which has led to a very heterogeneous contamination of the territory due to the variation in prevailing wind directions and precipitation during the most severe release phases. As a result of the physical peculiarities of processes during the accident, the strontium and plutonium isotopes are more abundant in larger particles and hence were deposited closer to the source, essentially in Ukraine, Belarus and the Russian Federation, while the iodine and caesium isotopes contained in smaller particles spread all over the northern hemisphere. In Ukraine, the most heavily affected areas are the regions of Zhytomir, Rivne, Volynsky, Kyiv and Chernigov. Areas with up to 80 Ci/km^2 (3×10^6 Bq/m^2) have been detected, and caesium concentrations of up to 20 000 Bq/L were found in milk.

After the accident, there were no regulations concerning the evacuation of the population from other heavily contaminated areas outside the exclusion zone. During the Soviet era, it was officially denied that other areas of the country were contaminated and needed action to protect the population. This denial became increasingly

difficult to maintain as 'glasnost' took hold. Finally, in 1991, shortly before Ukraine gained independence, the Ukrainian Parliament passed the Law about the Status and Social Protection of Citizens Who Suffered from the Consequences of the Chernobyl Catastrophe, which has been updated by several laws and decrees since then. This Law defines three additional zones according to the level of surface contamination, as well as compensation and privileges granted to the 'victims' of the accident. Details will be given in Section 4.2.

Monitoring of environmental radioactivity

Table 4.1: Permissible concentrations of Cs-137 and Sr-90 in food products and drinking water

Bq/kg or Bq/L

	Cs-137	Sr-90
Bread and flour products	20	5
Potatoes	60	20
Vegetables	40	20
Fruit	70	10
Meat and meat products	200	20
Fish and fish products	150	35
Milk and dairy products	100	20
Condensed milk	300	60
Milk powder	500	100
Baby food	40	5
Eggs *(each)*	6	2
Fresh wild berries and mushrooms	500	50
Dried wild berries and mushrooms	2 500	250
Herbs	600	200
Other food products	600	200
Drinking water	2	2

Source: Ministry of Health Protection, State Hygiene Norms

In a country suffering from this disastrous legacy, monitoring of radioactivity in all kinds of environmental media is paramount. This task is carried out by several ministries and State committees: Ministry of Environmental Protection and Nuclear Safety (MEPNS), Ministry of Health Protection, Ministry of Emergency Situations and Protection of the Population from the Consequences of the Chernobyl Catastrophe, Ministry of the Agro-Industrial Complex, Committee for Hydrometeorology, Committee for Water Management. To avoid duplications and gaps in this widespread task, the coordinator (MEPNS) needs to distribute the monitoring work carefully. Completely separate programmes carry out sampling/measuring of radioactivity and chemical pollution in the environment.

The State Committee for Statistics collects the monitoring results. However, it is reportedly difficult to establish a coherent database and further evaluate the information, because the measuring methodologies and the formats of the results are inconsistent. This means that the potential benefit of partially very tedious work is not fully appreciated and that one of the most important purposes of monitoring, i.e. its use for the evaluation of consequences and decision-making, cannot be met. Furthermore, departmental barriers undermine harmonization and cooperation. As a result, an organizational and technical revision of the entire monitoring system is under way. The final aim is to monitor easily accessible parameters, like activity concentrations in air, surface soil and surface waters, automatically, but it is not clear whether this will be achieved because of financial problems. Every year the Ministry of Environmental Protection and Nuclear Safety issues a 'National Report on the State of the Environment', which covers both conventional pollution and radioactive contamination.

Food products are especially important for the exposure of humans. According to the "Provisions of the Sanitary and Epidemiological Well-Being of the Population" (February 1994), monitoring laboratories of the Ministry of the Agro-industrial Complex carry out spot checks of radioactivity concentrations in food products. Special measurements are performed only if a nuclear facility releases a high amount of radioactivity. Generally, the producer of foodstuffs is responsible for the quality of his products. Measurements of radioactivity in building materials and timber were also said to be obligatory.

The permissible levels (PL) of radionuclide concentrations in food products are set by the National Commission on Radiological Protection of the Population of Ukraine (NCRPU) in cooperation with the Committee for Hygienic Regulation of the Ministry of Health Protection. The most recent norms (PL-97) were published in 1997 and are given in Table 4.1. The norms are applied in such a way that the sum of the measured Cs-137 and Sr-90 concentrations divided by their respective PLs must not exceed 1. The PLs have been set so that the additional ingestion dose does not exceed 1 mSv/a, when a specific, statistically averaged diet is consumed per year. As for physico-chemical reasons the analysis of Sr-90 takes several weeks, only Cs-137 is measured in practice, while the Sr-90 contents are estimated on the basis of experience

regarding the relative abundance of the two radionuclides.

Most of the sampling and measuring equipment for environmental radioactivity (at the Committee for Hydrometeorology in Kyiv) has reached the end of its lifetime, and the conditions of the premises are such that cross-contamination of samples is difficult to avoid. It is very unlikely that the station would be prepared to carry out a measuring programme of the size and the accuracy that would be required in the event of an accidental release of radioactivity into the environment. It also seems that more attention needs to be paid to monitoring indoor and outdoor natural radioactivity in regions with high radon exhalation from the ground, mainly uranium-mining and processing areas.

Facilities engaged in handling radioactive material

After the breakdown of the USSR, Ukraine inherited a developed nuclear infrastructure, which had, however, been oriented towards the needs of the huge territory and the centralized structure of the former Soviet Union. Among the inherited nuclear facilities were:

- 5 nuclear power plants (NPP) with 15 reactors (10 VVER-1000, 2 VVER-440, 3 RBMK-1000) with a total rated power of 13 600 MW(e) and 1 RBMK-1000 (Chernobyl Unit 4), which was destroyed after the 'beyond-design-basis accident' on 26 April 1986
- 3 uranium mines and a milling facility located in the south-east
- 2 nuclear research reactors at Kyiv and Sevastopol
- About 5000 small users of sources of ionizing radiation (SIR)
- 6 regional centres ("Radon") to manage radioactive waste generated by small users of SIR and by research reactors.

Nuclear reactors. There are two basic types of reactors operating in Ukraine, both of USSR design of the 1960s and 1970s:

- RBMK-1000 ('Reactor of High Power with Channels'), a graphite-moderated, water-cooled boiling-water pressure-tube reactor with an installed gross capacity of 1000 MW(e). This reactor type, designed for a life span of 30 years, was built only in the Soviet Union. Originally it had been developed to breed plutonium for nuclear weapons, while electricity generation was merely a by-product. To fulfil its primary purpose in the most cost-effective way, the RBMK design has a number of special physical properties and technical features (e.g. positive shut-down effect, positive void coefficient, no pressure vessel, no containment) representing a technology that must be considered inherently risky. The four units built in pairs of two at the Chernobyl site belong to the RBMK reactor line. The construction of two additional units was stopped in 1986. Unit 2 of ChNPP was shut down after a major fire in the turbine hall on 11 October 1991. On 30 November 1996, Unit 1 was shut down for a complex technical inspection and to reduce the potential threat of this reactor type to the population. In October 1998, only one RBMK (Unit 3) was operating.
- VVER-440/1000 ('Water Water Energetic Reactor', also abbreviated 'WWER' in western literature), a water-moderated, water-cooled pressurized water reactor with installed gross capacities of 440 and 1000 MW(e), respectively. This reactor type has a pressure vessel, a containment and a two-circuit heat transfer system. VVER reactors are operating at the Rivne (RNPP, 3 units), South Ukraine (SUNPP, 3 units), Khmelnitsky (KNPP, 1 unit) and Zaporizhje sites (ZNPP, 6 units), with Unit 6 at ZNPP put into operation in October 1995. Although in principle less risky, the VVER concept still has a number of safety shortcomings (see Section 4.4).

In October 1998, the total installed capacity of the 14 reactor units in operation amounted to 12 880 MW(e) (gross) and 12 115 MW(e) (net), generating 45 per cent of the total electricity consumed in Ukraine. At present, 2 additional VVER-1000 reactors are under construction at the Khmelnitsky (Unit 2) and Rivne (Unit 4) NPPs. They are scheduled to be completed in 1999 and 2001, respectively. Those units had been about 70 to 80 per cent completed when construction was stopped in 1991. In 1996, plans to complete their commissioning were taken up again, and the licensing procedure is now under way. The Energy Programme of Ukraine is considering the construction and commissioning of two more reactor units at the Khmelnitsky site.

Spent nuclear fuel and radioactive waste management. In Soviet times, spent nuclear fuel from NPPs on Ukrainian territory was transported to Russia. Since independence, the fuel cycle of the Ukrainian nuclear energy system exhibits additional gaps, because there are no fuel

production, fuel reprocessing or final storage facilities. Only part of the spent fuel is shipped to the Russian Federation, but reprocessing products have not been returned so far, as a planned facility in the Russian Federation for reprocessing VVER spent fuel has not been built yet. The situation of an open-end fuel 'cycle' has led to an over-accumulation of spent-fuel assemblies in the cooling pools of NPPs, making the development of a long-term spent fuel concept more urgent.

The management of radioactive waste from NPPs and from the uranium-mining and processing industry is executed by the Ministry of Energy (State Committee on Nuclear Power Utilization (Goskomatom/Derzhkomatom, since 1997: Energoatom), while the Ministry of Emergency Situations is responsible for the radioactive waste in the exclusion zone of the ChNPP (so-called 'Chernobyl waste') as well as for that from other sectors of the economy. As pointed out in the 1996 Annual Report of the Ministry of Environmental Protection and Nuclear Safety "On the Status of Nuclear and Radiation Safety in Ukraine", this subdivision of very similar tasks results in a duplication of work and the mismanagement of human and financial resources.

The conditioning and storage of radioactive waste that is generated during the operation of nuclear power plants (so-called 'operational waste') represents a specific problem, as it is accumulated at the NPP sites in a state which the authorities consider to be unacceptable for safe storage. Only the Zaporizhje NPP is provided with an incinerator and a waste compactor. The 'high-degree' evaporation installations operating at Zaporizhje and Khmelnitsky NPPs to reduce liquid waste volumes lack conditioning and packaging facilities required for the long-term storage or final disposal of radwaste. As a result, 25 000 m^3 of solid and 125 000 m^3 of liquid waste have accumulated at NPPs with VVER-type reactors, and 5 000 m^3 and 5 800 m^3, respectively, accrue each year. Limited quantities of waste from small users of SIR are handled at the six regional processing and storage enterprises of the Ukrainian State Association "Radon", which is not equipped to process primary waste.

Options under consideration for the final storage of high-level radioactive waste (spent fuel and waste from reprocessing) include a site situated near Chernobyl, which is one of six that had been prospected for this purpose within the former Soviet Union, and a granite formation north of Zhitomir. The only ongoing project to provide intermediate storage capacity is the construction of an above-ground dry-storage facility for spent nuclear fuel on the Zaporizhje NPP site. A similar storage facility on the ChNPP site is in the planning stage.

Uranium mining and milling. There are enterprises for mining and processing uranium ores in the Dnipropetrovsk, Nicolaev and Kirovograd regions. They belong to the Industrial Association "Vostok Integrated Ore-Enrichment Plant" (IOCP), which also has a hydrometallurgical plant for processing uranium ore in the industrial zone of Zhoti Vody (yellow water) in the Dnipropetrovsk region. During the mining and concentration of uranium, large amounts of waste are produced (tailings). These materials contain radioactive isotopes of uranium and thorium, as well as their decay products, including the radioactive noble gas radon. They are sources of environmental radioactivity in gaseous and particulate forms.

A specifically environmentally hazardous technique of obtaining uranium is 'in-situ leaching', which was applied in Ukraine at the Devladove, Bratske and Safonovskoye sites from 1966 to 1983. With in-situ leaching or 'solution mining', the uranium-bearing ore is not removed from its geological deposit by mining. Instead, a leaching liquid (acid or alkaline) is injected through wells into the ore deposit, and the uranium-carrying liquid is pumped from corresponding wells. The wells cross aquifers and so contaminate the groundwater. The Devladove site was leached with sulphuric and nitric acid. The surface of the site was heavily contaminated by spills of leaching solutions. Since then, groundwater contamination is spreading downstream from the site at a speed of about 50 m a year and is expected to reach the village of Devladove in 25 years. Attempts to restore the Devladove site are reported to have been limited to surface soil clean-up by replacing heavily contaminated soils and by deep ploughing. There is also great concern about the spread of contamination along the road between uranium mines and processing facilities, as the ore is being transported in open trucks.

In April 1995, the Ukrainian Government approved a nuclear fuel industry plan, which schedules a threefold increase in uranium production by the year 2003. The envisaged production rate is expected to meet the demand of all Ukrainian NPPs. Details on the current amounts of uranium mining and processing are classified. On the basis

of known technical parameters, it is, however, possible to estimate Ukraine's uranium mining activities. A 1000-MW(e) VVER reactor has about 75 tonnes of uranium dioxide with U-235 enriched to 5 per cent. One third of this fuel (25 tonnes) is replaced per year, which amounts to an annual need of 350 tonnes for all 14 Ukrainian reactors. To produce 350 tonnes of 5 per cent U-235-enriched fuel from natural uranium containing 0.7 per cent U-235, more than 7 times the mass of natural uranium is needed: 2 500 tonnes of U_{nat} (not considering process losses). A report of the Intergovernmental Analytical and Advisory Council to the Cabinet of Ministers (September 1997) stated that the Ukrainian production of natural uranium covered 30 per cent of the national demand, which would amount to 830 tonnes of U_{nat}. Estimates found in the international literature vary widely from 700 to 1 200 tonnes of natural uranium for the 1997 production. Considering an average content of 0.2 per cent uranium in the natural ore (commonly between 0.1 and 0.5 per cent), 420 000 tonnes of uranium ore would have to be mined and processed in Ukraine per year to cover the 30 per cent supply.

The concentrated uranium is shipped to the Russian Federation in the form of U_2O_8, the so-called yellow cake, for U-235 enrichment and fuel rod production. This fuel plus the missing 70 per cent of the demand are then transported to Ukraine. Until 1998, delivery of nuclear fuel was performed basically as a compensation for the return of nuclear warheads from Ukrainian territory. Ukraine's total resources of natural uranium recoverable at a cost of US$ 80 000 a tonne or less are estimated at 45 600 tonnes of U_{nat}. With the assumption of a stable demand of 2 500 tonnes of U_{nat} per year and no recovery by reprocessing of spent nuclear fuel, these resources would suffice for 18 years. Since 1995, the price of natural uranium on the world market has fluctuated between US$ 20 000 and US$ 35 000 a tonne. Like many other countries in transition, Ukraine is seeking independence in its energy supply. Discussions on a long-term nuclear programme for energy production have to consider the current infrastructure of the nuclear industry as well as the facts mentioned above.

Occupational exposure and radiation protection standards

The individual exposure doses of staff at nuclear facilities reflect the status of radiation protection there. Their administrations are obliged to account for the exposure doses and to develop and take measures to decrease them. The three main principles adopted at the international level are:

- All exposure to radiation must be justified.
- All exposure must be 'As Low As Reasonably Achievable' (ALARA principle), social and economic factors being taken into account.
- Dose limits must be set and imposed, both to prevent deterministic effects and to minimize stochastic effects.

The exposure doses of personnel is commonly monitored with individual dosimeters (e.g. film badges, thermoluminescence dosimeters or ionization dosimeters) during working hours. All types of dosimeters essentially monitor external exposure. The Radiation Protection Department of the ChNPP reported that additional monitoring of internal doses (e.g. incorporated Cs-137) with the help of whole-body counters was routinely performed for NPP staff.

According to the Nuclear Safety Norms, 50 mSv/a was accepted for radiation workers until the end of 1997. The 1996 Annual Report of the Ministry of Environmental Protection of Nuclear Safety mentions NPP-dependent "control levels taking into account the actual radiation situation" of the particular NPP. These levels range between 35 mSv/a (Khmelnitsky) and 48 mSv/a (South Ukraine). The reported average annual doses (H_{eff}) have decreased by a factor of 2 since 1990 and were 5.2 mSv/a at ChNPP (operation start 1977-1981), 4.5 mSv/a at SUNPP (operation start 1982-1989), 2.2 mSv/a at KNPP (operation start 1987), 2.0 mSv/a at RNPP (operation start 1980-1986) and 1.3 mSv/a at ZNPP (operation start 1984-1995). The average dose for personnel in west European NPPs is 2 to 3 mSv/a. Relatively high doses result from maintenance and repair works at the reactor units, when contaminated and neutron-activated parts have to be handled. It is therefore not surprising that the higher doses are associated with the older units requiring more extensive repair. This, in turn, suggests that their continued operation needs to be reconsidered also from the point of view of the staff's need for protection against radiation.

Since January 1998, the dose limit for radiation workers has been lowered to 20 mSv/a. The dose limit adopted in this law is based on the Standards of Radiation Safety of Ukraine, which have been developed by the National Commission on Radiological Protection of the Population of

Ukraine (NCRPU) and by the Committee for Hygiene Regulations of the Ministry of Health Protection. At sites that were brought on stream after January 1998, the new limit may be exceeded up to 50 mSv/a if the average dose over a five-year period does not exceed 20 mSv/a. During a transition period, the dose limit is 50 mSv/a for personnel employed at sites brought on stream before January 1998, provided that the dose is reduced to 20 mSv/a during the transition period. The dose limit of 20 mSv/a is in accordance with ICRP Recommendation 60 and with the European norms Euratom 96/29, which have to be adopted by the EU Member States by May 2000.

Early-warning system

On the basis of two IAEA agreements, the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, both of which were ratified by the former Soviet Union in 1986 and also adopted by Ukraine after independence, the United States agreed with Ukraine and the Russian Federation, in 1992, to improve their nuclear safety (Lisbon Initiative).

One result of this Initiative is the Information and Emergency Centre (IEC, also referred to as the 'Crisis Centre') of the Ministry of Environmental Protection and Nuclear Safety, which is being equipped with the help of the EC TACIS programme and additional financial aid from various western countries. In the final stage, IEC will receive on-line information from all NPPs and from automatic monitoring stations located within a 30-km radius from the NPPs (GAMMA-System and Remote Monitoring System). In the 'normal operation mode', 'notifiable' events are described and classified according to the International Nuclear Event Scale (INES) and reported to the IAEA and other countries using the INES system. In the 'emergency operation mode', the First Deputy Minister decides to activate the IEC Emergency Plan, and selected experts are directed to report to the IEC immediately. Then the Data Analysis Group (interpretation and plausibility check of the data received, recommendations), the Liaison Group (information exchange with IAEA and other organizations, press releases), the Executive Group (review of recommendations, decisions on actions, management of operations) and the Technical Support Group (telecommunications) convene at the IEC to initiate further action.

In October 1998, parts of the on-line radioactivity and meteorological monitoring systems were established at ZNPP and RNPP. The plan is to extend those systems to all NPP sites and to use satellite communication instead of land cables. Provisions have been made to also install the RODOS system (Real-time On-line Decision Support) for nuclear emergency management in Europe, which would yield information on radiological consequences of accidental releases and would support decision-making on appropriate countermeasures. In the event of high activity releases from the other three NPPs not yet connected to the system, the information is passed on via telephone or e-mail from the operator to the municipal, rayon and oblast authorities and, finally, to the Deputy Health Minister. The IEC is the most important institution for national and international notification and for immediate action in the event of a nuclear accident in Ukraine. It is also an excellent example of international cooperation and effective financial support, as it is of obvious mutual benefit.

4.2 Post-Chernobyl problems and actions

Management of the 'exclusion zone'

The 'exclusion zone' was defined immediately after the accident as a circular area with a 30-km radius around the ChNPP, irrespective of the density of surface contamination. Evacuation from the 76 settlements of this zone was compulsory, and living in this area continues to be forbidden. Since 1996, the Ministry of Emergency Situations and Chernobyl Matters has been responsible for assessing and supervising all the remainders of the Chernobyl accident and their impact on the environment in the exclusion zone, except in the so-called 'industrial zone' of about 2 km^2 around the ChNPP, which is the responsibility of the power plant administration. The departments and sections of this Ministry carry out extensive scientific investigations into the present situation as well as into contamination and radiation exposure since the accident. At present, there are about 15 000 people working in the zone, most of whom are employed in the more than two dozen State companies, State agencies and scientific institutions. It is obvious that because of their specific tasks some of those organizations have to be stationed within the exclusion zone. However, to reduce occupational exposure, the Ministry has recently decided to carry out an assessment with the aim of reducing the number of organizations and their staff there to the absolute minimum. This assessment should also

include the 5 700 staff members of the ChNPP itself.

The accident recovery and clean-up operations have produced very large amounts of radioactive wastes and contaminated equipment. Some of these wastes are buried in trenches or in containers insulated from groundwater by clay or concrete screens within the 30-km zone. However, 600 to 800 waste trenches were hastily dug in the immediate vicinity of Unit 4 in the aftermath of the accident. These unlined trenches contain the radioactive fallout that had accumulated on trees, grass and in the soil to a depth of 10-15 cm and which was bulldozed from an area of roughly 8 km^2. The estimated radioactivity is now of the order of 1 PBq (peta = 10^{15}). About the same amount is stored in specially constructed facilities next to Unit 4. Some 100 waste trenches have also been dug outside the 30-km zone. Those wastes are transferred to storage places within the 30-km zone, if leakage of radioactivity to the groundwater is observed. Moreover, much contaminated equipment and many helicopters, engines and vehicles are stored in the open air in the exclusion zone.

The original clean-up activities are poorly documented, and much of the information on the present status of the unlined waste trenches and the spread of radionuclides has been obtained from a one-time survey. Some of its findings are:

- The water-table in the vicinity of Unit 4 has risen by a few metres since 1986 and may keep on rising. This is apparently due to the construction of a wall around the reactor to protect the Kyiv reservoir from contamination and to the ceasing of drainage measures formerly associated with the construction of new units on the site.
- Most of the investigated waste trenches are periodically or permanently flooded, and the relatively high mobility of Sr-90 may lead to leakages into the Pripyat River from the closest trenches. The Ministry of Emergency Situations estimates that Sr-90 removal from the exclusion zone by surface runoff with the Pripyat River ranged from 2.5 to 9.3×10^{12} Bq until 1996. Groundwater contamination peaked at 500 Bq/L of Sr-90 near the ChNPP.
- Caesium and plutonium are less mobile, and contamination with these radionuclides is confined to the near vicinity of the disposal trenches. Losses of Cs-137 by surface runoff were estimated to be one order of magnitude lower than those of Sr-90.

Many questions remain concerning the Chernobyl waste, so equally large characterization efforts are required. At present, most disposal sites are unexplored, and some are uncharted. Monitoring groundwater movement is insufficient, and the interpretation of the hydrologic regime is complicated by artificial factors like pumping and mitigation measures. Furthermore, the mechanisms of radionuclide leaching from buried fuel particles are not yet fully understood. International initiatives are currently under way to study technical solutions to eliminate these numerous sources of residual risk on the site.

In 1995, the Ministry of Protection of the Population from the Consequences of the Chernobyl Accident, the predecessor of the Ministry of Emergency Situations, developed a "Concept for the Chernobyl Exclusion Zone" addressing such issues as necessary changes in legislation, differentiation of functional sub-zones, inventory of waste deposits, protective measures for waste deposits, waste processing, water-protective actions, fire prevention in forested areas, medical and sanitary measures, environmental monitoring, future scientific tasks as well as forecasts of radionuclide behaviour and of the ecological development. In fact, this 'Concept' is merely a list of the exclusion zone's problems for which solutions need to be developed. In 1997, a new "Concept for the Zone" was developed and submitted to the Cabinet of Ministers, but it has not yet been adopted.

It has to be accepted that the exclusion zone can never be restored to pre-accidental conditions. Part of the reason is the prohibitive cost of decontamination. Moreover, considering the great variety of physical and geological conditions and radioactive contents of the waste deposits, dump sites and other activity accumulations, removing radioactive material and transporting it to waste repositories may not always be the best solution in terms of keeping the total dose to clean-up workers and the affected population to a minimum. Safe enclosure on the spot may be a better option.

The artificial water reservoir established to provide cooling water for the ChNPP is another potential environmental threat. This so-called cooling pond has accumulated radioactivity from leakages during operation of the reactor units, and it is not clear

who is responsible for its management, as it is situated partly inside the 'industrial zone' (responsibility of the ChNPP administration) and partly in the 'exclusion zone' (responsibility of the Ministry of Emergency Situations). It has a surface area of 22.7 km^2 and an average depth of 5 m. Its water level is about 6 m above that of the Pripyat River. With an activity concentration of about 1 Bq/L of Cs-137, the water can be considered rather clean, but the activity is accumulated in the sediment. As long as cooling water is needed, water losses are replaced by pumping from the Pripyat River. After the shutdown of the NPP and the removal of all spent fuel, no more cooling will be required, and evaporation losses will dry out the pond if resupply is stopped. Then radioactivity of the dry sediment would be subject to erosion and resuspension, unless protective measures are taken.

To access the zone, a special permit is required. This is verified at special checkpoints at a distance of 30 and 10 km from the plant. The members of the EPR Team did not identify any other means to prevent people entering the area from somewhere else but the main road. Moreover, they spotted only one sign indicating that it was forbidden to pick up any objects.

Situation and concepts of the `Shelter´

Within only seven months following the explosion of the reactor, the destroyed Unit 4 of the ChNPP was entombed in a 300 000-tonne concrete and steel structure known as the 'Shelter', 'Envelope', 'Sarcophagus' or 'Object Ukritiye'. The construction uses as a support what remained of the walls of Unit 4 and to a certain extent also of those of the Unit 3 building. Multiple sensors were placed inside the shelter to monitor radiation parameters and a number of physical and chemical parameters to characterize the air, the radioactive material and the building structure. Various systems help to mitigate any changing adverse conditions, including the injection of chemicals to prevent criticality excursions in the fuel and to suppress dust resuspension and pumping to remove excess water leaking into the building through cracks and holes. At the time of construction, the shelter was seen as a provisional barrier, while a more radical solution was found to eliminate the destroyed reactor and safely dispose of its highly radioactive materials. Such a solution will have to be found very soon, because the physical conditions inside the hastily built shelter promote the corrosion of structural materials and some heavy reactor components are in an unstable position.

The fuel in the damaged reactor exists in three forms: (a) as pellets of 2 per cent enriched uranium dioxide plus some fission products essentially unchanged from the original forms in the fuel rods, (b) as 'hot particles' of uranium dioxide a few tens of microns in diameter or as particles of a few microns made of fuel fused with the metal cladding of the fuel rods, and (c) as three extensive lava-like flows of fuel mixed with sand or concrete (so-called elephant feet). The estimates of the quantity of this molten fuel are very uncertain. The amount of dispersed fuel in the form of dust is estimated at several tonnes. There are over 3 000 m^3 of water in various rooms of the reactor building. Its activity concentration ranges from 0.4 to 40 MBq/L.

One process that is raising great concern is the corrosion of the lava-like, fuel-containing material in the presence of excess water. As corrosion proceeds, uranium dioxide is dissolved in water, which may result in the formation of polymeric structures and in a higher concentration of active substances after sedimentation with fragments of the fuel material. This increases the probability of a supercritical mass forming and of a local self-supporting chain reaction setting off. Estimations of the TNT-equivalent of such local events are in the order of 0.5 kg. The installed monitoring systems FINISH and ICAS recorded evidence of limited excursions in 1990 and 1996, and neutron poison solutions have been injected to stop the chain reaction. The primary danger is the release of radioactive dust into the environment; the secondary is the disruption of building structures with possibly more severe consequences. Another reason why removal of the fuel-containing material deserves serious consideration in the near future is the decay of Pu-241 with a half-life of 14 years into the alpha-emitter Am-241 (half-life: 432 years), which means that half of the Pu-241 has already been transformed into Am-241. Americium is more mobile than plutonium and thus more difficult to retain.

Inside the shelter, external exposure is largely from the fission product Cs-137, but the inhalation of radioactive fuel dust containing Pu-239 also represents a great hazard. Since the beginning of 1987, the intensity of the gamma radiation inside the building has fallen by a factor of 10. Outside the shelter, the highest dose rates are measured on the roof. They have also decreased from 0.5 Gy/h (Gray = unit for absorbed energy dose) to less than 0.05 Gy/h today. Current activity emissions into the environment range around 10 GBq/a for Cs-137 and 0.1 GBq/a for plutonium and other

transuranium elements. This is more than ten times the release rate of Unit 3. During recent years, a number of expert groups have considered potential situations that would lead to extensive releases of radionuclides into the environment, including the collapse of the roof and internal structures, a possible criticality event and the long-term migration of radionuclides into groundwater. Such situations could lead to releases in the order of 0.1 to 0.4 PBq of fuel dust and fission products. Perhaps causing the greatest concern is the effect that the collapse of the shelter might have on reactor Unit 3, which is still in operation. The considered scenarios and the fact that ongoing processes are continuously altering the chemical and physical properties of the molten fuel and degrading the building itself explain that the shelter in its present form represents a permanent risk for people and the environment at least in the 30-km zone.

In 1996, an international group of experts elaborated an EC-TACIS-initiated study of solutions to make the Chernobyl Unit 4 and its present shelter environmentally safe. On the basis of this study, the G7 Nuclear Safety Working Group (G7-NSWG) and representatives of the Ukrainian Government decided to develop a Shelter Implementation Plan (SIP) financed by EC-TACIS and the United States Department of Energy. The SIP identifies 22 different tasks designed to reduce risks and to improve safety in a systematic way. They are combined into five groups: (1) reduction of collapse probability, (2) reduction of collapse accident consequences, (3) improvement of nuclear safety, (4) improvement of radiological and industrial safety, and (5) long-term strategy for conversion into an environmentally safe site. Task group 5 describes the decisive steps: (a) removal of the fuel-containing material, (b) conditioning of the material for intermediate storage and final disposal, and (c) construction of a confinement building for the shelter ("shelter 2"). It must be noted that SIP is a study project to optimize the design of the various steps and not the conversion project itself. The costs are estimated at US$ 758 million. On 20 November 1997, Ukraine and the European Bank for Reconstruction and Development (EBRD) signed a framework agreement, which was ratified by the Parliament of Ukraine on 4 February 1998. A contract with the winner of the tender for project management consultants was signed on 22 April 1998.

Shutdown of ChNPP

The four units completed at the site of the Chernobyl Nuclear Power Plant are of the RBMK type. The numerous studies made after the `beyond-design-basis´ accident at Unit 4 on 26 April 1986 have revealed that the disaster was the result of a combination of physical peculiarities of the technical design, which had insufficient diagnostic systems, and the low information levels and risky operations of the personnel. As reactors of this type were always built in a double-unit configuration, Unit 3 was also seriously affected, and great efforts were made to put all three remaining units back into operation after the accident: Units 1 and 2 in November 1986, Unit 3 in December 1987. The international community has observed the continuation of operations with very great concern and fear ever since.

The history of national and international decisions regarding the fate of ChNPP reflects the tension between political, economic, social and safety arguments:

17 February 1990:	Parliamentary Ordinance about the shutdown of all units by the end of 1995.
29 October 1991:	Parliamentary Ordinance about the immediate and permanent shutdown of Unit 2 and the permanent shutdown of Units 1 and 3 by the end of 1993.
September 1992:	Approval of the "Concept of ChNPP Decommissioning" and the "Decommissioning Programme of ChNPP".
21 October 1993:	Parliamentary Ordinance about the cancellation of all previous decisions concerning the future of ChNPP.
April 1995:	Statement of the President about the shutdown of all units and the beginning of ChNPP decommissioning by 2000.
20 December 1995:	Signature of the Memorandum of Understanding between the G-7, the EC and Ukraine to close ChNPP by the year 2000.

End of 1996:	Decision of the G-7 and the EC on a grant to make Unit 3 safer.
22 December 1997:	Decree of the Cabinet of Ministers about the shutdown of Unit 1.
9 January 1998:	Adoption of the new regulation "Main Safety Provisions for Decommissioning of Nuclear Power Units and Research Reactors".
July 1998	Declaration of the Ukrainian Government concerning the application of the Memorandum of Understanding (of 20 December 1995).

The situation of the ChNPP in October 1998 can be summarized as follows:

- Operation of Unit 1 was stopped in 1996, and preparations are under way to remove the nuclear fuel.
- Unit 2 has not operated since the major fire in 1991, but repair was completed in 1996. Since then, it is kept "under conservation", and the possibility of its re-starting is being considered.
- Unit 3 is operating after a roughly half-year outage phase in winter 1997/98 for inspection and repair. The combined main stack of Units 3 and 4 showed severe construction defects, but repair work was carried out in the first half of 1998.

The more recent Decree of the Cabinet of Ministers (No. 361 of 15 March 1999) considers that it would be reasonable to shut down Unit 2 before the schedule laid down in the Memorandum of Understanding.

There are three basic aspects to ChNPP and its closure. Regarding its *environmental safety*, the International Conference on the Consequences of the Chernobyl Accident, held in Vienna in April 1996, came to the conclusion that all existing RBMK reactors were potentially dangerous and should be closed down. The explosion of Unit 4 and the subsequent accidents at Units 1 and 2 have demonstrated that there are various sources of failures associated with this reactor design. Improvements of safety features are limited for physical and technical reasons, and programmes to improve safety have not been fully implemented. Some progress was achieved concerning automatic emergency shutdowns and training of personnel. On the other hand, reactor components are ageing and outage phases are increasing due to extended repair needs, dragging resupply and organizational problems. This also reduces the economic benefit of operating this reactor. Furthermore, it must be noted that, depending on the radionuclide, a RBMK reactor releases 10 to 100 times more radioactivity per unit of electricity generated than a VVER reactor.

With respect to *electricity supply*, Ukraine has been emphasizing the need for capacity compensation. The Memorandum of Understanding identified the completion of Unit 2 at KhNPP and Unit 4 at RNPP (K2/R4-Project) and the improvement of their safety as priority projects to compensate for the loss of capacity when ChNPP is closed down by the year 2000. The reduction in the national electricity demand by almost 50 per cent since 1991 and the commissioning and start-up of Unit 6 at ZhNPP in October 1995 have triggered an extensive national as well as international debate on the medium-term necessity of compensating for ChNPP capacity, and the decisions to start funding have not yet been made. The total volume of loans envisaged for the K2/R4-Project is US$ 190 million from the European Bank for Reconstruction and Development (EBRD) and US$ 475 million from the European Commission (Euratom).

At present, about 5 700 employees are working on the ChNPP site. Most live in the town of Slavutych, which was built about 50 km east of the site to replace evacuated Pripyat. It is estimated that after closure of the plant, about half the employees would be involved in safety and decommissioning measures, while the other half would lose their jobs. The resulting social problems would be substantial. They are aggravated by the current economic crisis, making any new job opportunities in the area of Slavutych unlikely at present.

Contamination levels and dose impact on residents of the 'zones'

As late as 1991, the Ukrainian Parliament adopted the Law on the Status and Social Protection of Citizens Who Suffered from the Consequences of the Chernobyl Catastrophe. It recognized on that

occasion that hazardous contamination had occurred in Ukraine beyond the exclusion zone. In 70 articles, this Law describes in detail:

- Criteria for defining the contaminated zones according to the surface contamination by the long-lived isotopes of caesium, strontium or plutonium and to the resulting additional doses;
- Estimations of additional doses to the population depending on the zones;
- Conditions of compulsory and voluntary evacuation;
- Categories of 'liquidators' and 'victims' with respect to health effects and to dates and duration of their work in the zones during clean-up;
- Compensation and privileges granted to these categories;
- Provisions for special medical care; and
- Criteria for additional compensation, privileges, pensions etc. for people living or working in the zones.

The Law was supplemented by the Decree of the Cabinet of Ministers on the Settlements and their Relation to Zones [No. 106, 23 July 1991]. The Law and the Decree resulted in the definition of four zones of contamination with the following specifications (distorted activity numbers result from the conversion of the originally used unit of measure, the Curie, into Bequerel):

Zone 1: exclusion zone (30-km zone) as defined before. Total area: 2 827 km^2; 76 settlements affected. Despite obligatory evacuation in 1986, by 1998 about 800 people, mainly over 50 years of age, had come back to their settlements for personal reasons (so-called 'new comebackers').
Zone 2: surface contamination: >555 kBq/m^2 Cs or >111 kBq/m^2 Sr or >3.7 kBq/m^2 Pu. Total area: 882 km^2; 80 settlements affected on the basis of contamination and another 12 settlements included because of dose calculations. Additional dose: >5 mSv/a. Obligatory evacuation of the 50 000 people is not yet completed, about 11 000 are still living there for lack of suitable alternatives.
Zone 3: surface contamination: 185 - 555 kBq/m^2 Cs or 5.5 - 111 kBq/m^2 Sr or 0.37 - 3.7 kBq/m^2 Pu. Total area: 3 177 km^2; 654 settlements affected directly and another 181 settlements included because of socio-economic and administrative links. Additional dose: 1 - 5 mSv/a. The free choice of evacuation ('guaranteed' evacuation) affected 600 000 people, about 30 000 moved out (mostly young people).

Zone 4: surface contamination: 37 - 185 kBq/m^2 Cs or 0.74 - 5.5 kBq/m^2 Sr or 0.185 - 0.37 kBq/m^2 Pu. Total area: 37 205 km^2; 1 183 settlements affected directly and another 150 settlements included because of socio-economic and administrative links. Additional dose: <1 mSv/a. About 1.8 million people live in this zone. They are subject to special radiological checks.

Very importantly, the Law led for the first time to the publication of contamination maps and lists of settlements in relation to one of the three zones. The Decree has been changed and amended several times since 1991, as investigations into contamination and human exposure proceeded. The tendentious effect of the changes has been to increase number of settlements included in the 'zones', which is not surprising in view of the privileges associated with their status. It is also an open secret that some people live or work in the zones for economic reasons. More recently, the trend seems to have reversed, as more communities apply to have their status returned to normal. There are two main reasons for this development: the Chernobyl Fund, which finances the privileges, was reduced by 50 per cent in 1998, and the status of zones implies a number of restrictions on land use, hindering the development of small enterprises. In principle, the law foresees such a change in status, but it has not been applied yet.

The obligatory or guaranteed evacuation from the zones takes place if the annual dose limit of 5 mSv/a is reached. This is the limit that was valid for members of the public in Ukraine between 1991 and 1997. Since January 1998, the dose limit has been reduced to 1 mSv/a. It is still not clear whether steps will be taken to change the authorized evacuation from zone 3 into an obligatory one under the effect of the new Law. Since human exposure to natural radiation may reach values of 100 to 120 mSv/a in some areas of the world (e.g. at certain locations in Iran, India and Brazil), action to reduce additional doses from accidental releases below 5 mSv/a is often not economically justified. Therefore, in many countries this higher limit is accepted for existing contamination, while for licensing purposes of new facilities the limit is 1 mSv/a. This internationally accepted radiation protection philosophy suggests that there is no need to consider making the now voluntary evacuation of zone 3 obligatory.

With the new dose limits, Ukraine is duly adjusting to international trends. Following the most recent recommendations of the International Commission

for Radiological Protection concerning acceptable effective equivalent doses to members of the public [ICRP Publication 60, 1990], the Council of the European Union decided to reduce the dose limit to 1 mSv/a [Directive 96/29/EURATOM, 1996]. All EU Member States are obliged to put this directive into national legislation by 13 May 2000.

It must be noted that because of the patchy nature of the Chernobyl fallout, surface contamination and, hence, resulting additional external and internal doses to individuals may vary drastically even within one zone. External doses are greatly affected by scattered fuel fragments (hot particles), which contain fission and activation products of high specific activity. Additionally, doses are highly dependent on the lifestyle and diet of the individual. Consistent methods to calculate doses to individuals from surface contamination, including the effects of countermeasures, have been the subject of a great number of national and international research projects in those territories. The results are readily available from the scientific literature and will not be repeated here in detail. Generally, it can be stated that the contamination per unit of surface has not changed since the accident, except for certain areas where highly contaminated soil has been removed. However, external irradiation from radioactive deposits on soil surfaces decreases gradually as radionuclides slowly migrate downwards into the soil with the overlying soil acting as a shield.

The dynamics of internal doses due to the consumption of contaminated food is much more complicated and cannot be generalized because of counteracting effects. On their migration path, radionuclides may move into or out of the rooting depth of a plant, and hence their availability for root uptake may increase or decrease with time. Furthermore, radioactive compounds undergo physical, chemical and biochemical processes in the soil environment, which may also alter their availability for uptake into plants. In most agricultural soils, a decrease in the radionuclide concentrations in crops has been observed with effective half-lives of ten years or less. In contrast, almost constant activity levels are found in products (e.g. berries, herbs, leaves, nuts and animals that feed on them) from so-called semi-natural ecosystems, like unmanaged forests, meadows or shrub land. The best known examples are mushrooms accumulating caesium. Consequently, a person's internal dose is highly dependent on the food he or she eats (agricultural or semi-natural food products). Radioecological surveys in zone 2 have shown that the internal dose could be reduced by up to 95 per cent, if mushrooms were omitted from the diet. Public surveys have also found that dried mushrooms are in fact a popular ingredient in Ukrainian cooking. Ukrainians eat up to 10 g of dried mushrooms a day. It is not clear to what extent this consumption stems from tradition or from a shortage of alternatives. In 1998, between 80 and 90 per cent of the total dose in zone 2 resulted from internal exposure.

It should also be mentioned that heavy surface contamination following the Chernobyl accident was not limited to Ukraine, but also severely affected regions in Belarus and the Russian Federation, which share borders with Ukraine. For example, the areas exceeding 555 kBq/m^2 of Cs-137, which corresponds to the Ukrainian definition of zone 2 (obligatory evacuation), are about seven times larger in Belarus than in Ukraine. Consequently, the same scientific, technical and administrative problems have to be tackled in both countries. Furthermore, there are no NPPs in Belarus, hence its infrastructure for monitoring radioactivity is much less dense than Ukraine's. In spite of their common interests and the fact that the RBMK-type reactors of the ChNPP are considered inherently unsafe, there are no official links or cooperation between nuclear safety authorities or NPP operators at Chernobyl and local authorities of the nearby regions in Belarus.

4.3 Framework for nuclear safety management

Legal heritage and recent legislation and regulatory actions

The political changes of 1991 and the subsequent dissolution of the Soviet Union resulted in substantial changes in Ukraine's legal system. Regarding nuclear safety, Ukraine inherited a regulatory philosophy based on a multi-level centralized State supervision with more than one regulating centre and a very complicated assignment of responsibilities. Actually, there was no legislative basis for nuclear energy use, but a large number of compulsory codes and rules issued by different authorities without appropriate coordination or coherence. This was the starting point at the time of the declaration of independence of Ukraine, and step by step the inherited system is being replaced by legislative action, with about 30 per cent of the old system remaining by October 1998. The decisive difference of the new

decentralized approach is that it aims at rendering the operators of NPPs responsible for the safety of their installations. Therefore, the responsibility of the authorities is to define objectives and to verify that the constructors and operators set up adequate procedures and implement them correctly.

The most important laws concerning nuclear safety and radiation protection of the population and the environment are:

- The Law on Environmental Protection (25 June 1991) generally aims at protecting the environment and the life and health of the population against the negative effects of environmental pollution, including radioactive contamination.
- The Law on Ensuring the Sanitary and Epidemiological Safety of the Population (24 February 1994) regulates relations in the area of sanitary and epidemiological well-being, defines the rights and duties of State authorities and individuals and establishes the procedure for arranging State sanitary/epidemiological supervision.
- The Law on the Use of Nuclear Energy and Radiation Safety (8 February 1995) constitutes Ukraine's fundamental nuclear law. It establishes the priority of human and environmental safety and the rights and responsibilities of citizens with regard to the use of nuclear energy. It introduces an important change to a full-fledged licensing system rendering the operators of nuclear facilities responsible for the safety of their installations and the national authorities responsible for setting objectives and verifying that adequate procedures, hardware and software are developed and implemented.
- The Law on Radioactive Waste Management (30 April 1995) is intended to protect the population and the environment against the harmful effects of radioactive wastes now and in the future. It defines the responsibilities of governmental authorities and establishes a State registration system.
- The Law on Uranium Ore Mining and Processing (19 November 1997) is the basis for the future exploitation of Ukraine's uranium resources.
- The Law on the Protection of the Population from the Effects of Ionizing Radiation (14 January 1998) reduces the annual dose limit accepted for members of the public from 5 mSv/a to 1 mSv/a.

The legislative reforms also aim to adjust to international standards, as set out in the international treaties and conventions to which the Ukrainian Government is a signatory. In this context the following laws were approved:

- Law on the Participation of Ukraine in the 1980 Convention on the Physical Protection of Nuclear Material (5 May 1993),
- Law on Adhering to the Treaty on the Non-Proliferation of Nuclear Weapons (16 November 1994),
- Law on Adhering to the Vienna Convention on Civil Liability for Nuclear Damage (12 July 1996),
- Law on Amendments to Legal Acts Due to the Adherence to the Vienna Convention on Civil Liability for Nuclear Damage (3 December 1997),
- Law on the Ratification of the Convention on Nuclear Safety (17 December,1997),
- Law on the Ratification of the Agreement Between Ukraine and IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (17 December 1997).

As part of the former USSR, Ukraine is a signatory to:

- the Convention on Early Notification of a Nuclear Accident (26 January 1987) and
- the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (26 January 1987).

By March 1998, two laws were submitted to Parliament for approval:

- draft law on permissible activities in the field of nuclear energy, and
- draft law on the physical protection of nuclear materials, nuclear installations and other radiation sources.

Three laws were at different stages of preparation:

- law on regulatory bodies for nuclear and radiation safety,
- law on foundation for financing of regulatory measures for nuclear and radiation safety and
- law on amendments to article 14 of the Law on the System of Taxation, which aims at the creation of adequate financial support for nuclear regulatory bodies.

Meanwhile (June 1999), these three laws were also submitted to Parliament. In the preparation stage are the Law on amendments to the Law on the Use of Nuclear Energy and Radiation Safety and the Law on ratification of the Convention on the Management of Radioactive Waste and Spent Nuclear Fuel, which was signed by Ukraine on 29 September 1997.

To support Ukraine's development of nuclear regulations, the European Commission is funding (through the TACIS programme) a three-year project, Transfer of West European Regulatory Methodology and Practices to the Nuclear Safety Authorities of Ukraine, for the Nuclear Regulatory Administration of the Ministry of Environmental Protection and Nuclear Safety.

Executive and legislative bodies of nuclear safety

In total, five ministries bear responsibility for nuclear safety and radiation protection in Ukraine. The *Ministry of Environmental Protection and Nuclear Safety* (MEPNS) comprises three directorates that share its responsibilities for nuclear safety:

- The Nuclear Regulatory Administration (NRA), which took over the responsibilities of the former Committee for Nuclear and Radiation Safety. Its basic activities are: establishing regulatory criteria and requirements, licensing activities in the utilization of nuclear energy, supervising compliance with norms, regulations and standards in nuclear and radiation safety, R&D for improving safety levels of nuclear installations, State registration of nuclear materials and controlling their storage and use, analysing up-to-date international experience in the safe use of nuclear power, providing official bodies and the public with information on the safety status of nuclear power sites.
- The Nuclear Safety Inspectorate (NSI), which has one office in Kyiv and one at each of the five NPPs. Its main functions are: supervising compliance with legislative and regulatory requirements, developing procedures for inspecting the safety status of nuclear facilities, preparing mandatory measures to eliminate violations and deficiencies, analysing safety reports of operators and proposals for safety improvement, training personnel and identifying training needs, issuing licences to personnel of nuclear facilities, studying and applying international inspection experience, applying sanctions in case of violations of safety rules and standards, limiting/suspending operation of nuclear facilities when safety requirements are not met.
- The State Ecological Inspectorate (SEI) with 24 Regional Inspections in the administrative centres of Ukraine, 2 Municipal Inspections and the Committee of the Crimea Autonomic Republic. On behalf of the State, they supervise compliance with safety requirements outside nuclear facilities and by users of ionizing radiation sources and issue respective licences.

Furthermore, there are several specialized centres reporting directly to the Ministry, called Technical Support Organizations (TSOs): the Scientific and Technical Centre with branches in Kharkiv, Odessa and Slavutych; the Main State Centre for Quality of Supplies and Services with regional branches in Lviv, Zhovty Vody, Ivano Frankivsk, Nikopol and Sumy; and the Ukrainian Radiological Training Centre. These TSOs provide technical support to the three afore-mentioned directorates.

The basic areas covered by the State sanitary/epidemiological services of the *Ministry of Health Protection* concerning radiation protection are: definition of sanitary rules and dose limits for the population, control and supervision of compliance with sanitary legislation, standards, criteria and requirements aimed at ensuring the sanitary well-being of the population, definition of priorities for health protection against adverse environmental factors, control over eliminating causes of and conditions for the emergence and spread of radiation exposure of people, and recording of observed radiation effects.

The *Ministry of Emergency Situations and Chernobyl Matters* was established on 28 October 1996 by the Presidential Decree 'About the Ministry of Ukraine for Questions of Emergencies and for Affairs of Protection of the Population from the Consequences of the Chernobyl Catastrophe'. Its main tasks are: drawing up proposals for the Cabinet of Ministers about the borders of the contaminated 'zones', providing scientific and information support for decisions concerning the exclusion zone and the contaminated territories, developing strategies to protect the population from the consequences of accidents, coordinating decontamination projects, analysing the state of remediation in Chernobyl-affected areas, organizing radioactive waste management projects in the contaminated territories, and establishing and updating data banks on monitoring and scientific

investigations performed in accident-affected areas. The Ministry, in cooperation with the Exclusion Zone Administration and the Research-Industrial Association 'Pripyat', publishes the "Bulletin on the Ecological Situation in the Exclusion Zone" (biannually, also in English) specifically meant to inform the population.

The *Ministry of Energy* was established by presidential decree of 6 May 1997. Its Department of Nuclear Energy is responsible for promoting nuclear energy and thus responsible for the State enterprise 'Energoatom', which operates the nuclear power stations. After its foundation, the Ministry took over parts of the responsibilities originally assigned to the Ministry of Emergency Situations, namely the management of radioactive waste that arises from the normal operation of NPPs and of waste associated with the fuel cycle and with other enterprises handling radioactive material. It is difficult to believe that a clear separation of responsibilities between both Ministries is always possible.

The fifth ministry involved in the use of ionizing radiation and radioactive material is the *Ministry of Industrial Policy*. It is responsible for the use of sources of ionizing radiation. Radiation sources are applied in various industrial production facilities controlling production processes, but also in commercial products (e.g. smoke detectors).

The "highest establishment independent from governmental departments and organizations in all questions related to radiation safety of the population" is the *National Commission on Radiological Protection of the Population of Ukraine* (NCRPU), which was founded in 1991 by parliamentary decree. Its main objective is to define the basic principles of radiation protection of the population's health and life and to develop proposals, recommendations and concepts to be submitted to the legislative bodies. The NCRPU works in close cooperation with various ministries, commissions, committees, scientific institutes and organizations that are involved in radiation safety. It also maintains contacts with national radiation protection commissions in other countries and with international commissions and organizations. The current items on its agenda are: developing a scientific concept for the exclusion zone, unsuitability of the use of the exclusion zone for reprocessing nuclear fuel, methods for estimating build-up factors of radionuclide concentrations in soils, and developing a legislative procedure to accelerate the solution of the radioactive waste transport problem.

In 1994, the NCRPU started publishing quarterly reports (*Bulletin of the NCRPU*) on radiological safety in Ukraine with high-level scientific papers on national and international radiation protection issues with English abstracts. This series of publications was discontinued, however, because of a lack of funds.

The legislative branch in the area of nuclear safety and radiation protection is represented by the *Committee on Questions of Ecological Policy, Utilization of Natural Resources and Liquidation of the Consequences of the Chernobyl Catastrophe*. It is one of 24 committees of the Ukrainian Parliament, and it was established in July 1998 as a result of the merger of the Committee on Environmental Policy and the Committee on the Liquidation of the Chernobyl Catastrophe. Its twelve members are members of Parliament appointed by their parties, and they represent all parties currently elected to Parliament. The Committee develops legislative initiatives and prepares draft laws concerning (a) technological and environmental policy, (b) sustainable development and ecological standards and (c) social protection of people suffering from the Chernobyl accident.

Furthermore, there are about ten other committees/commissions related to the President, the Cabinet of Ministers or the Parliament that are involved in matters of nuclear safety, radiation protection and the consequences of the Chernobyl accident. Inter-ministerial work is performed by working groups or commissions. However, the distribution of responsibilities between the different ministries is not considered to be well defined yet, which causes duplication of work and gaps. Officials from the ministries frequently report that they learn about their respective counterparts only from lists of addressees on official documents. Personal contacts seem to be rare. As the tasks of the different ministries involved in nuclear safety and radiation protection are very similar, they all need to have at their disposal almost identical competence and expertise.

4.4 Instruments for the management of nuclear safety

Licensing and operation permits for nuclear facilities

By October 1998, the legal basis for licensing the use of nuclear energy and for issuing operation permits for reactors currently producing electricity

was still in a transient state. There are only temporary operation permits. In practice, the operator of a facility in operation sets the limits of activity releases, which are approved by the 'On-Site Centre Inspector'. The Nuclear Regulatory Administration then grants a temporary permission for operation, which is valid until the next shutdown for refuelling/maintenance (about 1 year).

The Law on the Use of Nuclear Power and Radiation Safety requires that, by December 2000, all reactors in operation must obtain a licence for permanent operation from the Nuclear Regulatory Administration of the MEPNS. The licensing procedure demanded by this Law is still under development. Since the safety of reactors must be fully analysed to obtain a permanent licence under the new Law, something which never happened in Soviet times, much work needs to be done, e.g. taking measures to improve nuclear safety as specified in the licences.

Although there is no explicit law or regulation on the licensing of new nuclear reactors, the ongoing licensing processes for the Khmelnitsky Unit 2 and Rivne Unit 4 follow those implemented in western Europe, and they are based on the legislative framework listed in Section 4.3. This indicates that legislation on the main items of a licensing procedure already exists, but is dispersed over a great number of laws and regulations, some of which originate from Soviet times. The potential financiers of the possible completion of Khmelnitsky 2 and Rivne 4 (K2/R4-Project), the European Bank for Reconstruction and Development and the European Commission, have made it a condition of their support that west European procedures are applied in the licensing process, involving the following steps:

- Preparation of a feasibility study and decision of principle by the Cabinet of Ministers.
- Choice of a site by the Cabinet, based on the three sites put forward by the proponent.
- Project design, which leads to a decision by the Cabinet to authorize the construction of the plant. At that stage, the production of an environmental impact assessment (EIA) is compulsory.
- Authorization to load the reactor with nuclear fuel, for appropriate tests and verification and authorization to operate.

The process is in the third stage. An important feature of the licensing process is the public participation at certain stages of decision-making. The Law on Environmental Protection is complemented by the Law on the Use of Nuclear Energy and Radiation Safety of December 1995, chapter II, which defines the rights of private citizens and citizens' groups to obtain information on the use of nuclear energy and radiation safety (section 10) and their rights to participate in shaping the policy on the use of nuclear energy and radiation safety (section 11). For this purpose, the Law also stipulates that State authorities must publicize authorized information through the mass media and that local government authorities may organize public hearings to defend projects associated with the siting, planning, equipping, operating and decommissioning of a nuclear installation or radioactive waste management facility. For the hearings on the K2/R4-project in October 1998, in Kyiv and at the sites, information material had been distributed, and concerned citizens and NGOs raised questions and critical aspects, which were discussed and taken up in the procedure reports.

Improving the safety features of VVER reactors

All Ukrainian VVER reactors, including those under preparation at the Khmelnitsky and Rivne NPP sites, were designed in the former USSR in the 1960s and 1970s. None meets the safety rules and regulations currently in force in Ukraine, especially the General Regulations for Ensuring Nuclear Power Safety (OPB-88). Therefore, at the beginning of its activity in February 1992, Goskomatom made a proposal to the NPP administrations to perform a comprehensive safety reassessment of all VVER reactors in operation with the aim of improving their safety.

The guidelines for assessing safety levels of the 13 VVER units currently in operation in Ukraine were introduced in about 15 missions and seminars held at the Ukrainian NPPs since 1992 within the framework of the IAEA Technical Support Programme. IAEA experts defined a specific evaluation and reporting format that addresses so-called 'safety indicators'. Each year, Ukraine's NPPs are obliged to prepare "Reports on the Current Level of Operational Safety", which are submitted to the supervisory and licensing departments of the NRA. The structure, content and scope of the information required are laid down in the "Regulations for Annual Reports on

Evaluation of the Current Operational Safety Status of Nuclear Power Plant Units with VVER-Type Reactors".

The list of necessary safety measures was developed with the help of various international projects on the basis of the recommendations drawn up in the framework of the IAEA Extrabudgetary Programme on the Safety of VVER NPPs. The resulting Programme for Enhancing the Safety of Nuclear Power Plants with VVER-1000 and VVER-440 Reactors was established by Goskomatom and agreed by the regulatory body in 1993. It identifies 39 'Priority I' measures and 19 'Priority II' measures to be implemented within 2 and 4 years, respectively.

By law, the technical measures to improve the safety and reliability of Ukraine's NPPs are carried out during the annual shutdown for maintenance and refuelling. However, information on their actual implementation is somewhat confusing. The report of the Ministry of Environmental Protection and Nuclear Safety on the Status of Nuclear and Radiation Safety in Ukraine for 1996 gives conflicting information on the progress achieved. "With respect to enhancing operational safety as a consequence of the safety reports, the nuclear and radiation level reached in 1996 at Ukrainian NPPs can be evaluated as satisfactory; no nuclear and radiation accidents occurred during the reporting period." "The conducted analysis has revealed that fulfilment of terms has failed the programme and is implemented to not more than 10 per cent." "There were 4-5 measures implemented of the mentioned programme of first priority." "Only 30 per cent of the upgrading measures could be performed because of a sharp decrease of financial and material resources." An NRA paper presented at an IAEA symposium in 1996 noted that "Efforts have been made to bring the operation of NPP units in line with the requirements of the new technical standards, but these measures have been of a specific, local nature and in many cases have proved physically impractical or have not been carried out for economic reasons."

Following the fire that broke out at Unit 2 of the ChNPP in 1991, Goskomatom developed the Comprehensive Programme for Fire Protection of Cabling Structures of Ukrainian NPPs for 1995-1996, which was approved by the Ministries of Internal Affairs and of Environmental Protection and Nuclear Safety in 1994. The latter stated in its 1996 Report that, by the end of the reporting period, this programme had not been carried out. Furthermore, the Report noted that there was great concern that, in recent years, NPP staff had lost the economic incentives to produce electric power. As consumers fail to pay for generated electric power, the debts of nuclear plants grow proportionally to the amount of generated electricity. This results in the non-payment of wages, strictly limits the purchase of spare parts and equipment and means that upgrading programmes are not applied. Demonstrations by NPP staff in summer 1998 have drawn wider attention to this problem. Since 1995, there has been an increase in the number of human errors in NPPs, which highlights the gravity of this development. This trend not only creates a safety problem, which is serious enough in itself, but it also leads to an economic imbalance between the accumulated installed capacity and the reduced load factor (load factor = ratio of actually produced energy over maximum producible energy). The 1996 Report lists examples of safety measures at reactor units of Zaporizhje and South Ukrainian NPPs resulting in considerable increases of electricity production simply by reducing outages.

The upgrading measures (Programme for the modernization of the NPPs of Ukraine with VVER reactors of the B-320 type) for the VVER reactors presently under construction (Khmelnitsky Unit 2 and Rivne Unit 4) were drawn up by Energoatom in cooperation with an international expert group from the EdF (France), IVO (Finland) and Tractebel (Belgium), and they were reviewed by the Association Riskaudit of the GRS (Germany) and the IPSN (France). Some of the features that were criticized are: the speed of insertion of control rods, fire protection, diagnostic instrumentation, emergency electricity generation and reactor vessel integrity. The EBRD and the EC have made their financial support for completion dependent on the condition that these plants attain a level of engineered safeguards comparable to that of pressurized water reactors (PWR) currently in operation in western Europe.

4.5 Conclusions and recommendations

The management of nuclear safety was certainly among the most difficult – if not the thorniest – issues awaiting the new Ukrainian Government when it embarked upon the transition. In addition to the difficult socio-economic problems that accompany any transition process, the topic was magnified by the accident that had occurred at Chernobyl only a few years before, arousing very much international attention indeed. Furthermore, its legacy is particularly heavy in matters of nuclear

safety – and correspondingly expensive to assume. Confronted with a large number of constraints, Ukraine opted to put the responsibility for nuclear safety to the hands of the nuclear facilities, progressively creating the legal and administrative framework to produce this result.

Although this strategy is correct, its implementation appears sometimes unnecessarily long and not always exclusively dominated by considerations of nuclear safety. For example, about 30 per cent of previous legislation has not yet been replaced to reflect fully modern safety management. For some important short-term problems – like the conditioning and storage of operational radioactive waste – there are still no adequate conditions for their satisfactory management. This also applies to the development of a spent fuel concept, which is never an easy undertaking. The consequences of some particularly hazardous techniques of obtaining uranium – like in-situ leaching – do not appear to be tackled with determination. Regarding the consequences of the Chernobyl accident, it is still not clear which concept will be selected for the exclusion zone. Also, it would be advisable to promote direct contact between the Chernobyl Nuclear Power Plant and the relevant authorities of the adjacent areas in Belarus, to improve the coordination of the various research and monitoring projects undertaken in the respective areas. Such coordination is also part of the new responsibility for safety of the operators of nuclear facilities. The implementation of this recommendation would greatly benefit from international projects on the transfer of regulatory methodology from countries with a similar safety philosophy, but also national resources would have to be stepped up.

At present the discussion about the future of Units 2 and 3 of ChNPP appears to be mixing environmental safety considerations, electricity demand and socio-economic prospects of the ChNPP staff and the city of Slavutych. These issues urgently need to be separated to clarify the situation. The existing risks associated with the management of the consequences of the accident in the exclusion zone and the shelter, as well as with the continued generation of electricity in Unit 3 should lead to (a) the discontinuation of electricity generation at this site in accordance with the recent Memorandum of Understanding, (b) the decommissioning of Units 1, 2 and 3 and (c) the development of a sustainable long-term management plan for the entire site. International financial assistance will be necessary not only for the management of the technical consequences of the accident, but also as a contribution to the solution of social and economic problems affecting Chernobyl staff and the population of Slavutych.

The generation of electricity at ChNPP under the current conditions does not seem to be essential to maintain an adequate electricity supply in the country. For example, none of the ChNPP units generated electricity during the winter 1997/98, and there were no particular interruptions in supply. The licensing procedures of K2/R4 for capacity compensation are being followed. The immediate future of the ChNPP will also depend on the willingness of the international community to contribute to the solution of the social and economic problems that will appear in the area, once Units 2 and 3 are shut down permanently. Irrespective of any formal considerations, it seems to be an illusion to expect that the Ukrainian authorities can solve these problems on their own.

Recommendation 4.1:
Following ChNPP Units 1 and 2, Unit 3 should also be shut down permanently according to the Memorandum of Understanding. If K2/R4 should start operation, the possible shutdown of other older reactors should be considered. The international community should consider assisting financially in all technical and socio-economic consequences of such decisions, which in some cases may substantially affect entire communities, like the city of Slavutych.

Some streamlining of administrative mandates appears necessary. In total, five ministries and about ten committees and commissions related to executive and legislative bodies are involved in nuclear safety and radiation protection, and their number has increased in recent years. The definition of their responsibilities is unclear. The lack of contact and cooperation between the different administrative levels inevitably leads to the independent development of concepts and to duplication of work. All legislative and executive bodies working on nuclear safety should be screened with the aim of reducing their number and concentrating their workforce. The tremendous tasks to be carried out in this field in the near future can be completed only when it is done in a cost-effective way and when a clear structure is established and duplication of work is avoided.

Recommendation 4.2:
Legal instruments (including the final adoption of licensing procedures for nuclear facilities) and institutional arrangements for nuclear safety

should be aligned with the strategic objective of making operators of nuclear facilities responsible for safety. Environmental policy requirements regarding uranium mining, radioactive waste management and plans for the exclusion zone around Chernobyl should also be formulated swiftly.

The VVER-type reactors (water-moderated, water-cooled pressurized water reactor) currently in operation do not meet the safety rules and regulations in force in Ukraine, and programmes to improve safety are not fully implemented, although experience has shown that upgrading and modernization are effective means to increase electricity production efficiency. Efforts are therefore necessary to implement the safety culture agreed upon in the respective international conventions and to avoid wasting existing capacities. The need and the conditions for upgrading the VVER units now under development (Khmelnitsky 2 and Rivne 4) are presently being considered in negotiations on the Ukrainian requests for western support.

Owing to the economic situation, the necessary upgrading measures cannot be taken at once. Thus, an optimization concept needs to be developed. It should include a realistic scenario for the development of electricity demand, the number of reactor units actually needed, the effects of upgrading and modernizing and the selection of those units that would meet the demand in the most cost-effective way. This concept should be a guideline for setting priorities for the implementation of upgrading programmes. The public will tolerate or accept nuclear power only if the authorities prove that they too are seriously concerned about safety. As in many other countries, too little attention is paid and too little funds are allocated to the development of the use of renewable energy sources, like sun and wind. In view of the favourable geographical and meteorological conditions in some areas of Ukraine, this option represents a promising alternative to nuclear energy.

Recommendation 4.3:
A realistic scenario for the role of nuclear energy should be developed urgently. The scenario should include (a) a revised projection of the future demand for electricity, (b) an assessment of the long-term capabilities of renewable energy in Ukraine, (c) a programme of energy saving measures and (d) an operational plan to make VVER reactors safer. See also Recommendation 13.5.

Ukraine's nuclear fuel cycle is not closed. Many important steps between uranium mining and its final disposal are disrupted. With the continuation of nuclear energy production, these disruptions develop into pressing economic, ecological and safety problems. It is not realistic to believe that a complete chain of facilities for a closed or an open fuel cycle can be established in Ukraine within the time still available for developing and applying solutions. The highest priority should be given to the management of the different kinds of waste that have accumulated within the past 20 years: the medium-term (commonly ~40 years) dry storage of spent nuclear fuel, the processing and conditioning of medium-, low-level and Chernobyl waste as well as tailings from uranium mining and their safe disposal or enclosure. The trend of accumulating radioactive waste, most of which improperly stored, must be reversed. The shutdown of ChNPP and its decommissioning will produce large quantities of radioactive material of all categories.

Recommendation 4.4:
The nuclear energy programme should put emphasis on the construction of dry storage facilities, preferably in the vicinity of nuclear power plants, and on the construction of waste-processing, conditioning and final disposal facilities focusing on long-term safety according to international standards.

In its present form, the shelter is a continuous source of radiation and of radioactive emissions in the order of 1 000 times those of a VVER reactor. It must be regarded as a permanent risk to people and the environment at least in the exclusion zone, due to physical and chemical processes in the fuel-containing material and the continuing degradation of the building. The structure is expected to collapse and release large amounts of fuel dust and fission products, unless appropriate countermeasures are taken. The crucial question is the time of its occurrence. All preparatory actions to convert the shelter and make it environmentally safe have been completed: the Shelter Implementation Plan (SIP) has been developed, money is available for the study phase and a contract has been concluded with the project management consultant. Any delay increases the risk and the costs. The plan provides sufficient room for modification of the different steps on the basis of information gained from preceding steps, so that no further planning is required at this stage.

Recommendation 4.5:
In view of the constantly decreasing stability of the shelter and the fact that nuclear excursions cannot be excluded, the SIP should be implemented without delay.

Today, the exclusion zone represents a huge reservoir of accumulated hazardous materials of very heterogeneous kinds, partially concentrated at a large number of dumping and storage locations, while the rest is unevenly dispersed over the entire area of nearly 3 000 km^2 with small, highly radioactive spots. Shortly after the accident, radioactive material was moved to clear the immediate vicinity of the destroyed reactor to build the shelter. This had to be done without any comprehensive strategy and resulted in a large number of unprotected or even uncharted waste dumps. As time goes by, radioactivity continues to disperse horizontally and into the groundwater, and recovery will become increasingly difficult. Considering the time that is necessary to make the zone ecologically safe, information on critical sites is in danger of getting lost. The Ministry of Emergence Situations maps all waste trenches and accumulations of radioactivity and recovers unsafely deposited material. These activities must be continued, despite the enormity of the task, and they should include a characterization of the physical and geological situation and activity inventory of each site. A comprehensive concept for improving the ecological safety of the zone must be finalized. This concept should include guidelines for future uses of the territory and acceptable activity levels with respect to the anticipated use. It should also define a principal procedure to decide on the two possible options for the fate of radioactivity of waste trenches and dumping sites: safe confinement on site or waste repository, depending on the particular characterization of the site and the minimization of the radiation doses involved. The concept should also respect the strategies developed for the ChNPP, the shelter and the cooling pond. From a radiation protection point of view, it should also be reconsidered whether as many as two dozen institutions with 11 000 people actually need to be stationed in the zone.

As the radioactivity concentrations in many environmental media of the 'zones' are slowly decreasing and more knowledge is gained on site-specific pathways of radionuclides into food products and on dietary effects on individual doses, this development must be observed closely. The principal trend should be to lower the status level and finally return to normality wherever possible in view of radiation protection principles. The models being applied to estimate exposure doses from radioactivity measurements should be as realistic as possible and as conservative as necessary. Close cooperation between science and governmental authorities is required to improve the economic situation and the quality of life of the population in the zones.

Recommendation 4.6:
To ensure a decent future for the exclusion zone, it is paramount that the Chernobyl waste should either be confined safely on site or disposed of in repositories in accordance with the minimum risk principle. The temptation to convert the zone into a large dumping area should be resisted. The status of settlements in the zones should be reconsidered frequently on the basis of realistic scientific analyses, and the change of status towards more normality should be promoted by the authorities wherever justified.

Managing nuclear safety effectively requires a particularly powerful information system of environmental radioactivity. Such a system can be organized in many ways. However, the system has to be well coordinated, and an appropriate and timely evaluation of monitoring data is essential. Also, technical and administrative work could considerably be reduced and streamlined by concentrating monitoring responsibilities and tasks in a smaller number of ministries and committees than is currently the case. Sampling and analytical methods, siting of stations and their equipment, as well as laboratory practices need to be revised and adapted to modern requirements. The layout and the equipment of the facilities that monitor radioactivity in different environmental media date back to the Chernobyl accident or earlier. Apart from the fact that the recent lowering of dose limits accepted for the public requires lower detection limits and more sensitive measuring, the monitoring instruments would not be capable of determining activity concentrations reliably. They are too old, and the different laboratory areas for preparing and measuring samples are not isolated, which leads to cross-contamination of samples and equipment. The main aim of any review of the monitoring network should be to improve the quality of stations rather than their number. Low-level measurements must meet strict quality requirements.

Recommendation 4.7:
A programme to improve the technical layout and equipment of monitoring facilities should be developed and implemented. Sampling, measuring, evaluation and documentation procedures should be standardized so as to facilitate the establishment of a national databank. See also Recommendation 1.5.

The early-warning system is an obligatory complement to the information and monitoring system. It is also a key installation for providing radiation protection to Ukraine, to neighbouring countries and to more distant countries. The European Union and several western countries recognized this when they decided to finance the equipment of the Information and Emergency Centre (IEC) and the monitoring system. It is part of the implementation of international conventions.

Recommendation 4.8:
The planned Information and Emergency Centre should be completed urgently, and the remaining three NPP sites should be equipped with all the automatic monitoring instruments. All attempts by the Ukrainian authorities to obtain the final share of financing as foreseen in the IEC concept should be supported.

Chapter 5

PROMOTION OF INDUSTRIAL SAFETY AND CLEANER PRODUCTION

5.1 The broad situation of industrial safety and cleaner production

The general economic and social context

Since independence Ukraine's economic situation has gone from bad to worse. For instance, GNP has shrunk by 48 per cent and more than half the population lives below the poverty line. Table 5.1 illustrates the development of economic production between 1985 and 1997. Output from the main industrial sectors declined considerably. Production of mineral fertilizers has decreased by 55 per cent over the past twelve years. A similar trend characterizes other sectors, for example the output of synthetic resins and plastics or of the cement industry fell by around 80 per cent during the same period. The main reasons for the decline in industrial output were old technologies and equipment, lack of financial resources and reduction in market opportunities at national and international levels.

Every year the State cuts budgetary funds for environmental protection and science. At present,

Table 5.1: Output of main industrial products, 1985-1997

	1985	1990	1993	1994	1995	1996	1997
Electric energy produced *(Billion kWh)* **a/**	272	270	227	201	192	181	177
Oil *(1 000 t)* **b/**	5 800	5 300	4 248	4 198	4 090	4 096	4 130
Gas *(Billion m^3)*	..	..	19	18	18	18	18
Coal *(Million t)*	189	165	116	94	84	70	71
Cast iron *(Million t)*	47	45	27	20	18	18	21
Steel *(Million t)*	55	53	32	24	22	22	26
Mineral fertilizers *(1 000 t)*	5 100	4 800	2 495	2 337	2 221	2 338	2 300
Synthetic fibre and thread *(1 000 t)*	165	179	80	39	41	33	26
Synthetic resins and plastics *(1 000 t)*	722	827	332	233	178	117	..
Cement *(1 000 t)*	22 400	22 700	15 000	11 400	7 621	5 047	..
Tractors *(Number)*	135 900	106 200	55 000	16 000	10 386	5 428	4 600
Footwear *(Million pairs)*	186	197	101	38	20	12	..
Paper *(1 000 t)*	299	369	181	94	98	95	88
Fabrics *(1 000 m^2)*	1 160	1 212	574	263	169	109	..
Sugar *(1 000 t)*	6 247	6 791	3 838	3 342	3 900	3 292	2 032
Meat *(1 000 t)* **d/**	2 357	2 763	..	..	957	757	525

Sources: Statistical Yearbook of Ukraine, 1996;
The State of the Environment in Ukraine, 1994;
CESAM, Environmental Policy and the role of foreign assistance in Central and Eastern Europe.

Notes:

a/ Produced by communal use power plants and block power stations.

b/ Including gas oil.

c/ 100% nutrients.

d/ Including 1st category sub-products.

State budget allocations amount to 0.24 per cent for environmental protection and to about 0.9 per cent of the total budget for science. Against this background of deep recession and scarce funds for remedial action, the needs for improving industrial safety and reducing the pollution potential of the country's industry are obvious and require only a general presentation.

There is little industrial investment of domestic origin at present. There is not much foreign investment either. Ukraine has failed to attract large foreign funds due to its slow pace of reform, political infighting over market transformation and poor economic performance. However, foreign investments have been injected into the food industry (about 20 per cent of the total), domestic trade (16 per cent) and machine building (8 per cent). The timber and the pulp and paper industry, construction and construction material industries have attracted another 5 to 7 per cent. And interest in the chemical and petrochemical sectors started to grow last year. The main recipient of foreign funds have been the Kyiv, Zaporozh'ye, Odessa, Dnepropetrovsk, Cherkasy and Donetsk Oblasts and the Republic of Crimea. In Crimea and Donetsk, newly created special economic zones are attracting foreign investors with a range of tax breaks and other concessions.

Evidence of need for cleaner production

Table 5.2: Pollution effluents by sector, 1995 and 1996

1 000 tonnes of pollutants

	1995	1996
Industry	..	**3 250.5**
of which:		
- power engineering	833.7	876.3
- ferrous metallurgy	1 240.1	1 102.1
- coal industry	780.0	737.4
Agriculture	**253.1**	**218.5**
Household utilities	**1 259.6**	**1 223.5**

Source: State of the Environment: Country Overview - Ukraine. EU Tacis Programme. Ministry for Environmental Protection and Nuclear Safety of Ukraine. 1998.

Both water and air pollution at the national level remain considerable. Overall data regarding water pollution in 1995 and 1996 are included in Table 5.2. The largest share (21 per cent) was discharged into the Dnieper basin, almost 16 per cent into the Sverskyj Donets basin and over 4 per cent directly into the Black Sea.

The mining and the energy industries exert heavy pressure on water resources (for details see Chapters 10 and 13). The decline in production over recent years has led to a cut in the volume of abstracted water (4 billion m^3 for the energy sector) and consequently of waste water directly discharged into water bodies. The energy sector generates 43 million m^3 of polluted waste water, far behind metallurgy (1 billion m^3), the coal industry (600 million m^3), the chemical and oil industries (above 200 million m^3) and the machine-building industry (about 50 million m^3). In 1996, Ukraine counted 1 355 entities that discharged contaminated water, i.e. 20 fewer than in 1995. A total of about 3.2 billion m^3 of contaminated water was directly discharged into bodies of water in 1996, including 980 million m^3 of untreated waste water. The volume of such water increased by 68 million m^3 compared to 1995, i.e. up 7 per cent. There are no data giving a global picture of the importance and toxicity of the pollution discharged into surface waters. However, it is thought to be severe (see chapter 10 for the specific case of mining activities). Underground waters are not preserved either. Pollution, in particular from petrochemical activities, is so alarming that a three-year scientific and technical programme on the development of petrochemical pollution in groundwaters has been launched. It is likely that underground waters are threatened by infiltration from industrial premises.
Regarding air pollution, power and metallurgy plants are the largest stationary sources of emissions of nitrogen oxides (up to 70 per cent). Most sulphur dioxide emissions come from power engineering, metallurgy and coal industries (87 per cent), and most hydrocarbon and volatile organic compound (VOC) emissions from the coal and chemical industries and oil refineries (63 per cent). In the past five years, dust emissions have fallen by 52.5 per cent, sulphur dioxide emissions by 46 per cent and those of nitrogen oxides by 41 per cent.

Soils are also heavily affected by industrial activities. Soils are polluted by the air pollution depositions of particulates generated by various industrial processes. Pollution by heavy metals (lead, copper, cadmium) is of serious concern (see chapter 12). Soils are also polluted by petrochemicals from petrochemical plants (6), airbases and other old army sites, the network of transit and internal oil and product pipelines (more than 600 km) and sites of extraction, storage and

transport of oil and oil products (more than 300). In addition, the Chernobyl disaster resulted in the pollution of 8.4 million ha of land by radionuclides (see details in chapter 4).

There are more than 2 500 enterprises and organizations dealing with hazardous substances in Ukraine. Every day 220 different hazardous substances are transported on the country's territory. Out-of-date technologies and violations of transport regulations mean that hazardous substances threaten to poison an area of more than 64 000 sq. km and 18 million people.

These national totals hide considerable regional variations. Technological pressures are considerable in industrialized regions, producing extreme ecological situations. The city of Mariupol on the Sea of Azov's coast is one human settlement where pollution phenomena are well documented. Emissions of air pollutants in Mariupol are at a level of 339 000 t, discharges of waste water into the Sea of Azov total 880 million m^3, of which 235 million m^3 contain toxic substances, the rest being thermally polluted. Over 100 million m^3 of industrial and domestic wastes are stored within the city limits. In situ measurements and theoretical calculations have shown that the concentration of toxic substances in the air in most parts of the city and in the local waters of the Sea of Azov are 3 to 4 times higher than allowed. In some areas, the heavy metal content of the soil is from 6 (Pb) to 125 (Zn) times higher than allowed. Special studies have shown that people living in the most heavily polluted areas of the city are less healthy than their counterparts in the cleaner areas. A sanitation programme is to be implemented over a 15-year period at an approximate cost of US$ 400 million. It is envisaged that enterprises and local budgets will fund the programme.

Aspects of industrial safety

Industrial safety is considered to be part of general national security. Virtually all economic sectors pose safety risks. Cases of accumulating obsolete pesticides and import or transit of prohibited hazardous substances for agriculture have been reported. They may be caused by delays in the permitting of the use, transport or storage of hazardous substances, as it is in the hands of different administrations. The safe storage, use and destruction of rocket fuel components are very urgent problems and carry truly enormous safety risks.

According to various international assessments, the main reasons for this critical situation are:

- Ukraine's excessive technological pollution load;
- its high concentration of potentially hazardous industries;
- the high rate of obsolescence at the main industrial sites;
- the increased non-compliance with accident prevention measures and the use of dangerous equipment due to a lack of discipline at all levels in industry;
- the excessive concentrations of toxic chemicals in the environment, mostly pesticides and decaying pesticide residue;
- the unsatisfactory disposal, use and burial of highly toxic, radioactive and household waste.

Accidents and abnormal events in Ukraine during 1996 frequently originated from technological factors. They have increased steadily over the past years. Chapter 14 on health reports on the most frequent occupational diseases and accidents in various sectors of industry (see in particular Table 14.6). In recent years, including 1996, gas pipelines have suffered ever-more severe problems. About 14 400 km (43.5 per cent) of the main pipeline have unsafe and low-quality anti-corrosion protection. Three major disasters occurred in 1996 in the gas industry. A leak followed by a fire in the Novopskov - Aksai Mozdok pipeline near Lugansk had serious consequences.

5.2 Objectives, instruments and institutions for the promotion of industrial safety and cleaner production

Objectives and legislation

Parliament stated in 1992 that Ukraine, as a whole, was an environmental disaster zone. This political declaration had, however, only a limited environmental impact, as it did not spell out procedures or authority for specific activities, nor did it set priorities or deadlines. Moreover, it was not based on a well-structured national environmental action plan. Instead the Cabinet of Ministers approved the Principal Directions of the State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety in August 1996 and the Rada adopted them in March 1998. However, safety

issues are covered only very broadly and cleaner production topics hardly at all.
According to the Principal Directions, solving technological and ecological safety issues requires:

- the reconstruction of the technological environment and technical re-equipment of the production industry, based on the introduction of innovative scientific achievements, energy- and resource-saving technologies, ecologically cleaner technological processes, use of renewable energy resources, and the safe disposal or use of various types of wastes;
- the introduction of effective environmental controls in the scientific research, design, construction and functioning of artificially created sites, in order to manage the technological pollution loads and to use natural resources efficiently;
- the classification of Ukraine into regions according to their technological pollution and ecological loads, and the creation of technological and ecological load maps;
- the development of methodologies to define the level of environmental risk caused by technological facilities;
- research into appropriate environmental monitoring models for industrial, power generation, construction, transport and agricultural facilities.

The objective of the Government's policy is to draw up and introduce legislative acts that can improve the system of regulatory mechanisms and fit European regulations and practices, mainly the European Union Seveso II Directive. It aims at increasing the level of environmental safety and fulfilling requirements to enable Ukraine to accede to international agreements and conventions, specifically the UNECE Convention on the Transboundary Effects of Industrial Accidents. A draft law on changes and amendments to the Law on Environmental Protection was drawn up and submitted to Parliament. This draft law proposes new instruments to regulate environmental safety:

- procedure for the identification of hazardous activities
- environmental audit
- requirements for licensing hazardous activities
- economic mechanisms for environmental protection
- environmental insurance.

For the further development of this law, it was decided to draw up a law on environmental safety, which will cover technological safety. Its first concept foresees:

- the designation of governmental bodies to manage environmental safety and the determination of authority and liabilities (the State, local authority, enterprise, public)
- rules and procedures for the issuance of special permits, licences to carry out hazardous activities and the specification of safety requirements that enterprises have to meet, cooperation with the State governmental bodies and with the population.

The new draft law on environmental safety sets forth the most important principles and provisions to ensure environmental safety. It specifies the right of citizens to environmental safety, the principle of priority of environmental safety requirements; environmental safety norms and measures, in particular requirements with regard to the siting, design, construction, reconstruction, putting into operation and running of enterprises, structures and other objects, and to the application of herbicides, pesticides, artificial fertilizers, toxic chemical substances and other agents. Protection from uncontrolled and harmful biological and other effects are covered, as are impacts of exposure to radiation, protection from pollution by industrial, household and other waste, as well as transport safety, research activities, application of new machinery, imported equipment, technologies and systems. Finally, the law also covers relevant activities of military or other defence enterprises and the operation of similar companies in towns.

A first draft of the law on high-risk installations aims at preventing large accidents and minimizing their consequences for the population, the environment and other important assets. The law would apply to enterprises using – or capable of using - hazardous substances, except:

- military enterprises;
- installations dealing with radioactive substances;
- installations dealing with biologically active substances;
- mining companies;
- transport companies;
- landfills.

Regulation No. 440 (20 June 1995) of the Cabinet of Ministers appointed the Ministry of Environmental Protection and Nuclear Safety as the responsible body for issuing permits for the production, storage, use, disposal and destruction of hazardous substances. In 1997 the Ministry issued 782 permits, of which 352 for storing, 256 for using and 130 for transporting hazardous substances. The substances were mainly compounds of lead, mercury and cadmium. The Ministry has developed a database and a system for the exchange of information to improve the procedure. Half the regions are currently connected to the system.

Institutions

There are several organizations involved in the regulation of industrial safety on the State level:

- The Ministry of Environmental Protection and Nuclear Safety;
- The Ministry for Emergency Situations and Chernobyl Matters;
- The Ministry of Health Protection;
- The Ministry of Internal Affairs;
- The State Committee on Labour Protection Supervision;
- The Committee for Hydrometeorology.

The State Commission on Technological Safety and Emergency Situations is responsible for coordinating the actions of other ministries (see above list) to prevent emergencies. Each region has its own commission on emergencies. The head of the Commission is the first Vice-Prime Minister and the first deputy is the Minister for Emergency Situations and Chernobyl Matters. The other deputy is the Minister for Environmental Protection and Nuclear Safety. The main goals of the Commission are to:

- coordinate the activities of all institutions dealing with technological safety and emergencies
- coordinate damage restoration at the national and regional levels
- control the use of technical and financial resources for building or reconstructing dangerous installations
- guide the activities of the bodies responsible for monitoring and for environmental protection systems.

Instruments

Many State-owned enterprises in Ukraine are having to cope with severe environmental problems stemming from the failure of the centrally planned economy to control industrial pollution. Privatization programmes do not always remove the uncertainty about who is responsible for the environmental problems of the enterprise to be privatized. Two distinct types of problems are at issue:

- contamination caused by past industrial activities, and
- unacceptable levels of pollution from ongoing operations.

In Ukraine, there is no environmental impact assessment procedure (EIA) in the sense of the EU legislation. As in other former USSR republics, an ecological expertise procedure exists (See Chapter 1). However, in the current privatization process, potential foreign investors ask primarily for an EIA in order to assess the environmental risks they are taking. The existing by-laws do not satisfactorily address this problem. In addition, there is no law on past ecological damage clearly stating the respective responsibility of the previous (State) and new owners.

Ukraine's privatization programmes are seeking to attract technical and managerial know-how and the capital needed to restructure its industry. Some foreign investors are deterred by the prospect of possibly having to assume liability for past environmental damage and by the lack of clear and credible rules for ongoing pollution control. The evaluation of environmental factors in the privatization process does not solve all problems satisfactorily. On the whole, the privatization process has not had a favourable impact on the use of cleaner technologies.

Regarding the prevention of accidents, the concept of a common system was envisaged already in 1995. The purpose of creating a unified State system for the prevention of accidents, disasters and other emergencies is: (a) to systematically control the safety conditions and pollution loads of environmentally dangerous facilities and processes; and (b) to forecast and prevent accidents, disasters and other emergencies and minimize their impact. At present, a governmental information and analytical system for emergencies is being set up. Assessments keep the risk of industrial accidents in check. Environmental inspections take place to

verify that enterprises with a high environmental risk observe legislative requirements.

5.3 Specific programmes for industrial safety and cleaner production

In October 1993, OECD, in cooperation with Ukraine's Ministries of Environmental Protection and of Industry, initiated a demonstration audit targeting waste minimization, environmental and production efficiency, and health and safety at the RADIKAL Chemical Plant, a producer of caustic (NaOH) and chlorinated products. The audit was followed by a seminar for the Ukrainian chemical industry and relevant authorities and research organizations. The audit was carried out by western experts. It took approximately two days, and the findings were based on visual impressions and oral information supplied by company representatives who accompanied the auditing group through selected departments of the plant. A second step to promote waste minimization and efficiency improvements brought Swedish, Lithuanian and OECD experts to three heavily industrialized centres in eastern Ukraine: Kharkov, Severodonetsk and Dnepropetrovsk. The core of this stage consisted of seminars for different audiences, largely from chemical industries.

Netherlands experts have started the second phase of the implementation of a cleaner production programme in Ukraine, on the basis of documentation from the above-mentioned activity. Ukraine and the Netherlands agreed to cooperate within the framework of a memorandum of understanding concerning environmental protection and the Netherlands Matra programme. The proposals were later modified, as significant problems arose in their implementation. The project described in this proposal was directed at supporting the Ukrainian (regional) authorities and representatives of the general public in the management of their environment along the principles of sustainable development and Ukraine's social transformation objectives. Four aims were set:

- Strengthening environmental management on a regional level.
- Training officials, volunteers and representatives of other target groups.
- Raising public awareness and participation.
- Providing logistical support.

In the beginning of 1995 Ameco was commissioned by the Netherlands Ministry of Housing, Spatial Planning and the Environment's Directorate of International Cooperation (VROM/IMZ) to start a project in the Dnepropetrovsk region within the framework of the Memorandum of Understanding. The project primarily focused on the possibilities for strengthening the position of local authorities and their opportunities for promoting "self-regulatory measures" at local enterprises: the introduction of Environmental Care Systems, good housekeeping measures, environmental audits and in-company environmental education, by means of preparing a handbook on low-cost good housekeeping measures. The development of the project resulted in the decision to establish the *'Dnepropetrovsk Environmental Information Centre (EICD)'*, where the representatives from the Netherlands work closely with a group of local authorities, regional companies, research institutions and NGOs. All organizations involved in the project at the evaluation meetings in October and November 1996 declared that they wished the initiative to be further developed. Two strongly related tracks were suggested for simultaneous development in the near future:

- Development of the regional environmental policy.
- Further development of the EICD as an independent institute. The existing EICD structure was split into two core activities: the development of (a) a federation of environmental movements, and (b) an independent environmental research institute (incl. departments of laboratory/monitoring, environment and economics, environmental health, agriculture and environment research).

The goal is to integrate economic and environmental policy development and to identify "win-win" opportunities that have remained unexploited. Environmental management is a prerequisite for sustainable development. To be effective, it needs to be an integrated part of corporate management. The intrinsic responsibility of the company for the environment is crucial in the development of an environmental management system. At the heart of an environmental management system is the commitment to minimizing or preventing pollution at the source. In the course of the project, the Dnepropetrovsk Environmental Oblast (regional) Committee (DOEC) will set up an environmental information centre.

Denmark's cleaner technology programme was used as a reference. It was implemented in three steps. The first aimed at identifying environmental problems in Danish industries so as to pinpoint key areas for intervention. The second stage focused on developing cleaner technology solutions for the target sectors. The third step involved demonstrating the advantages of cleaner technologies through a pilot and demonstration programme in the industry. The experience gained in developing the Danish EPA's cleaner technology concepts made it possible for Ukraine to cut short most of the activities of the first two stages. This accelerated the promotion of cleaner technology in Ukraine and also led to savings. Danish experts supplied technical assistance to the project in the areas of cleaner technology audits, application of no- and low-cost cleaner technologies, preparation and implementation of cleaner technology projects, training of local experts and company staff, and project management. Ukrainian experts collected data at the enterprises and covered existing technical knowledge. They also made the practical arrangements and supplied local parts to make the no- and low-cost cleaner technology changes.

Ukraine's machine-building industry was selected to implement the programme. It consists of some 1 400 companies producing everything from small items like scissors to bigger ones like agricultural machines. The entire sector currently operates at 40 per cent of its capacity. It employs around 500 000 people, of whom 63 000 are engaged in military production. The industry has a total turnover of some US$ 215.4 million. The machine-building industry and the local authorities have long shown an active interest in applying the concept of cleaner technology and other preventive ways of solving industrial pollution problems. The pollution load from electroplating workshops involved in the project will be cut thanks to:

- A 75 per cent reduction in water use,
- A 50 per cent cut in the use of chemicals,
- 20 per cent energy savings.

This reduction is expected from a minimum of five demonstration projects where both no- and low-cost, and high-cost cleaner technology options will be implemented. An additional reduction in the pollution load from a minimum of 20 enterprises is expected from the implementation of no- and low-cost cleaner technologies. No- and low-cost changes in all participating enterprises will help them to reach the above-mentioned targets and increase their profits.

The first phase of the project has been carried out, during which the selected enterprises were audited. Local experts and technical staff at the enterprises were trained in cleaner technology auditing, environmental management and occupational health and safety. The enterprises made the no- and low-cost cleaner technology changes, including the purchase of new safety equipment and other small changes to existing health and safety equipment. Also during the first phase of the project, the Cleaner Technology Coordination Unit in Ukraine was established as a separate unit under supervision of the Ministries of Environmental Protection and Nuclear Safety and of the Machine-building Industry.

Three demonstration projects will be implemented during the second phase of the project. Company staff will be trained in the operation and maintenance of the new equipment, in the "best operational practices" for existing equipment, and in occupational health and safety. This phase will be finished during the first half of 1999.

The fact that relevant partners participate in marketing the cleaner technology and the business planning concepts in the machine-building industry in Ukraine adds credibility to the argument that these concepts have commercial benefits. The possibility of drawing on their assistance for commercial match-making generates interest in participating in auditing and demonstration activities. Personnel hired and trained during the project will remain attached to it for its entire duration. Experience from other environmental projects has shown that it is difficult to contact

enterprises. It was not easy to involve Ukrainian companies either, but they did eventually show interest and are going to complete the demonstration projects on time (spring 1999).

Another initiative of the World Environmental Centre was carried out between September 1995 and July 1998. Energy conservation/waste minimization demonstration projects were developed on the basis of a USAID/WEC cooperative agreement. The WEC industrial waste minimization programme consisted of three phases:

- Waste Minimization Demonstration Programme;
- Waste Minimization Impact Programme; and
- Waste Minimization introduction throughout industry.

The goal of the Waste Minimization Demonstration Programme is to demonstrate the effectiveness of waste minimization by implementing successful programmes at specific enterprises. For the first phase, WEC selected four enterprises with a large output and a high number of employees, and whose management was open to incorporating new ideas into the production process. Later on six more companies were involved. The main results are summarized in Table 5.3. The tyre manufacturing plant "Dniproshina" in Dnepropetrovsk achieved particularly good results (see Table 5.4.).

One of the results of the cooperation was the establishment of the consulting company "RESOURCES", which works with mining companies and steel mills on different environmental issues, including pollution prevention.

There are some other organizations in Ukraine that aspire to become cleaner production institutions. One of them is Pridneprovje Scientific - Educational and Information Centre for Cleaner Production (PSEIC), a non-governmental organization. PSEIC is an association of enterprises, organizations, creative groups, scientists and specialists trying to make industry and agriculture more environmentally friendly. PSEIC was founded to save the environment from the adverse effects of economic activities in order to protect and sustain nature.

PSEIC wants to "green" industry, i.e. make industries less harmful from an ecological point of view. Its projects deal with technological foundations of environmental protection, and optimization of chemical and metallurgical industries (particularly their equipment) on the basis of systemic - structural analysis. Regarding education, PSEIC is qualified not only to train students, but also to retrain specialists (mainly from industry): tutors, teachers, engineers and other experts in the sphere of ecological management, environmental technology and equipment, design of cleaner production, etc.

The Pridneprovye Ecological Foundation (PEF) is also a non-governmental association with similar aims and membership. It focuses on projects in the Pridneprovsk region to encourage scientific and practical developments in an effort to save and preserve nature and to incorporate ecological education into school curricula. However, the activities of these two NGOs to promote cleaner production are very limited mainly due to the lack of internal and external support and networking.

In 1997, the Parliament adopted the National Dnieper Programme at a cost of US$ 6.58 billion. The Programme sets objectives and deadlines. By the year 2000, discharges of untreated sewage from waste-water treatment plants have to be eliminated, municipal storm water drainage has to be decreased by 30 per cent and agricultural runoff by 20 per cent. The Canadian Government has shown great interest in the Programme and has started several activities that partly relate to cleaner production. For example, the Canadian International Development Research Centre (IDRC) in 1994 started the Environmental Management Development in Ukraine programme, worth US$ 9 million. Two of the programme's main aims are to introduce environmental audit and promote technologies. Food enterprises received grants for environmental audits and for making production processes cleaner. In addition, workshops on cleaner production were organized and corresponding training material was published. A big project to test the effectiveness of using ramial wood chips (cuttings from the tips of tree branches) as a natural and plentiful alternative to chemical fertilizers has been implemented.

The official introduction of environmental audits started in May 1995. The Ministry of Environmental

Table 5.3: World Environmental Centre Programme in Ukraine a/

Plant name	Location	Equipment provided by WEC	Equipment cost *(US$)*	Projects *(Number)*	Annual benefits estimated *(US$)*	Reduced annual use - nat. gas *(m^3/year)*
Chemical plant "Stirol"	Gorlovka b/	Conductivity Meters 920; pH Controller & Analyser	12 300	3	439 000	reduced ammonia losses
Wire & Steel Cable Plant "Silur"	Khartsyzsk b/	Planting Thickness Tester; Plating Rate Monitor	9 500	1	26 000	reduced copper losses
Steel and Iron Works	Yenakievo b/	Process Calorimeter; Process Controller	22 500	1	140 000	1 700 000
Coke Oven and By-products Plant "Markochim"	Mariumpol b/	Oxygen Analyser; Combustion Analyser	21 000	1	40 000	2 730 000 c/ coke oven gas
Metallurgical plant	City of Donetsk	Portable Gas Analyser; Revisions to scheduling; Process Control Systems	29 000	3	1500 000	10 700 000
Chemical Reagents Plant	City of Donetsk	In-situ Oxygen Analyser; Portable Combustion Analyser	11 000	1	45 000	500 000
Chemical Plant "Azot"	Dniprodzierzynsk d/	Combustion Analyser; Conductivity Meter; Steam Traps	30 000	3	500 000	5 600 000
Detergent Plant Dniprobytchim	Dnipropetrovsk	Packed Steam Boiler	54 000	1	23 000	280 000
Pavolograd Chemical Plant	Pavolograd d/	In-situ Oxygen Analyser; Portable Combustion Analyser	17 000	2	40 000	492 000
Tire Plant "Dniproshina"	City of Dnipropetrovsk	In-situ Oxygen Analyser; Steam Traps; Insulation	21 000	2	425 000	5 300 000
		TOTAL	**173 000**	**17**	**3155 000**	**24 572 000 c/**

Source: Energy conservation / Waste minimization demonstration projects.

Notes:

a/ Sponsored by the United States Agency for International Development , USAID.

Table 5.4: Results of the projects at the tyre manufacturing plant "Dniproshina" in Dnipropetrovsk

Project description	Project benefits		
	Equipment provided by WEC	Monetary	Environmental / Energy conservation Reduction in natural gas
	(US$)	*(US$)*	*(m^3/year)*
1 Improvement in efficiency of boiler No.2	In-situ oxygen analyser at cost of **12 000**	**57 000** *Payback period = 2.5 months*	**558 000**
2 Reduction in steam losses at vulcanizing facility	28 steam traps at cost of **4 800**	**52 000** *Payback period = 1.1 month*	**430 000**
3 Reduction in heat losses at vulcanizing facility	Thermal insulation at cost of **6 500**	**14 600** *Payback period = 6 months*	**144 000**

Source: Programme for waste minimisation and energy conservation World Environmental Centre. Annual Report, 1996 - Ecological and economical implementation results.

Protection and Nuclear Safety, together with the IDRC, conducted a training seminar on environmental audit for representatives of agricultural and industrial enterprises and other specialists. The results of this project were compiled and disseminated in two manuals. Recommended by the Ukrainian Ministry of Education, they are widely used in universities, as well as for vocational training of specialists. The Educational and Demonstration Centre of Environmental Management and Audit was organized at the Ukrainian National University of Food Technologies. With the help of IDRC, a seminar on environmental audit for university lecturers was held. The Interregional Centre of Environmental Audit was organized with the patronage of the International Dnieper Fund. The Ministry of Environmental Protection and Nuclear Safety authorizes the Centre to undertake environmental audits of private and governmental companies.

The second stage of the Ukrainian and Canadian Environmental Audit Introduction Project started in 1998 and is scheduled to be completed in 1999. It takes relevant international standards (ISO 14010, 14011, 14012) into consideration.

- Audits are being introduced at the same time as environmentally friendly technologies.
- Zaporizhia region was selected for the development of a model regional strategy. Local authorities and businesses are involved in its implementation.
- Multi-sided (territory, technologies, waste) environmental evaluation methods have been tested in light industries.

All the programmes and projects mentioned above deal directly or indirectly with cleaner production, in terms of both implementation and dissemination of information in industry. In fact, this is only a starting point for a more systematic, more methodological and broader introduction, training and implementation of cleaner production and pollution prevention. According to an evaluation of the authorities, companies and other stakeholders, the USAID / World Environmental Centre's Waste Minimization Programme (implemented) and the Danish Programme for the Machine-building Industry (to be finished at the beginning of 1999) were the most effective and successful.

5.1 Conclusions and recommendations

Since the beginning of the transition, the Ukrainian authorities for environmental policy and management have seemed especially concerned about industrial and environmental safety and the introduction of cleaner technologies in all economic sectors. The signing of the International Cleaner Production Declaration by Ukraine in Seoul in October 1998 confirmed these intentions. This basic attitude is all the more noteworthy, as it is rare in the extreme social and economic conditions that generally accompany the transition process. As a result, Ukraine is among the very few countries in

transition where a growing number of staff is involved in the promotion of environmental safety and cleaner technology.

Nevertheless, many problems remain to be solved. The main general reasons are:

- the legal basis for environmental risk assessment has not yet been introduced;
- the process of drawing-up and introducing legislative documents for the application of cleaner technologies has not been concluded;
- awareness (environmental, economic) about the policy of cleaner technologies is low;
- there are not enough specialists to guide the application of cleaner technologies.

Environmental safety

The legal instruments are incomplete in their regulation of relations and coordination between the actors involved. They also lack effective levers and mechanisms for the attainment of environmental safety. Environmental risk assessment in industry is a potentially powerful instrument. However, its legislative basis is emerging only gradually. It should be based on the draft law on environmental safety. Some demonstration projects are being implemented (environmental risk assessment project at the chemical plant "Azot, Rovne," German support), and standards are being drawn up (enumeration and limit values for hazardous and toxic substances at enterprises) for the application of the environmental risk assessment (ERA) procedures. Their results should be incorporated into the necessary legislative instruments.

Recommendation 5.1:
There is an urgent need to develop a coherent legal system on the issue of environmental safety by drawing up all required regulations and ordinances, and so provide clear-cut task sharing and coordination among the responsible bodies. See also Recommendation 10.2.

Recommendation 5.2:
Ukraine should speed up the adoption of the draft law on high-risk installations based on the EU Seveso II directive and the ECE Convention on Industrial Accidents, and prepare the relevant regulations, ordinances and norms necessary for the implementation of this law.

According to the "Principal Directions" (see Chapter 1), a single national system of emergency prevention and response should be established. The purpose of creating such a unified State system is to systematically control environmentally dangerous facilities and processes, to regulate their safety conditions, to monitor their pollution load, to prevent accidents, disasters and other emergencies, to forecast them, and to minimize their impact.

The first urgent step towards setting-up such a system should be taken to control dangerous substances. However, it would soon have to be followed by other measures. The full-fledged implementation of the system requires in particular:

- a formal network of administrations involved in accident prevention and management at all levels of government;
- a legislative basis for the regulation of technological and environmental safety that would adapt the practices of countries with developed structures to Ukraine's circumstances, including a national classification list of dangerous and toxic substances (e.g. pesticides) and a system of unified control over the circulation of dangerous substances and equipment;
- a scientific and methodological (possibly automated) basis for identifying environmentally dangerous activities, and forecasting and assessing emergency situations;
- a regulatory and methodological basis for an accident prevention and response system, including organizational and technological schemes and mechanisms for the control of accidents and emergencies;
- an integrated State system for accident prevention and response that can become part of an international system of notification and support in the event of an accident; and
- mandatory environmental insurance for environmentally dangerous production.

Recommendation 5.3:
The Ministry of Environmental Protection and Nuclear Safety should effectively coordinate the use, transport and storage of hazardous substances, taking into account the relevant EU practices. The setting-up of a centre for chemical safety should be considered in this connection. This measure should be seen as a first step towards the urgent establishment of a comprehensive national emergency prevention and response system. See also Recommendation 6.6.

Cleaner production

Cleaner production is in an embryonic stage in Ukraine. The Basic Capacity Level (i.e. the minimum level needed for cleaner production concepts and principles to be disseminated spontaneously throughout industry and society) is unlikely to be reached in the near future. The achievements made in internationally funded or co-funded projects and in the development of appropriate legislation are negligible compared to the needs. Nevertheless, these experiences show in which direction a reduction in the pollution potential of existing production processes should be sought. There is an urgent need to integrate these scattered experiences into a coherent programme.

It is worth pointing out that there is a project in the town of Kharkov to create a clean technology centre. The pilot project is funded by the Netherlands, Germany and USAID. If it is successful, experiences of this kind should be expanded to other oblasts where industrial activities are intensive.

Environmental policy measures are required as incentives for cleaner production. The range of policy instruments is described in various sources - such as the OECD "Policies to Promote Technologies for Cleaner Products: Guide for Government Self-Assessment" - and Ukraine needs to apply the mix of policies and instruments that is best adapted to its circumstances, facilitating a greater use of integrated, preventive environmental strategies.

Effective enforcement is also crucial for cleaner production in enterprises. Permitting and other mechanisms should emphasize the need to improve environmental performance continuously, rather than only at particular points in time. Promoting reporting on pollution and waste streams in ongoing production processes could be a good starting point for the development of preventive environmental management.

Recommendation 5.4:
A national cleaner production strategy, including a statement of programmatic policy objectives, management measures, information means, education and training programmes, other provisions for capacity building, institutional arrangements and funding mechanisms for the application of cleaner production, should be developed and adopted. The strategy should include a time schedule for implementation of the measures and should favour integrated approaches to cleaner production. Full cooperation with other ministries as well as industrial representatives should be ensured in the development of the strategy. The administration of cleaner production policies – including that of technological transfers – should be freed of all unnecessary bureaucratic complications.

As recommended by OECD, the short-term objective of the cleaner production programme should be to ensure that Ukraine achieves the Basic Capacity Level of sustainable cleaner production by 2003. The implementation of the programme should begin with low-cost measures. There is a huge potential for good housekeeping improvements in basically all Ukrainian companies. These types of measures demand very small and even negligible investments, but, if and when implemented on a large scale, have the potential to lead to very significant improvements in production efficiency because they require smaller amounts of raw materials and energy. These measures may also lead to substantial reductions in emissions to air and water and in waste. Thus these measures can be expected to yield economic benefits for the company that applies them.

Recommendation 5.5:
Industry should be encouraged to recycle and reuse materials and resources, including water resources, which are currently used in an unsustainable way. *See also Recommendation 8.6.*

The full realization of the potential for cleaner production of low-cost, industrial housekeeping measures requires a series of supporting measures. The most appropriate instrument to this end is clearly environmental management, be it of the ISO14000 series or the EMAS type. As experience in other countries in transition shows, environmental management and audit very rapidly develop into a condition for success in international trade. The introduction of this instrument requires training and education - including the development of easily accessible training and education material - for company managers, capacity building in environmental audits, as well as demonstration and information on projects undertaken in each branch of industry, including funding. This strategy should first concentrate on initiating education and training in cleaner production methods, and on enabling the dissemination of information on demonstration projects. The necessary legislation concerning the formal introduction of environmental audit and management systems

should be attempted only when industrial managers appear ready to capitalize on the economic benefits.

Recommendation 5.6:
The Ministry of Environmental Production and Nuclear Safety should consider, at least for a limited period of time, supporting the provision of information on the potential for economic improvements through the introduction of cleaner production in Ukrainian enterprises. Likewise, education and training in this area should be promoted by requesting universities, business schools and other relevant educational establishments to integrate cleaner production and pollution prevention principles into their curricula. If there is not enough national funding for these activities, they would merit priority consideration in any international assistance programme.

In addition to training, information and policy measures, institutions are needed to promote the concepts and principles of cleaner production. There is an urgent need to establish a few cleaner production centres. They can play a key role in supporting cleaner production and environmental management in enterprises. Where they exist, they help involving stakeholders in cleaner production programmes, particularly by providing some of the required information, education and training functions particularly for small and medium-sized enterprises (SMEs). They could also play a significant role in the identification and preparation of cleaner production investment projects. Furthermore, cleaner production centres should specialize in developing realistic business plans, including assessments of cleaner production possibilities - a long-term goal for all large and medium-sized enterprises in the most polluting sectors of industry - specifying the services which they could provide to clients, including enterprises, Government, financial institutions and donors. Finally, they could also help organizing environmental audits, once the demand for such services takes off. The successful experience of the pilot project handled in cooperation with Sweden is likely to stimulate external financing.

Recommendation 5.7:
Centres for cleaner production should be established in each of the industrialized regions of the country. The centres should participate in the promotion of cleaner production concepts and principles in all possible ways.

Once no-cost and low-cost cleaner production measures have been applied, major environmental gains will come through investments. Generally, enterprises should use their own resources, including credit, to finance such investments. Since their capacity to do so is constrained for many reasons, a funding framework needs to be established to ensure a minimum of investments into cleaner production projects. External financing may have to play a role in complementing domestic financing. In this case, past experience proves that it is necessary to realistically describe the projects' objectives. In addition, the Ukrainian partners in such projects should accept rather strict monitoring of the financial flows.

A key issue in financing cleaner production investments is the development of project preparation capacity. Governments and donors should support programmes to build this capacity, involving the cleaner production centres referred to above, or other appropriate institutions with trained staff to help identify and prepare financially viable projects. If adequate conditions are met, the Government should consider how public funds could support cleaner production investments in an interim period. One approach could involve creating a specific financing mechanism for such projects within a national environmental fund or establishing revolving funds that are tailored to the project's payback period, and with interest rates which may be below commercial rates.

Recommendation 5.8:
The funding of cleaner production investments should initially be given special consideration. If necessary, and for a limited time, fiscal measures should be taken to complement other sources of funding so as to promote such investments.

Introducing clean technology in this period of hardship would certainly be eased if foreign

investors were ready to bring funds and know-how. To attract them, many obstacles to doing business in Ukraine should be lifted. In particular the legal framework regarding the responsibility for past environmental damage should be clarified.

Recommendation 5.9:
Instruments for evaluating the environmental damage caused before privatization should be identified and introduced into the legislation; responsibility and liability sharing between the former and future owners should be clearly stated.

Chapter 6

WASTE MANAGEMENT

6.1 Current waste flows

Overall waste generation and accumulation

Ukraine generates an estimated 700 to 1 720 million tonnes of wastes per year. By 1997, the total amount of waste on Ukraine's territory exceeded 25 billion tonnes, which corresponds to approximately 40 000 tonnes per square kilometre. Only a fraction of this waste, less than 10-12 per cent, is recycled; the rest is disposed of at surface dumps or accumulated in sludge ponds, refuse heaps, ash storage sites, etc. The total surface of these sites has reached 160 000 ha. On the whole, Ukraine is one of the biggest waste generators and accumulators. The total amount of accumulated waste has risen over the years, as shown in Table 6.1. This trend was visible in 1997 too.

Table 6.1: Accumulation of waste, 1980-1995

Tonne/capita

	1980	1990	1995
Accumulated waste	240	318	400

Source: Ukrainian Environment: Facts and Figures (1996).

The amount of household waste accumulated is equivalent to less than 3 per cent of the amount of industrial waste. For OECD countries, this figure ranges from 19 per cent (Japan) to 26 per cent (Germany). The Ukrainian source interprets this as evidence that natural resources are used inefficiently in Ukraine. These numbers must be interpreted with caution, as some doubt can be cast on them.

Industrial and similar waste

The major industrial waste generators are mining and quarrying, the chemical and metallurgical industries, the oil industry, energy industries, construction materials, and pulp and paper. Approximately 70 per cent of Ukraine's gross product comes from the metallurgical, chemical and oil industries, which are the largest waste generators. The amount of industrial and especially mining waste is high, presumably because the industrial structure is very outdated, leading to large quantities of production waste as well as inadequate products, which end up as waste. Notwithstanding an estimated overall 1.5- to 2-fold production decrease in the major industrial waste generators in 1994 - 1995, their toxic waste generation has decreased only by 25-30 per cent. Thus the fall in industrial and other production during the 1991-1997 period did not result in a comparable overall drop in general waste generation. The most likely explanation is that the economic decline was accompanied by a further deterioration of machinery and production processes.

Hazardous (toxic) waste

For relevant details on radioactive and hazardous mining wastes see Chapters 4 and 10. By 1998, the total amount of accumulated hazardous (toxic) waste was estimated to have exceeded 5 billion tonnes, which corresponds to approximately 8,000 tonnes per square kilometre. This includes nearly 50 million tonnes of wastes of the highest toxicity (1st to 3rd degrees according to the -- still valid -- Soviet classification). Table 6.2 gives total amounts of accumulated toxic wastes at "organized" (official) storage sites in Ukraine in the period from 1994 to 1998.

A considerable increase in waste accumulation, especially for the most toxic classes, may be due to the following causes:

- Progressing inventorying and "passportization" (earmarking/registration) of toxic waste in many oblasts;
- A change in the existing waste classification. As a result, much waste that used to be considered less toxic or not toxic at all is now regarded as (more) toxic.

Wastes contaminated with heavy metal compounds (chromium, lead, nickel, cadmium and mercury) dominate the hazardous wastes in all hazard classes. They stem mainly from heavy and light

Table 6.2. Accumulated total amounts of toxic wastes, 1994-1998

Million tonnes

	1994	1995	1996	1997	1998
Total	**4 045.79**	**4 188.83**	**4 062.63**	**4 158.63**	**4 210.54**
Hazard class I	0.19	0.03	0.03	0.03	0.04
Hazard class II	13.30	17.30	42.10	1.40	1.40
Hazard class III	27.40	27.80	28.50	32.60	32.90
Hazard class IV	4 004.90	4 143.70	3 992.00	4 124.60	4 176.20

Source: Statistical Yearbook on Environmental Protection and Use of Natural Resource, 1998, State Statistics Committee.

metal industries and the chemical industry. Electroplating waste makes up 90 per cent of the generation of 1st degree toxic waste. Of the total amounts of toxic waste generated, less than 30 per cent undergo recycling, whereas only 1 per cent of the hazardous waste is adequately treated.

Obsolete pesticides and other toxic agricultural chemicals are a special category of highly toxic waste. The total amount of these wastes is estimated to range between 10 700 and 20 000 tonnes. About half is of unknown character or quality. There are 109 centralized storage sites, which are under local government administration, and approximately 4 000 storage sites at agricultural enterprises. Many of the storage sites pose potential environmental risks, because of the high toxicity of the materials present and their open or poorly contained storage. The ownership of pesticides has changed several times. Some pesticides have been mixed, so chemical reactions may have occurred, resulting in the formation of new substances with unknown characteristics. Chemical identification is one of the priorities to eliminate this problem.

Household (municipal) waste

According to a rough estimate, approximately 40 million m^3 of waste is being accumulated annually in cities and villages. This corresponds to about 0.8 m^3 per capita. However, there is no reliable estimate of municipal solid waste generation. It is taken to 700 city landfills, 80 per cent of which do not take precautionary measures for the protection of underground water and ambient air. There are also 4 waste incinerators, whose technological equipment does not meet modern environmental standards. The largest landfills are located in the following oblasts: Dnepropetrovsk (140 ha), Donetsk (330 ha), Odessa (195 ha), Zaporizh'ya (153 ha).

6.2 Policy, objectives and programmes

Legal framework

The regulations and standards of the former Soviet Union remained in force at the time of independence and are gradually replaced or amended by new laws and regulations. In addition, some new legislative norms that are relevant to waste management have been introduced. The major problem with both policies and legal instruments is their implementation. Even those old legal instruments that are still valid are not fully and properly implemented, and there is a wide discrepancy between policy intentions and ambitions on the one hand, and the realistic possibilities for implementing them on the other.

The most significant step in the development of a new legal framework for waste management was the adoption of the new Law on Wastes (5 March 1998). The main provisions of this Law relate to the reduction of waste generation and accumulation, the stimulation of waste recycling, and environmentally safe waste disposal. It addresses principles and general aims, as well as generic approaches to the issues of waste management. The main issues addressed include:

- Determining the responsibilities of the waste generators;
- Establishing the authority of State organs and the functions of the managing bodies;
- Determining the specially authorized waste management bodies and their functions.

The Law emphasizes the need to define ownership of waste, and places the responsibility for adequate management of waste on its owner (the enterprise).

Most provisions require the formulation of regulatory, technical or financial instruments. The full application of the Law thus requires the drawing-up and implementation of more than 20 subsidiary legal acts, in addition to the provision of budgetary and other resources. Some of those instruments have been promulgated. Progress in their implementation cannot yet be assessed. They include:

- Rules on the registration of waste-disposal sites (Cabinet of Ministers Decree No. 1216, 3 August 1998)
- Rules for defining and registering the categories of ownerless wastes (Cabinet of Ministers Decree No. 1217, 3 August 1998)
- Rules on the drawing-up, approval and revision of limits for waste-generating and disposal sites (Cabinet of Ministers Decree No. 1218, 3 August 1998)
- Maintenance of registers of facilities where waste is generated, treated or used (Cabinet of Ministers Decree No. 1360, 31 August 1998)

In addition, there are plans to develop and adopt a series of other Decrees on hazardous waste, packaging materials and solid domestic waste. A plan is under preparation to identify the complete set of laws required for waste management and their promulgation dates. Ukraine has ratified the Basel Convention (see Chapter 3).

Other legal instruments relevant to waste management include:

- Law on Environmental Protection
- Law on ensuring sanitary and epidemiological public welfare
- Mineral Resources Code
- Law on Pesticides and Agricultural Chemicals
- Law on Radioactive Waste
- List of toxic substances including toxic industrial wastes, biotechnological products and other biological agents, the production, storage, use, burial and destruction of which require a permit
- Instruction on processing applications for permits for the production, storage, transport, use, burial or destruction of toxic materials including toxic industrial wastes, biotechnological products and other biological agents.

Evidently, some of these instruments have begun to be applied only recently. For example, in 1997, 300 physical or legal persons were registered as users of dangerous chemicals. During this period about 200 permits were given for the transport of dangerous chemicals. It is not known how many of these permits concern toxic wastes.

Institutional framework

The new Law on Wastes is the first attempt at organizing waste management in a comprehensive manner. Prior to its existence, there were no structured institutional responsibilities. The practices of waste management at the various levels of government were largely unknown. An overview of the institutional framework for waste management in Ukraine therefore has to start from the provisions of the new Law, taking into account that it has only just come into force.

The institutional framework and the responsibilities of the various players are primarily described in chapter IV of the Law on Wastes ("Competence of bodies of executive power and bodies of local self-government in waste management"). Surprisingly, the Cabinet of Ministers has wide-ranging responsibilities, not only as coordinator, but also in technical matters, such as: approving procedures for granting permits and establishing conditions for waste collection; approving lists of hazardous wastes; defining the procedures for recording the generation, use and disposal of wastes; organizing the training of specialists in waste management.

At the central government level, the Ministry of Environmental Protection and Nuclear Safety and the State Sanitary-Epidemiological Service continue to play an executive role. On behalf of the State, the Ministry verifies compliance with environmental safety requirements. For instance, it proposes waste charges and national waste management regulations to the Cabinet of Ministers. It issues permits for waste management operations and transboundary waste movements. It approves draft limits on waste generation, and the siting of waste management facilities. It also supervises the compilation and maintenance of registers of waste-generating facilities and waste disposal sites.

The State Sanitary-Epidemiological Service verifies

compliance with State sanitary regulations, rules and hygiene standards for waste-related activities. This includes specifying priority measures for protecting human health.

The local State authorities develop and introduce regional and local waste management programmes, as parts of national programmes. They coordinate and promote the development of business activities in waste management, and control the activities of waste management facilities. They also create and maintain records, and set up registers for the generation, treatment, use and disposal of wastes.

Local bodies of self-government are responsible for: collecting and disposing of domestic wastes; resolving issues dealing with the siting of waste management facilities; establishing waste disposal charges in accordance with legislation; supervising the efficient use and safe waste management; eliminating unauthorized and uncontrolled waste dumps.

The Law on Wastes broadly follows the distribution of responsibilities that has existed until now. However, subsidiary legal acts, good administrative procedures and sufficient budgetary means will be needed to ensure that the various authorities can live up to their responsibilities.

Strategies and policies

The "Principal Directions of State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety" (approved by the Verkhovna Rada on 5 March 1998) is the current environmental policy document. It spells out policy aims and tasks. Its goals are resource-related, environment-related, or methodological and organizational. Resource-related goals include the valuation of wastes, the assessment of the technical processing capability and of the ability to replace primary by secondary raw materials, the economic justification of waste use, and an actual scheme for the use of the resources. Its environmental management goals cover the minimization of waste through the introduction of cleaner technologies, the reduction of the toxicity of wastes, and the regeneration and recultivation of polluted territories. Finally, its methodological and organizational goals include the development of a programme including administrative, legal, organizational, and environmental measures, as well as the necessary associated scientific, information and analytical services. The following tasks are derived from the goals (see Table 6.3).

The following main measures are defined on the basis of these tasks:

- increase the volume of metallurgical slag processing, which should result in the processing of the entire volume of produced slag within 5-6 years
- use metal-containing waste from metallurgy enterprises, in the cement industry
- expand the use of ash and ash slag from thermal power plants
- double the production of ceramic tiles from coal-processing wastes, and add them to the furnace charge at the operating brick factories, over a period of 5-6 years
- expand the production of gypsum and building materials of phosphogypsum, organize and prepare the use of phosphogypsum for the improvement of saline soils

- increase the use of limestone waste for the production of limestone powder and cement, and ensure the use of limestone and sulphur wastes for lime treatment of acid soils in agriculture
- fully process wood wastes into chips for technological purposes, and turn cuttings and sawdust into briquettes for use as fuel or hydrolytic yeast production.

The list of priorities and corresponding tasks is ambitious and optimistic. The document does not set any deadlines, allocate responsibilities or identify the means needed to achieve such an ambitious programme. There is no reference to the economic and administrative circumstances prevailing in Ukraine, and no attempt to explain how the policy objectives fit into these circumstances. The main measures, containing sometimes quantitative goals and deadlines, appear unrealistic. Moreover, the measures are formulated purely in terms of technology, and not in terms of prospective markets, investment needs or necessary institutional reforms.

The aim with regard to the management of municipal solid wastes is to collect, transport, and treat waste with industrial techniques, and to recycle its valuable components. The principal tasks necessary to achieve this objective envisage:

Table 6.3: Principal policy tasks concerning industrial waste

Aspect/goal	Task
Resource -related	- determine volumes, production rates, location of wastes - determine composition and properties of wastes - analyse conditions and regulations for primary and secondary raw material use; raw material markets and feasibility of waste use - justification of priorities for secondary resource use - classification of wastes by resource indicators - develop new and improve existing technologies and production schemes for waste use - provide selective storage of wastes, and conserve resource-valuable wastes - develop specific recommendations for waste use and for integrated raw material processing
Environment -related	- estimate toxicity and investigate impact of waste on ecosystems - classify wastes according to their ecological hazard - develop requirements for waste conservation and storage depending on toxicity - provide justification of economic measures for safe waste disposal, and the reduction of toxic content and volume - elaborate technologies for safe decommissioning of toxic waste - create regional safe repositories for toxic waste
Environment and resource -related	- certification (inventory) of wastes and technologies - comprehensive environmental and economic assessment of the efficiency and prioritization of measures for waste use and treatment
Methodology and organization	- develop pricing methods and classification of the resource value of waste - create information, and resource and technology databases - expand information and analytical capabilities for support in decision-making on waste-related issues - adopt and implement the Law on Wastes, as well as economic, administrative and other incentives for the use and safe decommissioning of wastes

Source: Principal Directions of State policy of Ukraine in environmental protection, use of natural resources, and ensuring ecological safety, 1998.

- Implementation of new methods of household waste collection, permitting selective recovery of valuable components.
- Drawing-up of industrial treatment programmes for household waste.

Programmes and projects

Draft State programme on toxic waste management. This programme was recently developed and submitted to the Government for approval. It covers the period 1998-2005. Its main goals are (i) to improve the level of environmental safety at the oblast level by decreasing the generation and accumulation of toxic waste, and (ii) to treat toxic waste, including obsolete pesticides. One of the first measures is to identify all repositories (their number being estimated at 2 000) of toxic waste and its composition. Another important step will be to establish a network of small enterprises, at oblast level, to collect and treat the waste. In the meantime, the National Centre on Hazardous Waste Management has been established following a Government decision. It seems that the success of the programme will hinge on the following two factors: availability of the funds for the planned waste management companies, and raising public awareness and information. Parliament is expected to consider the programme in the first half of 1999. In the meantime, the first draft of the law on hazardous wastes has been drawn up. The Cabinet of Ministers of Ukraine has considered the draft and recommended that it should be included in the basic Law on Wastes as a special chapter.

In relation to this programme, a Danish-Ukrainian cooperation project to mitigate the risks related to accumulated obsolete pesticides has been under preparation since 1998. The project will last 30

months. The project is intended to (i) prepare a national plan for the elimination of risks related to obsolete pesticides; (ii) demonstrate how obsolete pesticides can be handled, transported, provisionally stored and disposed of in existing facilities; and (iii) prepare project documents for high-priority investments and make contact with potential investors.

Programme on the Use of Wastes of Production and Consumption for the Period till the year 2005. This programme (decree of the Cabinet of Ministers, No 668, June 1997) is intended to develop and promote modern technologies, facilities and equipment and also create capacities for the use of waste, taking into account priority economic, environmental and social issues. The programme will also help businesses to participate in solving the problems of waste recycling in a market economy.

6.3 Management practices, instruments and enforcement

Solid waste management, including municipal solid waste management, has not caught up with practices in OECD and EU countries. Few Ukrainian oblasts have specialized arrangements for the centralized storage, treatment and use of hazardous wastes. The lack of resources to treat them means they accumulate in large amounts on industrial premises, or are illegally disposed of, frequently in unreliable storage sites or even discharged into the sewage system.

Municipal solid wastes are generally managed in a scattered way, with little reuse. Recovery of usable materials is more or less limited to metal and glass. This may raise a little money for some cities and towns, but it does not make a dent in the volumes of waste for landfilling or incineration.

Waste storage

There are about 2 760 waste sites, mostly sludge accumulating ponds, ash-storage sites, and landfills of municipal solid waste and mixed waste. Household waste is landfilled at 656 major sites, covering a total area of 2 600 ha. There are 109 sites for the centralized storage of obsolete pesticides and toxic agricultural chemicals and about 4 000 storage sites for such wastes at agricultural enterprises.

The industrial and domestic waste disposal sites frequently fail to meet environmental safety requirements. Practically all sites were put into operation 10 to 30 years ago. The majority of them are filled to 90 per cent. Some waste accumulation sites that were constructed without proper protection measures have become an environmental threat on a regional scale.

Specialized (dedicated) waste storage sites for waste disposal operate only in some regions of Ukraine. The majority of sites (95 per cent) take in both municipal solid waste and industrial wastes. There is barely any separation or pre-selection of wastes. Practically none of the landfills has special water protection facilities like protective dams and walls, channels or drainage piping. One of the biggest landfills in Ukraine is located near Kyiv, serving about 3 million inhabitants of the capital and some other neighbouring territories of Kyiv oblast. This landfill is managed by the Kyiv State

Box 6.1: The new Dnepropetrovsk landfill

The old landfill of Dnepropetrovsk is being plagued by similar problems as most other landfills in Ukraine. However, a recently built landfill incorporates environmental measures that can compete with west European standards. These include: good groundwater protection using both insulating clay and 2 mm HDPE bottom film, leachate inspection holes, provisions for future biogas exploitation (the landfill had been operating only a few months at the time of the site visit), weekly waste covering by clay and soil to keep animals away.

The construction of the landfill was financed by private investors (perhaps the first case in Ukraine). The investment will pay for itself partly through the recovery of metals, glass, paper and plastics. Recovery is organized in a rather rough way at the landfill, and it is not clear whether occupational safety standards are met. The recovered metals are sold, but for other recovered materials complicated barter mechanisms are standard practice. For example: glass goes to a vodka factory, where it will be exchanged against vodka, which is then marketed.

The obvious success of the new Dnepropetrovsk landfill management is caused by a number of factors. Foreign investment and creative management have been crucial. Some other factors are (i) the creation of a payback mechanism based on the recycling of materials, which requires a separation process and barter trade, (ii) the development of successful arrangements and processes for the collection and transport of wastes, (iii) the adoption of realistic prices for waste treatment and disposal that can be paid by the generators of waste, and (iv) the design of other imaginative income mechanisms permitting full recovery of costs.

enterprise of sanitary engineering. It is protected only by a 2 mm HDPE plastic film at the bottom; there is no recovery of biogas, and there are considerable leachate drainage and purification problems, as each day about 80 cubic metres of leachate percolates through the HDPE cover. There is no daily covering of the waste surface, and there is no control of anaerobic effects. A new landfill has recently been built in Dnepropetrovsk. It provides a positive example (see Box 6.1).

Waste incineration

Four waste incinerators were built during the second half of the 1980s, in Kyiv, Dnepropetrovsk, Kharkov and Sevastopol, to treat municipal (industrial and household) wastes. The plants recover only partially the thermal energy for local use. There is no generation of electricity. The capacities of the plants fall short of local requirements. In Kyiv, capacity is about 160 tonnes per day, whereas municipal waste generation is about 2 500 tonnes per day. The Dnepropetrovsk incinerator burns about 300 tonnes per day, compared to a daily generation of 770 tonnes. The share of incinerated waste in Kyiv and Dnepropetrovsk reaches 14 per cent of all municipal waste, which compares rather favourably with some developed European countries.

The existing incinerators (at least those in Kyiv and Dnepropetrovsk) appear to have some environmental drawbacks:

- the incineration plants do not recover energy in the best feasible way
- the operating temperature inside the plant seems to be in the range of 500°C to 600°C, i.e. at least 250°C lower than required to reduce the possible effects of the most dangerous air pollutants and the production of dioxins
- low combustion temperature implies also incomplete incineration, leaving part of the waste in the ashes and other combustion residues
- exhaust gases are unnecessarily polluting not only because of the low combustion temperature, but also because the old technology of humid filtering is used, leaving for instance nitrogen components visually perceptible
- the chimneys are too low to diffuse pollutants as required
- the by-products of combustion are disposed of in unprotected landfills.

Recycling

It is estimated that more than half the industrial waste generated annually is recyclable. At present, only 10-12 per cent is recycled. The recycled amounts of industrial and consumer wastes are decreasing. It is estimated that the recycling of major types of waste dropped in 1993 to 61 per cent and in 1994 to 41 per cent of the amount recycled in 1990. In the period 1992-1996, waste recycling dropped 20 per cent a year on average, exceeding the reduction in the total volume of industrial production.

Economic instruments

According to existing regulations, the producers of waste have to pay fees, which depend on the type of waste, and whether they are within or above the granted limit (see Chapter 2). The fees must be paid until final treatment, removal (safe decommissioning) or reuse has taken place. The fees are shown in Table 6.4.

Table 6.4: Waste fees

Toxicity class	Fee (hryvnia/ tonne/year)
I	53
II	2
III	0.50
IV	0.20

The municipalities are considered as enterprises, but for many years they did not have to pay. Since 1996, they have been expected to pay, however on average only 6 hryvnias per inhabitant per year, which falls far short of the cost of household waste management.

For an amount above the granted limit, the fee is multiplied by 5. It is, moreover, multiplied by 3 for disposal sites within 3 km from human settlements, and multiplied again by 10 if the disposal site is not properly installed. The limits are set each year by the regional department of environmental safety on the basis of proposals by the enterprise and in view of standard documents for certain production processes. The system is based on three regulations of the norms for payment, the norms for coefficients and the norms for the generation of waste.

The setting of limits appears to be arbitrary to some extent. The normative basis is not unified (i.e. it is scattered over several documents, and the

underlying goals and principles are not elaborated), and enforcement is not very transparent. Only 10 per cent or less of fees and charges are actually estimated to be paid up. Theoretically, the fees are split among the local government environmental funds (20 per cent), the environmental funds at the oblast level (50 per cent) and the State environmental fund established in the national budget (30 per cent). The distribution mechanism probably causes additional losses. Changes are expected to take place soon, but decisions still need to be taken by the Cabinet of Ministers.

Enforcement

Enforcement is impeded for several reasons. Firstly, the legal instruments relevant to waste management in Ukraine do not form a unified body that could be used in a transparent way in practice. This will most likely remain for a rather long period, i.e. as long as the subsidiary legal acts are not drawn up, simplified and matched to the economic reality. Secondly, there are certain ambiguities with respect to the practical responsibilities of different authorities for coordinated enforcement measures. Thirdly, there are also contradictions between various pieces of legislation. For example, the Law on Taxation does not allow tax relief for environmental investment, whereas the Law on Environmental Protection and the Law on Wastes do. Such contradictions should be resolved if the economic incentives are to be applied to minimize waste and improve waste management. Fourthly, the system of fees and fines for waste generation and storage does not function as intended. It is true that the economic situation makes it difficult to enforce the payment of legally prescribed fees for waste generation. But without proper internal control and audit mechanisms, such a system opens the door to irregularities and reduces the credibility of environmental legislation as a whole.

To prevent the uncontrolled import of hazardous waste and toxic compounds, the Cabinet of Ministers in 1994 issued Decree No. 117 on measures to control the import of waste (secondary raw materials) and its transit via Ukrainian territory. It was later amended by the Decree of the Cabinet of Ministers on the Control and regulation of transboundary movements of waste and its use or disposal. The decrees were developed in accordance with international practice in the transboundary transport of waste and within the context of major documents and principles of the Basel Convention. Decree No. 117 came into force on 1 April 1994 simultaneously with the Law on additions and changes to the Criminal Code and Criminal Judicial Code of Ukraine, No. 4043-XII, 25 February 1994. The latter makes the illegal import of waste and secondary raw materials a crime. It carries a maximum sentence of three years' imprisonment for the unauthorized import of hazardous waste. Since the decree came into force, there have allegedly been no cases of illegal waste import into Ukraine, at least the bodies of the Ministry for Environmental Protection and Nuclear Safety have not registered any such cases. No details are given about the organization or the efficiency of the enforcement of these decrees.

6.4 Conclusions and recommendations

Successful waste management requires several bases. For instance, there is a need for an internally consistent and complete legal basis for action at all levels of management. Adequate action programmes are also required to achieve goals, as is a system of non-overlapping responsible institutions. Moreover, awareness of the difficulties of waste management needs to be raised among the public at large and the generators of waste. Finally, there is a need for functioning waste collection, treatment and disposal installations. In Ukraine today, this last factor presupposes the availability of substantial funds for research and development, as well as for the building of many new facilities and the modernization of existing ones.

Ukraine still has a long way to go before it reaches these goals. The new Law on Wastes is clearly a step in the right direction. Ukraine's intention to complement it with the necessary regulations and other legal instruments as a matter of urgency is to be welcomed, as is the plan to clarify what further legal instruments are still required to modernize waste management and when. A major objective in this endeavour will be to arrive at an internally consistent, that is, non-duplicating and non-contradictory, system of all legal instruments required – i.e. texts that include the necessary bases for determining responsibilities and mandates, as well as all instruments normally needed for waste management in market economies. Attention will also have to be paid to avoiding redundancies in legal instruments – possibly leading to the consolidation of existing instruments.

Recommendation 6.1:
The current establishment of a modern legal basis for waste management should aim at internal

consistency and completeness with regard to management tasks and instruments, but avoid redundancies.

The renovation of the waste management system cannot succeed, unless it is accepted, supported and, eventually, financed by the public in general, as well as by waste generators. Improvements in these two regards appear to be necessary and possible. They will necessarily have to be based on the association of all partners in waste management to the development of the definition of goals for waste management, treatment and disposal practices, and on the establishment of sound cooperation. In this framework, waste generators and NGOs should be consulted to the maximum extent about the current legislative efforts. It would also be helpful to launch education campaigns at local, regional and national level to raise awareness about recycling and reuse of waste, as well as about the possibilities for minimizing the generation of problematic waste in particular (see also Recommendation 2.3).

Recommendation 6.2:
Industrial generators of waste and NGOs should be associated, on a consultative basis or through pilot projects, with the ongoing development of the legal framework for waste management, as well as with all future activities. Campaigns should be organized to raise public awareness about waste minimization and waste recycling.

Satisfactory waste management depends also on the quality of the institutional arrangements made. At present, responsibilities and mandates at different levels of administration require clarification with respect to enforcement, in particular for the management of hazardous waste. Three considerations appear to be of special importance for the future shape of the institutional framework for waste management. The first is that the local and regional administrations in fact receive the mandate for taking those decisions that are best taken at their level. This leads to the second consideration, namely that these administrations have the substantive competence to meet their responsibility. This might require the training of staff. The third consideration relates to budgetary provisions. These provisions need to be proportional to the responsibilities of the different levels of administration. Public revenues from the generation, collection, transport, treatment and disposal of wastes need to be shared fairly between the budgets of the administrations involved in their management, on the basis of the costs incurred. It is even more important to establish and ensure an efficient, transparent and credible system of enforcement.

Recommendation 6.3:
The clear definition of administrative responsibilities and efficient coordination between different institutions involved in waste management should be seen as a high priority. In the interest of law enforcement, duplication of mandates has to be avoided. Each institution involved should obtain satisfactory budgetary authority for carrying out its mandate. Internal control mechanisms and external audits are needed to ensure an efficient, transparent and credible system of enforcement.

Funds are particularly crucial for ensuring the creation of much needed waste separation, storage, treatment and disposal facilities. Given the country's current economic crisis, imaginative solutions will have to be found, and the new landfill in Dnepropetrovsk should be looked at with a view to assessing whether some or all of the solutions found there can be generally applied. A second possible approach consists in increasing prices for waste management services immediately to the highest socially acceptable levels, and to increase them in the future as the general economic situation improves. In both regards, pilot projects might help to gain experience.

A third possible approach consists in using systematically available options for foreign assistance. The following small/medium pilot projects might be eligible for international funding:

- biogas exploitation from the Kyiv landfill to produce both electricity for the grid and thermal energy, to be used locally
- a biogas treatment plant to use organic and agricultural waste and sludge from waste-water treatment plants
- adding equipment for the recovery of energy to waste incineration plants.

Further funding mechanisms could perhaps be found from international legal instruments (like the provisions of the Kyoto Protocol for Joint Implementation or the Clean Development Mechanism), as well as from a more targeted use of the environmental funds existing in the country.

Recommendation 6.4:
A comprehensive analysis should be undertaken of all realistic funding possibilities for the purposes of creating the waste management facilities required

in the country. A distinction between short- and long-term possibilities seems appropriate. The results of the analysis should be applied.

The priorities with regard to the renovation and building of technical waste management facilities seem to be in the areas of separation or pre-treatment of waste (improving the potential for recycling and reuse), recovery of (electric) energy from incineration, increase in the combustion temperature in incinerators and improvement of cleaning processes of their exhaust gases, as well as the protection of groundwater from disposal site leaching and the construction of new disposal sites. Furthermore, provisions should also be made for research, development and demonstration of domestically developed waste recovery and treatment processes.

Recommendation 6.5:
The establishment of a plan of priority actions to improve waste recovery and treatment operations from an environmental point of view should be considered urgent.

A (known) problem of great potential risk is the continuing storage of obsolete pesticides and other agro-chemicals. The ongoing efforts to determine their chemical characteristics are a precondition for their acceptable storage preceding their environmentally sound destruction. All efforts should be made to find the funds necessary to solve this specific problem, be they from national or international sources.

Recommendation 6.6:
The obsolete pesticides should be analysed for their chemical characteristics and the associated human health and environmental risks, stored in an acceptable manner to reduce these risks and finally destroyed as soon as possible. See also Recommendation 5.3.

Chapter 7

AIR MANAGEMENT

7.1 State and determinants of air pollution

Emission trends

Table 7.1: Trends in emissions of selected pollutants, 1991, 1997-1998

1 000 t

		1991	1997	1998
Sulphur dioxide (SO_2)	**S**	2 538.0	1 136.4	1 023.0
	M	-	-	-
	T	2 538.0	1 136.4	1 023.0
Nitrogen oxides (NO_x)	**S**	709.3	370.5	332.9
	M	280.5	85.3	111.6
	T	989.8	455.8	444.5
Non-methane volatile orgnic compunds, incl. hydrocarbons ($NMVOC_s$ incl. H_nC_n)	**S**	508.7	461.8	427.4
	M	793.7	203.3	-
	T	1 302.4	665.1	427.4
Carbon monoxide (CO)	**S**	2 940.9	1 366.1	1 278.9
	M	4 466.3	1 144.4	1 529.6
	T	7 407.2	2 510.5	2 808.5
Particulate matter (PM)	**S**	1 886.7	785.9	749.1
	M	-	-	-
	T	1 886.7	785.9	749.1
Other	**S**	-	411.1	345.0
	M	-	-	-
	T	-	-	-
Total 5 classic pollutants	**S**	**8 583.6**	**4 531.8**	**4 156.3**
	M	**5 540.5**	**1 433.0**	**1 641.2**
	T	**14 124.1**	**5 964.8**	**5 797.5**
Heavy metals	**T**	-	300.0	..
of which: **Lead (Pb)** *(tonne)*	**S**	-	32.0	34.9
	M		260.0	52.9
Methane (CH_4)	**T**	..	..	..
Ammonia (NH_3) a/	**T**	10.0	8.0	..
Carbon dioxide (CO_2) *(Million t)*	**T**	..	320.0	..

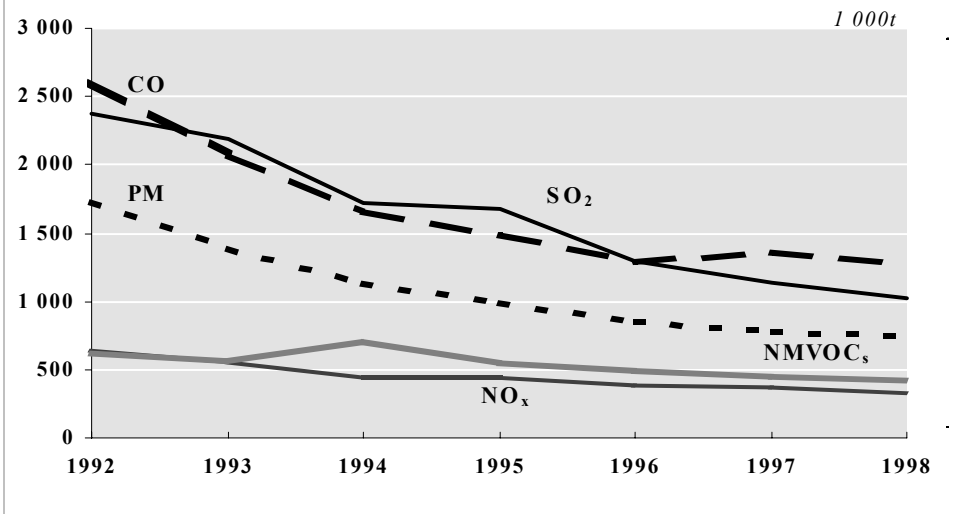
Source: ECMC data.

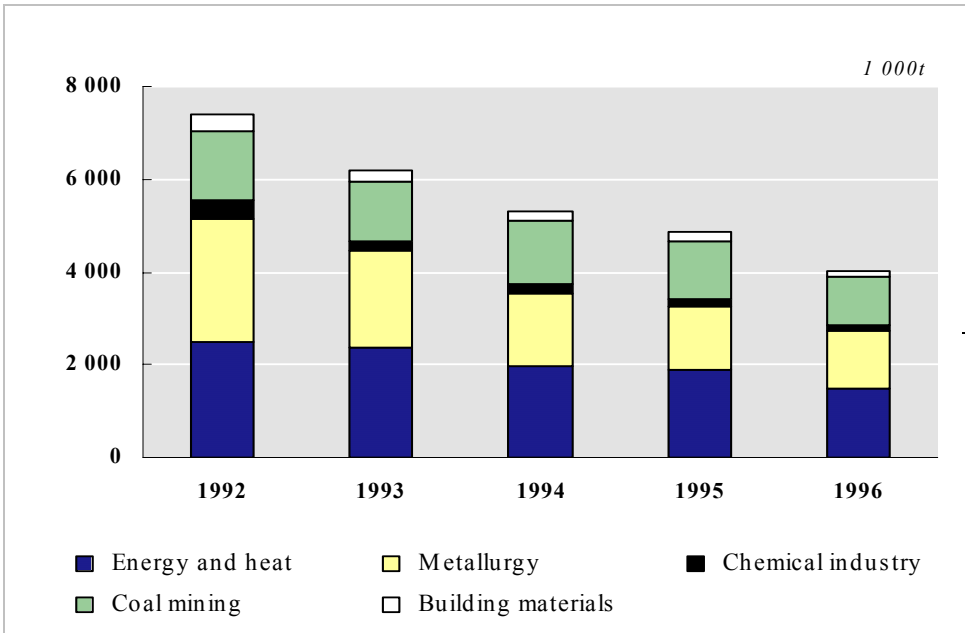
a/ EMEP data for 1996.

Emission sources: **S = Stationary sources**
M = Mobile sources
T = Total

Between 1991 and 1997, total emissions from all reported sources of the five conventional pollutants - particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide, and non-methane volatile organic compounds, including hydrocarbons (NMVOCs) -- decreased by 60 per cent, from 14 125 Kt to 5 500 Kt (see Table 7.1). This was due mainly to the decline in economic

Figure 7.1: Trends in emissions of selected pollutants, 1992-1998





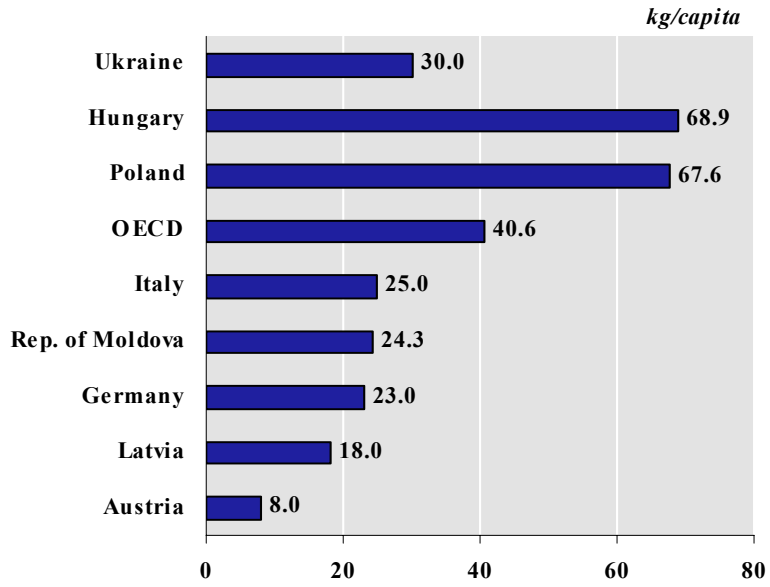
output and primary energy demand, including motor fuels. Between 1997 and 1998, industry's emissions of SO_2, NO_x and VOCs fell between 5 and 10 per cent, for similar reasons.

In 1998, emissions of these five pollutants from stationary sources were estimated at 4 156.3 Kt (about 75 per cent of the national total), about the same as in the previous year. The heavily industrialized region of Donetsk-Pridniprovsky accounted for about 80 per cent of these emissions. The decreasing trend in emissions from stationary sources has been observed in most oblasts and cities. For example, in Khmelnitzk and Kyiv oblasts emissions fell 42 per cent and 34 per cent, respectively. However, due to a deteriorating fuel balance, air emissions have increased in some cities, notably in Lugansk (40 per cent), Dniprodzerzhynsk (28 per cent) and Kyiv (13 per cent).

In general, high industrial emissions, ranging from 500 Kt to 100 Kt a year for the main pollutants, are also observed in Kriviy Rig, Mariupol, Donetsk, Yenakieve, Dnepropetrovsk, Debaltseve, Zaporozh'ye, Makiyivka and Gorlivka.

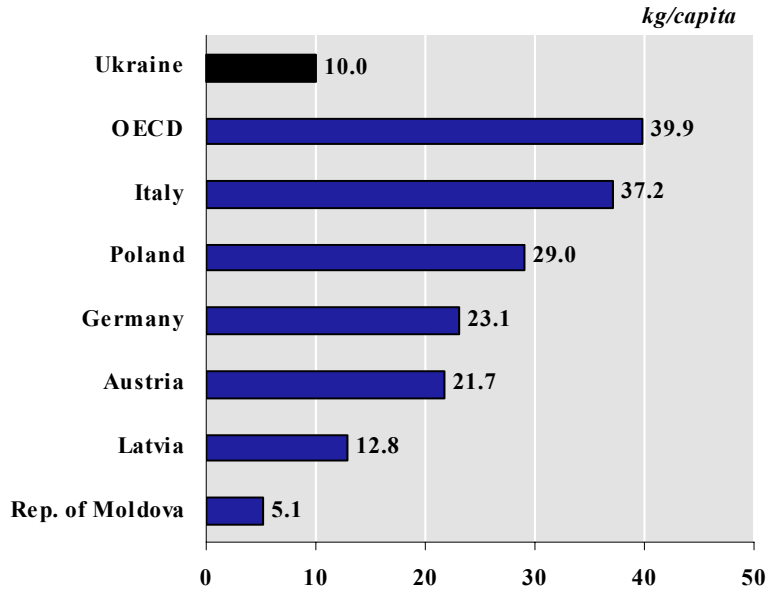
The stationary sources that contribute most to air pollution are in the energy and heat generation sector (32 per cent), ferrous and non-ferrous metal industries (27 per cent), the coal industry (23 per cent) and the chemical industry, including

Figure 7.2: Emissions of SO_x, 1996



Source: MEPNS, EMEP data, OECD, Environmental data, Compendium 1997.

Figure 7.3: Emissions of NO_x, 1996



Source: MEPNS, EMEP data, OECD, Environmental data, Compendium 1997.

refineries (2 per cent) (see Figure 7.1). The biggest polluters are power stations. They emit up to 85 Kt of SO_2 (Burshtynska TEC), 25 Kt of NO_x (Kryivorohska TEC) and 50 Kt of particulate matter a year (Luganska TEC). Burshtynska TEC is the single biggest polluter, with almost 140 Kt of annual emissions of these three pollutants.

Although covering 15 000 enterprises and 103 polluting substances, 7 of them contributing almost 90 per cent to national total mass emissions, emission reporting from stationary sources has not so far been extended to households and agriculture, except for bigger boilers in the latter sector.

The 1998 emissions of air pollutants from mobile sources are estimated at 1 885 Kt (30 per cent more than in 1997), reaching 31 per cent of the national total of these emissions. These percentages vary by pollutant: 63 per cent of national lead emissions, 54 per cent of CO, 36 per cent of VOCs, and 25 per cent of NO_x originate from transport. In many oblasts and cities, they outweigh those from stationary sources, accounting for 60 to 90 per cent of regional and/or urban emissions (Rivne, Uzhgorod, Kyiv, Odessa, Zhytomir, Ternopyl, Chernivtzy, Lutsk and Chernygiv). These emissions are gradually decreasing in the country as a whole, but mobile sources still emit 45 per cent of carbon monoxide, 30 per cent of NMVOCs and almost 20 per cent of nitrogen oxides. They also emit 260 t of lead annually.

Reported emissions from mobile sources come almost exclusively from petrol-fuelled road vehicles. Diesel-fuelled vehicles, including rail, navigation vessels and off-road vehicles such as construction machines and agriculture and forestry tractors, are excluded from the estimations.

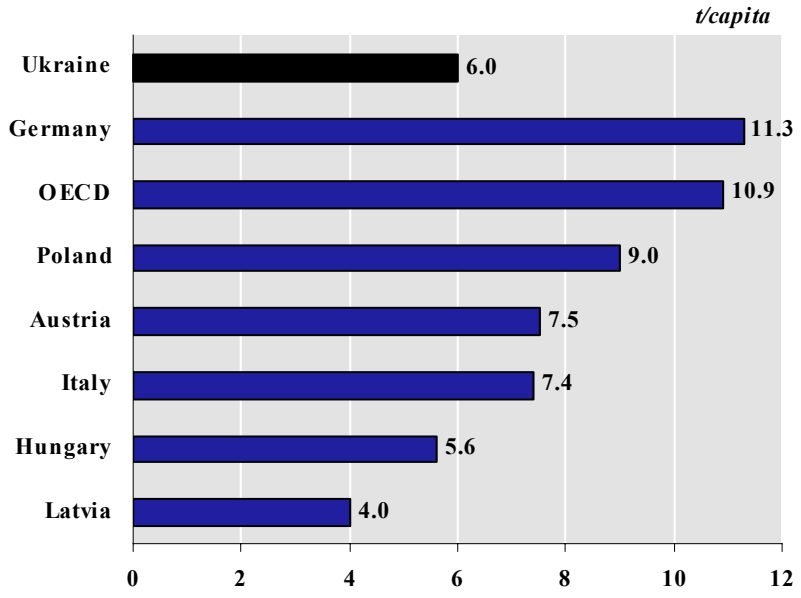
National emissions of carbon dioxide are estimated at 320 Mt, amounting to 75 per cent of the greenhouse-gas emissions. The other greenhouse-gas emissions are methane (24 per cent) and nitrous oxide (1 per cent). Heavy metal emissions are estimated at 300 t, including the above-mentioned 260 t of lead dust from road traffic.

The only emission sector split available in Ukraine is according to the main polluting industries and does not give a complete and accurate picture of the national emission pattern.

In 1996 Ukraine emitted 30 kg of SO_x per capita and 10 kg of NO_x. The figure for SO_x puts Ukraine within the middle range of countries in transition. It is slightly higher than in Latvia, Lithuania and the Republic of Moldova, but almost half that of Hungary and Poland. For NO_x, Ukraine's per capita emissions are among the lowest of the countries in transition. Ukraine's emission factor for SO_x is approximately 75 per cent of the OECD average, and for NO_x it is less than 25 per cent (see Figures 7.2 and 7.3). In terms of CO_2 per capita, Ukraine's figure of 6 tonnes is comparable to that of Bulgaria, Hungary, Lithuania and Latvia, and is about half the OECD average (see Figure 7.4).

According to the EMEP calculations for 1986-1995, Ukraine is a net exporter of sulphur compounds, nitrogen oxides and ammonia (see Table 7.2). The total amount of exports of these pollutants exceeds 1 200 Kt annually. Most of these pollutants were exported to the Russian Federation (European part) (35 per cent of sulphur,

Figure 7.4: Emissions of CO_2, 1996



Source: MEPNS, EMEP data, OECD, Environmental data, Compendium 1997.

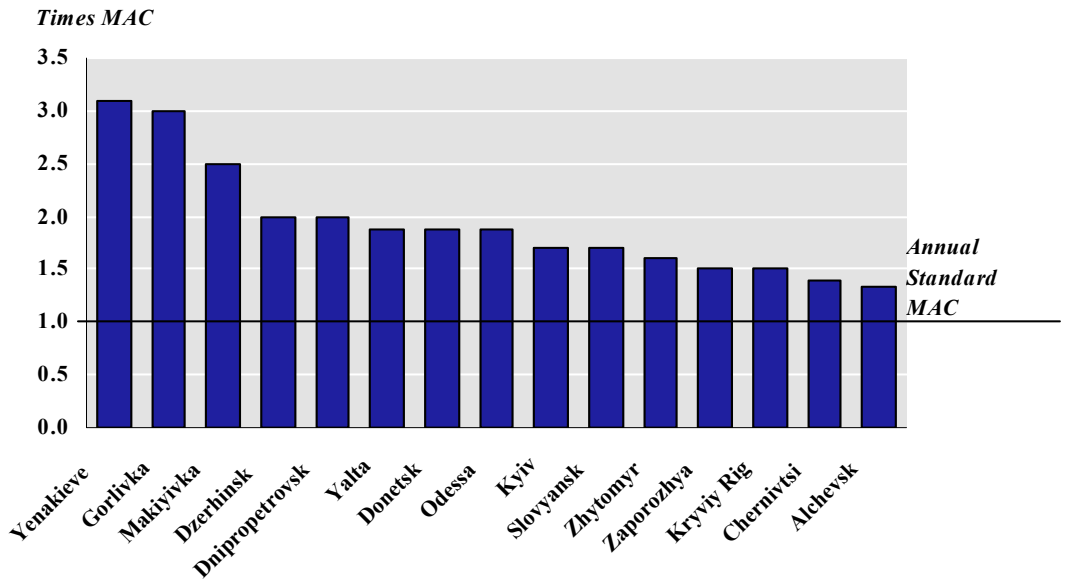
Table 7.2: Transboundary import/export budgets, 1986-1995

100 tonnes and %

Ukraine's territory	Oxidized S	Oxidized N	Reduced N
Export mass (100 t)	9 588	2 293	2 450
Exported % of emissions	73	83	41
Import mass (100 t)	5 228	1 608	1 288
Imported % of total depositions	60	77	27
Net import (100 t)	4 360	585	1 162

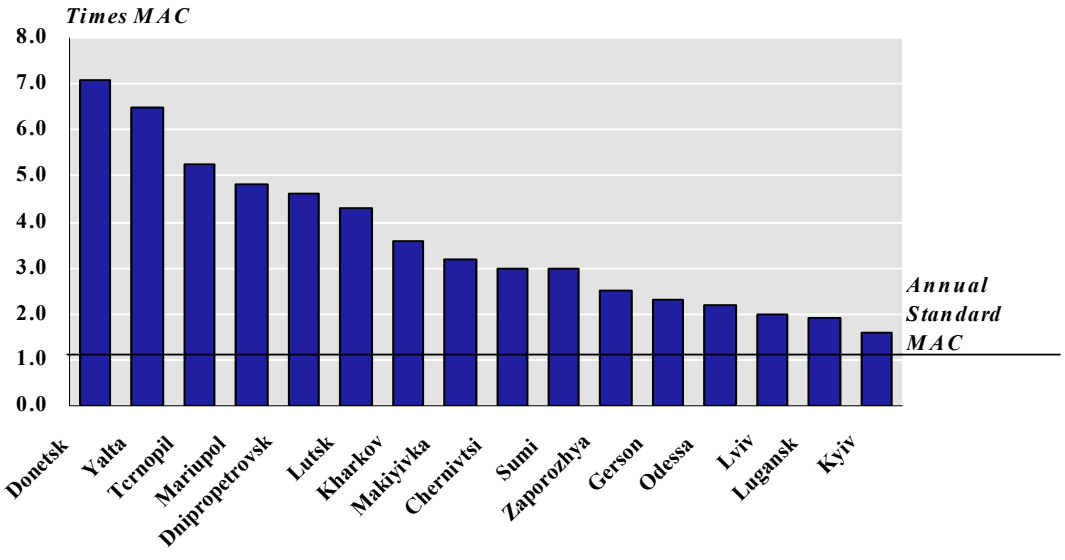
Source: EMEP/MSC-West Report (EB.AIR/GE.1/1997/2).

Figure 7.5: Exceedances of NO_2 in big cities, 1997



Source: Hydromet.

Figure 7.6: Exceedances of benzoα pyrene in big cities, 1997



Source: Hydromet.

27 per cent of oxidized nitrogen and 13 per cent of reduced nitrogen), and a lesser part to Belarus and Romania. According to the same calculations, the share of external sources in sulphur, oxidized and reduced nitrogen deposition on the territory of Ukraine amounts to 60 per cent, 77 per cent and 27 per cent, respectively. The main contributors are Poland, Germany and Romania.

Ambient air quality

The Committee on Hydrometeorology (HYDROMET) regularly monitors 54 cities and towns. 13 conurbations, primarily located in the Donetsko-Pridniprovsky industrial region, reveal high air pollution levels, not only with respect to the classic pollutants, but also to specific carcinogenic ones.

In general, annual concentrations of particulate matter, nitrogen oxides, sulphur dioxide and carbon oxide have decreased during the past few years along with emission levels. Yet, they often exceed the maximum allowable concentrations (MACs), the Ukrainian ambient air quality standards, 1.1-fold to 3.2-fold, depending on the pollutant and the city. Exceedances of nitrogen dioxide occurred in almost all big cities; at 3.2 times the MAC, Yenakievo recorded the maximum value (see Figure 7.5).

The situation concerning toxic air pollutants is much worse. Their annual concentrations exceed the annual standard values several fold in most big cities, particularly for formaldehyde with a peak of 8.5 in Odessa, and for benzo(a)pyrene 7.2 in Donetsk (see Figure 7.6), for phenol 3.8 in Yenakiyevo and Gorlivka and for ammonia 3.4 also in Gorlivka. Most of the short-term concentrations of heavy metals also exceed the MACs, e.g. copper MAC exceeded 11.6-fold in Dniprodzerzhins. In general, of the two measurements taken annually of different pollutants on the territory of Ukraine, at least one exceeds MAC, mainly for toxic air pollutants.

If measured data are compared with the standards recommended in the WHO Air Quality Guidelines for Europe (see Table 7.3), then the air quality with respect to the classic pollutants, except nitrogen oxides, is improving, and for SO_x and CO within the guideline values, WHO standards being less strict. However, for specific or toxic pollutants, even the WHO standards are exceeded in almost all big Ukrainian cities. The worst overall situation is in Kyiv, Kharkov, Dnepropetrovsk, Donetsk, Kriviy Rig, Lviv, Mariupol, Odessa and Zaporizhya.

Urban monitoring is supplemented by measurements of selected pollutants in atmospheric precipitation and snow cover. Concentrations in wet depositions on the territory of Ukraine correspond in most cases to natural background values, the highest pollutant contents being observed in precipitation in the Donetsk region. Acid precipitation has been found in the Autonomous Republic of Crimea and in Odessa oblast (pH below 4.5), while Volynska and Chernihivska oblasts and the cities of Kyiv and Lviv were exposed to low-acid precipitation ranging from pH 4.5 to 5.5.

Six stations located in Kyiv, Boryspil, Bohuslav, Odessa, Lviv and Kara-Dagh Nature Reserve of Crimea also monitor overall ozone concentrations and the state of the ozone layer. The longer-term results confirm a growing ozone deficit, which may lead to even worse ecological conditions, particularly during the period of biologically active solar ultraviolet radiation (spring to summer).

In addition, on the western border, two stations located in Rawa Ruska and Svitebsk monitor transboundary pollution within the EMEP programme and contribute to the background monitoring programme with respect to greenhouse-gas emissions. Their results confirm that precipitation is slightly acidic.

Underlying factors of air pollution

At present, most sectoral pressures come from energy-intensive heavy industry, including industrial combustion plants, combustion processes and traffic-generated air pollution. Large-scale industrial complexes, not restructured since independence, contribute significantly to all environmental problems, including air pollution. An energy intensity several times (9) the OECD average, combined with low energy efficiency, wasteful management of other natural resources and poor housekeeping and maintenance aggravate environmental pressures.

Of particular concern is the conventional energy sector, which supplies 67.5 per cent of the country's thermal energy and 50 per cent of its electricity. Most of this sector's energy-generating facilities are more than 25 years old. Although

Table 7.3: Comparison of selected Ukrainian air quality standards with recommended WHO guiding values

Substance	MAC* Ukraine mg/m^3		WHO guiding value / averaging time
	20 mn	24 h**	
Classic air pollutants			
Carbon monoxide	5.0	3.0	100 mg/m^3, 15mn 60 mg/m^3, 30mn 30 mg/m^3, 1h 10 mg/m^3, 8h
Ozone	0.16	0.03	0.120 mg/m^3, 8h
Sulphur dioxide	0.50	0.05	0.5 mg/m^3, 10mn 0.125 mg/m^3, 24h 0.05 mg/m^3, annual
Nitrogen dioxide	0.085	0.04	0.2 mg/m^3, 1h 0.05 mg/m^3, annual
Particulate matter	0.50	0.15	0.06-0.09 mg/m^3
Organic pollutants			
Formaldehyde	0.035	0.003	0.0001 mg/m^3, 30mn
Styrene	0.20	-	0.26 mg/m^3, 30mn
Tetrachloroethylene	0.50	0.06	0.25 mg/m^3, 24h
Toluene	0.60	0.60	0.26 mg/m^3, 1 week
Trichloroethylene	4	1	4.3x10^{-6}(mg/m^3), life-time
Inorganic pollutants			
Arsenic	-	0.003	1.5x10^{-6}(mg/m^3), life-time
Cadmium	-	0.0003 (compounds)	0.005 mg/m^3, annual (deposition)
Lead	0.0010	0.0003	0.0005 mg/m^3, annual
Manganese (compounds)	0.40	0.05	0.00015 mg/m^3, annual
Mercury	-	0.0003	0.001 mg/m^3, annual

Source: WHO Air Quality Guidelines for Europe and MEPNS.

* Maximum allowable concentration.

** Also interpreted in Ukraine as annual value.

natural gas dominates in primary energy consumption, substantial amounts of heavy fuel oil and low-quality coal are burnt, but none of the boilers has been equipped with secondary control measures to reduce emissions of SO_x, NO_x and other gases (see also Chapter 13).

In addition, most big polluting sources are located close to or even within densely populated areas, whose population suffers from pollution and where the number of road vehicles has been steadily growing since the mid-90s. The old vehicle fleet remains largely uncontrolled and poor-quality leaded petrol is still present on the market (up to 17 per cent officially), often mixed with unleaded petrol at filling stations. Currently, the price difference favours CNG-fuelling, but companies do not possess sufficient finances to invest in CNG-fuelled vehicles.

7.2 Objectives of air management

The 1996 Constitution of Ukraine includes the right to a safe life and a healthy environment (see

Chapter 1). The 'Principal Directions of State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety' were adopted in 1998 by the Parliament. In the first stage of their implementation (1997-2000), legislation and regulations are being developed and a set of urgent measures is being applied (also see Chapter 1).

In 1992, the Parliament declared the whole territory an environmental disaster area. However, combating air pollution is not a priority at the national level and is left to the regions. Their priority should be to stabilize and improve ecological conditions in cities and industrial centres, particularly in the Donetsk-Dnieper region, and to 'green' technologies in the most polluting sectors, i.e. industry, power generation, transport, construction and agriculture. In support of these priorities, the following urgent measures are to be taken:

- set up air-quality standards based on international standards and gradually harmonize the national standards with the international ones,
- introduce new ecological regulations based on process standards and norms, including technology-related emission standards for basic pollutants, and
- develop target programmes and short-, medium- and long-term action plans to decrease exceedances of air pollution in cities.

The Law on the Protection of the Environment of 1991 sets goals, but does not define enforcement mechanisms. It did, however, give the Ministry of Environmental Protection and Nuclear Safety basic responsibilities, and local governments and the Cabinet of Ministers the power to halt operations of polluting enterprises. In 1993, the State Environmental Inspectorate was created and its terms of reference adopted. Furthermore, environmental impact assessments were put in place in addition to permitting and licensing systems in the years 1992-1995 (for details see Chapters 1 and 2). The Law on the Protection of Atmospheric Air was adopted in 1992. It was based entirely on the 1981 Soviet Clean Air Act, which has simply been transposed into Ukrainian law without any changes. For details on relevant international conventions, see Chapter 3.

7.3 Institutional framework for air management

The main responsibility for developing policies and strategies for air protection and related objectives lies with the Ministry of Environmental Protection and Nuclear Safety. During 1997-1998, governmental activities were in accordance with the NEAP. The Ministry is also responsible for coordinating its implementation and developing the legal framework and economic tools for environmental protection, including air pollution abatement (for details, see Chapter 1).

The State Environmental Inspectorate verifies compliance with the air pollution abatement policies, can inspect the main pollution sources and supervises and guides other inspectorates, particularly those integrated within the Regional Environmental Bureaux (REB). 49 certified analytical laboratories are accredited by the State Environmental Inspectorate and its offices throughout the country.

The REBs perform primarily a kind of EIA for projects of regional relevance. They collect data on current emission levels from stationary polluters, and carry out quality checks. They also prevent and limit air emissions in accordance with the NEAP.

The Ministry of Environmental Protection and Nuclear Safety cooperates closely with the Committee on Hydrometeorology (HYDROMET) and particularly its Central Geophysical Observatory, the principal body responsible for air monitoring, including transboundary and background pollution.
In performing its duties, the Ministry seeks support from other ministries, particularly from the Ministry of Health Protection, which deals with living conditions, especially in urban areas. It also sets ambient air-quality standards. The Ministry of Energy is responsible for restructuring energy and heat generating facilities, and the Ministry of the Interior cooperates by checking exhaust emissions from vehicles.

Local governments are also responsible for permitting and licensing new and closing existing polluting activities if environmental violations occur. However, in practice they rely on the experience of REBs when making such decisions.

7.4 Instruments used in air management

Basis of management

A new draft law on atmospheric protection is under preparation. It has been agreed with the relevant ministries and institutions and includes three major changes compared to current practices:

- The overall orientation for air management is technological, the MAC is abandoned in favour of technological standards and norms, the specification of ground-level deposition limits and the incorporation of relevant international obligations. The new practices correspond to the relevant guidelines of the European Union, including the list of substances that need to be monitored.
- A new licensing and permitting system will be introduced, requiring inspectorates to use technological expertise.
- While MAC will no longer be calculated, maximum allowable emissions will be specified in harmony with ambient concentrations.

The new draft law specifies, for the first time, funding obligations for the programme (including for monitoring). In addition to this new legislation, a pilot project on regional air management and monitoring has been under way in Dnepropetrovsk oblast for seven years. The programme was initiated by the Academy of Sciences and is financed by the MEPNS, the Academy of Sciences and local budgets.

At present, air management in Ukraine is still based on old Soviet command-and-control mechanisms, i.e. the ambient air quality standards (MACs) and 'reference safe effect levels', covering a total of about 2000 substances. An air monitoring network and licensing are used to control polluting activities with respect to emission limits, established within a kind of EIA procedure and checked periodically by environmental inspectors. These mechanisms are combined with economic instruments, mainly emission charges and fines and environmental liability of polluters (both individuals and enterprises) in the event of serious violation and resulting damage to the environment.

Permits and norms for stationary sources

For stationary sources, the local bodies of the MEPNS issue permits to applicant enterprises, for each source individually for up to 5 years on the basis of environmental impact documentation prepared by institutions, provided ambient air quality standards are not in danger. The permitted emission levels reflect maximum production capacity. They are expressed in g/s for a period of 20 minutes, corresponding to MACs or 'reference safe effect levels', and calculated on the basis of simplified dispersion models. They take into account process technology, meteorological conditions and background concentrations of potentially emitted pollutants.

MACs are therefore met by dispersing the pollutants, rather than through control techniques. Location of the investment can be considered as an option in the EIA procedure. This allows relocating sources of pollution to less polluted areas, without reducing emissions. On the basis of maximum allowable emissions and real operating conditions, particularly the number of operating hours, REBs establish emission norms for the enterprise as a whole, which include all potentially emitted pollutants and are expressed in tonnes per year.

For investment projects of national importance (e.g. highways, airports), the norms are subject to State ecological expertise (SEE) performed by the Ministry of Environmental Protection and Nuclear Safety, instead of EIA. The Ministry's conclusions in such cases are not definite, as the final decision on the investment is made by the Cabinet of Ministers. Both EIA and SEE concern only the 1995 list of potentially hazardous activities. A few thousand EIAs are performed at regional and local levels each year, against some 10 SEEs.

Permits and norms have so far covered 700 substances, of which only 80 can be checked in practice by inspectors, using in most cases mass balances for energy and raw material flows and, to a lesser extent, emission measurements.

Permits and norms for mobile sources

Only vehicles are subject to regulations and subsequent control. Vehicles in general should meet individual exhaust gas standards, established for NO_x, CO and HC (Soviet GOST standards of 1987) from petrol-fuelled engines and for soot (opacity) (Soviet GOST standards of 1975) from diesel engines. They can be checked at stationary stations of the Ministry of the Interior, theoretically twice a year. In addition, they are subject to random spot checks, performed in general by the Road Transport Police (GAI) for one month each year as part of the 'Clean Air' campaign. As of 1999, annual vehicle inspection is to be introduced.

The standards are difficult to meet by the ageing Ukrainian vehicle fleet, particularly that of CO, which is stricter than in the EU. In addition, a general lack of measuring devices and irregular inspections of vehicles make them rather theoretical. Furthermore, big transport companies operating large vehicle fleets are not on the list of potentially hazardous activities, thus not subject to EIA or any pressure to modernize their vehicle

fleet – which would also be difficult for economic reasons.

The situation is made worse by low-quality motor fuels corresponding to old Soviet standards, including leaded petrol of 76 octane. Most of the fuel is imported from the Russian Federation, without its quality being checked at the borders. Leaded and unleaded petrol are also mixed at filling stations, preventing the widespread introduction of vehicles equipped with catalytic converters. As a first step to overcome this situation, the Ministry of Environmental Protection and Nuclear Safety, together with other interested ministries, drew up a draft programme on the conversion of road vehicles to unleaded petrol in 1998. On that basis, an action plan has also been proposed, which aims at improving fuel quality control, introducing an ecological tax on fuel (including on leaded petrol) to promote the use of environmentally-friendly fuels and converting the existing fleet to run on unleaded petrol.

Product standards

The Cabinet of Ministers banned the import of road vehicles not equipped with catalytic converters from 1 January 1997 and prohibited the use of such vehicles altogether from 1 January 2003 – measures that have since been suspended. Ukraine agreed at the 1998 Aarhus Ministerial Conference to phase out leaded petrol by the year 2005, and to increase gradually the market share of unleaded petrol to 80 per cent by the year 2002. It has also introduced fuel standards, which limit the lead content to 0.013 g/l and to 0.15 g/l (by 2001) in unleaded and leaded petrol, respectively.

The Government is not seeking to introduce other product standards, for instance for fossil fuel for energy and heat generation or for VOC-containing solvents. Neither is it planning to introduce so-called environmental labelling.

According to the National Energy Programme of Ukraine up to the year 2010, adopted in 1996, the Government plans to increase domestic production of natural gas from 18.1 Bcm in 1997 (22 per cent of the country's gas demand) to 27-35 Bcm by 2010 (for more details, see Chapter 13).

Ukraine has not yet adopted its own national Agenda 21. However, the document entitled 'The Main Concepts of Ukraine's Transition to Sustainable Development', prepared by the Ministry of Environmental Protection and Nuclear Safety and the National Academy of Sciences in 1996, does not refer to changing consumption patterns directly or indirectly.

Inspections and economic instruments

The main task of the inspectors is to verify emission limits set in norms and permits for stationary sources, including military installations, and calculate on that basis emission charges and fines, the latter being five times higher than the charge rate depending on the pollutant (for details, see Chapter 2). For the 93 most frequently emitted pollutants, the rates are individual; for the others they correspond to pollutant toxicity classes (see Table 7.4). The Cabinet of Ministers should constantly index the rates, but does so only if the local currency is considerably devalued against the dollar, the last time in 1998.

Table 7.4: Base charge rates for selected air pollutants as of 1993

Pollutant / Toxicity class	Rate *(UAH / tonne)*
Ammonia	10.0
Benzoα pyrene	67 871.0
Mercury, lead	2 260.0
Soot	18.0
Phenol	13.0
Formaldehyde	132.0
Chromium as metal	1 431.0
Particulate matter:	
< 0.0001 μ	16 052.0
0.001 - 0.01 μ	190.0
>0.1 but ≤ 10 μ	2.0
Class IV Non-toxic	3.0
Class III Medium dangerous	13.0
Class II Dangerous	87.0
Class I Highly dangerous	381.0

Source: Ministry of Environmental Protection and Nuclear Safety (MEPNS)

According to the statistics, only 10 per cent of emission charges are collected. Moreover, in the present economic situation and normal operating conditions, the fines calculated on the basis of permits seem quite unrealistic. However, due to a lack of proper maintenance and repair and the high number of technically obsolete production facilities, the latter are becoming increasingly hazardous and cases of accidental pollution are constantly growing. Therefore, the number of law suits, all media combined, is quite impressive,

totalling more than 40 000 cases in 1997 against physical persons only, and yielding UAH 2.3 million to compensate for the resulting environmental damage. Enterprises, most of them still State-owned, are treated more leniently; relevant figures are not available. Inspectors can keep 50 per cent of such gains and use this extra fund for their activities. The other half goes to the regional and State administration. The money collected (about UAH 50 million in 1997) from emission charges and fines and penalties is split among environmental funds at different level: local (20 per cent), regional (50 per cent) and State (30 per cent). It is not clear how the sums are spent.

They are not used for investments in control techniques, which are lacking, even in the Donetsko-Pridnprovsky region, for instance, where air protection has been declared a priority and where the NEAP target cannot be met without capital investments. The only new key investment project identified in this field is for the recovery of petrol vapours at Shebelinka Plant, costing about US$ 0.5 million and to be implemented in 1999-2000. Current expenditures to run existing control devices are almost exclusively borne by enterprises.

Inspectors are demoralized. The industry is ageing and enterprises cannot afford to modernize and retrofit polluting production processes, introduce control techniques and ensure their good housekeeping. The most striking example in that respect is the flue-gas desulphurization plant with a capacity of 200 MWel worth DM 54 million, delivered by Germany to the Dobrotvirska Power Station, close to Lviv. Its installation has been waiting for more than one year due to a lack of local resources. The new air management law will bring additional tasks for inspectors, primarily in technological issues. For the time being, related training programmes do not exist.

Measurement

The inspectors, more than 2 650 nationwide, systematically check about 120 major polluters once or twice a year, leaving less important sources to random inspection. In their work, they rely on their 49 laboratories, which analyse emission samples taken occasionally from inspected sources. However, in most cases, inspectors calculate emission rates, particularly for combustion processes, on the basis of fuel consumption and characteristics. In general, they are not adequately equipped to ensure regular and complete control of the licensed polluting sources. This is particularly true with respect to the large number of pollutants covered in the permits and their verification through automatic on-the-spot measurements of emissions for the main pollutants and automatic analyses in laboratories.

The licensed stationary sources are even worse equipped with measuring devices. They can take only sporadic measurements and rely on calculated emission factors. However, as the production capacity in industry has declined, companies are unlikely to be fined. Moreover, the lax collection of emission charges does not encourage them to improve their emission monitoring.

Installed control techniques on stationary sources can, in general, control only particulate matter emissions with an average efficiency of 96 per cent, using in most cases Venturi scrubbers, bag filters and electrostatic precipitators, all dating from Soviet times. For gaseous emissions, only simple primary measures (low-excess-air operation, flue-gas recirculation, etc.) to control NO_x have so far been introduced in boilers. Unfortunately, no secondary control measures are installed to cut toxic and carcinogenic pollutants, let alone classic pollutants like SO_x and NO_x.

A national industry of control technology/combating equipment for air emissions has not yet developed. In Soviet times, such industry was located outside Ukraine and did not manufacture more complicated equipment like flue-gas desulphurization or de-NOx plant. The same can be said of measuring devices for ambient air concentrations and emission rates.

The Central Geophysical Observatory has monitored air quality for many years under the supervision of HYDROMET. At present, the air monitoring network consists of 168 stations located primarily in 54 large cities, 16 in the capital. Two stations are monitoring ambient air pollution and atmospheric precipitation within the EMEP framework. In addition to air pollution monitoring in big cities, air pollution and atmospheric precipitation are systematically measured in 30 and 50 small settlements, respectively. Samples of ambient air are analysed in 36 chemical laboratories. HYDROMET possesses a methodological monitoring centre (Central Geophysical Observatory) and a Main Computing Centre for the collection and processing of primary information on air pollution levels in 54 cities.

The Observatory is responsible for programme coordination, methodological guidance, database management and maintenance and reporting to the

authorities, particularly in cases of MAC exceedances. Usually monitoring data are processed and transmitted to the Ministry of Environmental Protection and Nuclear Safety on a regular basis (usually monthly, then half-yearly and finally annually), except detected exceedances, which should be reported immediately, not only to the Ministry, but also to the authorities concerned.

Samples of the four substances, PM, NO_x, SO_2 and CO, are taken at all stations 4 times a day. This is an obligatory part of the programme. Specific pollutants are sampled and analysed depending on their regional/local emission patterns and existing technical possibilities. Three very hazardous pollutants are widely measured, i.e. NO_2, benzo(a)pyrene and phenol. However, a total of only 38 pollutants can be effectively monitored (of the 2000 MACs and 'reference safe effect levels' established, see above). In addition, some pollutants are analysed also in precipitation and snow cover, completing the pollution map of the country.

In one year about 1 million samples are taken and analysed, all pollutants combined, of which 46 to 50 per cent show exceedances, depending on the region and/or city, particularly with respect to specific pollutants of a toxic or carcinogenic nature. Yet, the information flow from regions and local stations to the Monitoring Management Centre is slow, because data are transmitted on paper, mainly for lack of electronic data transmission. This makes alert and/or alarm level reporting to authorities in real time almost impossible – it also complicates any use of the data depending on timely information. As a result, use of monitoring data is at present not fully developed.

Means for sampling air and for analysis have become obsolete. Most of the stations were installed at least 15 years ago. Their locations have remained unchanged and their sampling and analysing methods are exclusively those of the former Soviet Union, corresponding to GOST standards. Monitoring equipment and measuring devices are in most cases home-made and not internationally certified, and laboratories do not participate in calibration exercises. Still worse, there is no scientific institution to guide network modernization and develop new monitoring techniques. Recently, the Central Geophysical Observatory and all 36 local chemical laboratories have provided information on background pollution to prospective investors in an effort to improve their financial situation.

The Observatory needs at least UAH 3 million a year to regularly operate its air monitoring network. However, no financial support has been earmarked from the State budget, regional or local authorities, or industry. The network is operated only from the small HYDROMET budget. Therefore, it is almost impossible to develop, although there is a recognized need for such development. It is commonly agreed that the existing network is on the one hand too big, but its density is not always sufficient in problem areas. As a result, a reduction in the size of the network, the relocation of stations to particular impact areas, and the extension of the monitoring programme to all relevant pollutants are the major requirements for the future.

Also, a dozen institutions have similar monitoring activities for different purposes, for example the Ministry of Health Protection sporadically monitors heavily industrialized zones or densely populated areas, through its Centre for Hygiene and sanitary-epidemiological authorities.

The Ministry of Health Protection monitors air exclusively in urban areas, including also industrial zones, following independent programmes and occasionally at the request of the population. Although it measures the same pollutants, it uses different equipment (mobile stations) and methods (dry and partly automated), making it difficult to relate its results to those obtained by the Central Geophysical Observatory.

Data from the regions are sent to the Centre for Hygiene, which checks their quality and draws conclusions. Finally, they are reported to the Statistical Office, together with data on morbidity and mortality. There is no interpretation of dose-relationships between different data sets. In addition, the Centre for Hygiene draws maps of human exposure to different pollutants using dispersion models, where monitoring data are lacking.

HYDROMET and the Ministry of Health Protection do not harmonize their monitoring programmes or methods. Moreover, they do not cooperate when monitoring and interpreting the results obtained, despite the differences in methodology. Consequently, often two institutions are involved in evaluating the same pollution

situation, very often coming to different final assessments.

7.5 Conclusions and recommendations

Ukraine has set out its main policy objectives and actions for air management in its 'Principal Directions' and consequently in its NEAP. However, not much progress has been made in their implementation. Changing the existing legislative and regulatory framework for air pollution abatement is taking a long time. The imminent finalization of the new law on atmospheric protection – including the drafting of the necessary implementing regulations -- can be seen as an important step in the direction of modern air management, leading to the implementation of other urgent measures like target programmes and regional action plans, which are also included in the NEAP.

The complete new air management concept should be based primarily on some working principles and rules, combining effect-oriented policy measures with the use of state-of-the-art control techniques in a cost-effective manner. They should include integrated pollution prevention and control and BAT requirements within licensing, environmental impact procedures and changes in national ambient standards. These should conform closely to international practices, particularly with respect to ambient air quality, pollutant loads to different environmental media, emission limit values and environmentally-friendly products. Furthermore, product quality standards should be foreseen where they are of particular importance to the protection of air quality, primarily fuels for stationary combustion processes, and various VOC-containing consumer goods.

The implementation of the approach underlying the revised law should also give rise to a change in EIA and SEE procedures, fuel-quality checks, air quality and emission monitoring and responsibility sharing at different levels. The necessary modifications should be based on a critical review of all matters related to the present poor enforcement, including those inherent in old-style management of inspectorates, regional and local authorities.

The required tasks are demanding in terms of coordination of different governmental institutions, as well as the development of effective cooperation routines. While the creation of a special governmental unit for this purpose is not the only possibility to achieve this, its creation could make the political will to improve the current situation visible.

Recommendation 7.1:
The adoption of the revised Law on the Protection of Atmospheric Air should give rise to the urgent development of implementing regulations. The creation of an interministerial task force should be considered, to coordinate the rights and responsibilities of all levels of administration in the new air management scheme.

The new air management approach entails considerable changes in the tasks of environmental inspectors, for which they need to be urgently prepared. So far, the addition of technological expertise to the inspectorates is envisaged in the form of specially qualified staff. This is a very adequate first step. It needs to be complemented with technological training programmes for inspectors, as the new air management approach will lead them to become a type of 'technological advisers' in their day-to-day work. The requirement for training should also benefit from the experiences gained in the Dnepropetrovsk oblast with the regional pilot project for air management.

Recommendation 7.2:
A training programme for environmental inspectors should be established to prepare them for their new tasks following the adoption of the new Law on the Protection of the Atmospheric Air. It should benefit from relevant experiences obtained in oblasts with modern air management. The programme should include the necessary funding provisions and should start to be implemented urgently.

The existing economic instruments, mainly emission charges and fines, are ineffective and do not correspond to the polluter-pays principle, as their actual payment is sporadic at best. The economic instruments will have to be critically reviewed. Their rates will eventually have to rise and be regularly indexed to inflation, so that polluting becomes at least as expensive as installing low-cost control measures. But first the numerous environmental funds should be consolidated. There should be fewer legal entities, but they should include also the local level, where much spending for environmental purposes should normally take place. Another problem relates to penalties. Few enterprises have to pay up. Only physical persons are made to pay.

Although economic output has drastically decreased, and production continues to fall, unit

emissions, mainly from stationary sources are rising owing to improvements in accounting. This suggests that lower-quality fuel and raw material is used, that operating conditions are more difficult and that housekeeping is not very effective. However, inspectors do not investigate all these factors to reassess the environmental impact of polluters and change the conditions for using the environment. This reassessment could lead to increased charges and, eventually allow fines to be imposed, thus improving to some extent the efficiency of the economic instruments.

Recommendation 7.3:
The efficiency of existing economic instruments has to be analysed for the purpose of reassessing subsidies, consolidating environmental funds and increasing emission charges when necessary. The polluter-pays principle should be applied in a rigorous way to all emission sources, whether stationary or mobile, and systematically to both physical and legal persons. See also Recommendation 2.1.

Air monitoring shows that unit emissions from stationary sources are increasing and the vehicle fleet is ageing and expanding. The toxic and carcinogenic air pollutants prove this in particular. Almost all big cities are polluted to levels above the standards and their population is prone to developing further air-pollution-related illnesses and injuries. Therefore the priorities set in the NEAP need to be adjusted to this critical situation. In parallel with the modification of the legal and regulatory framework for air pollution abatement, comprehensive action plans, within the framework of the NEAP, should be drawn up to protect the health of the urban population more effectively. It is worth noting that one of the priorities set out in the NEAP is to lower air pollution in cities.

Recommendation 7.4:
The priorities in the NEAP and its present implementation phase should be critically reviewed and focus on designing a realistic medium-term action plan or plans, separately for each city, in order to lower air pollution. See also Recommendation 1.2.

The action plans should specify abatement targets for each city and for specific pollutants and should assign responsibilities to the major polluters, particularly in the energy and transport sectors. The action plans should be formulated in cooperation with the key players, i.e. various administrative bodies at all levels, industry and transport companies and the general public as well. Realistic action plans should be based on low-cost measures related to environmental management at plant level and cleaner production techniques, including better housekeeping and stricter control of exhaust emissions from vehicles. Conventional thermal power stations face the problem of burning poor-quality fuels, preventing more efficient control of exhaust gases. The feasibility of measures can be assessed through environmental audits of various sorts among the largest polluters. Such audits can be envisaged even in the present difficult economic situation, because the key players are skilled and experienced to perform these tasks. The results of audits should be reflected in the revision of permits and norms for polluters.

Recommendation 7.5:
The main polluters (i.e. power stations, chemical industries, metal industries etc.) responsible for air pollution in big cities should be subject to environmental auditing to identify their potential for cutting emissions via low-cost measures. See also Recommendations 1.4 and 13.6.

The HYDROMET ambient air quality monitoring, although quite extensive in terms of number of measurement stations and sites and samples taken annually, is based on old equipment and geographical coverage, dating from the former Soviet Union, and uses obsolete methods (wet and manual). Moreover, its data are processed periodically and not complemented by air monitoring activities carried out by the Ministry of Health Protection and its agencies and not supported by industrial monitoring around polluting sources. There are no systems to continuously monitor air pollution. The main network is unable to link air pollution levels with emission rates and identify, on that basis and in real time, activities suspected of violating norms during normal operating conditions. A first necessary step towards a better analysis of monitoring results enabling their full, normal use would be to upgrade the laboratory and computing equipment of HYDROMET, including the installation of modern GIS software and data transmission technology.

Recommendation 7.6:
All possible ways should be explored to install modern computing and laboratory equipment as well as data transmission and analysis software at HYDROMET. See also Recommendation 1.5.

Reducing the number of monitoring stations and relocating them to areas of highest concern should be envisaged as soon as possible, once the implications of the new permit system for

stationary sources are clear. The gradual implementation of integrated air-quality measurement should lead to improved geographical coverage of existing stations and sites, and to the installation of continuous measuring and sampling devices, especially in highly polluted urban areas.

Recommendation 7.7:
The air pollution monitoring system should be redesigned and integrate existing sectoral air-quality measurement programmes. It should follow modern methodology and use automated equipment.

The existing emission inventories do not adequately and accurately reflect the emission pattern in the country. Important sources are not taken into account (households, agriculture, off-road vehicles, navigation, etc.) and a sector split - in line with EMEP requirements - is not available. Moreover, the methods used to inventory emissions may use obsolete emission factors, e.g. exhaust emissions are based on old GOST standards taking mileage into account instead of real fuel consumption, decreasing artificially the real emission level. As the number of vehicles is growing and motor fuel consumption is increasing, emissions from road vehicles should be much higher than the values reported by the Ministry of Environmental Protection and Nuclear Safety. The existing reporting on combustion processes covers mainly boilers and reflects the permits given and norms established. It disregards some sectors, such as big transport companies and other major mobile sources.

Recommendation 7.8:
The existing inventory and related reporting system should be redesigned and expanded to cover the most important polluters and concentrate on classic as well as the most hazardous pollutants. The inventory methodology should be in line with the EMEP inventory guidebook. The public should be informed of the results.

Although Ukraine has signed many international agreements, few are adequately implemented. Some have not yet been ratified. Regarding the Convention on Long-range Transboundary Air Pollution, Ukraine should first designate its TOMAs within the VOC Protocol, and ratify it as well as the Oslo Protocol. It should also consider signing the new Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

Ukraine should also accede to the ECE Convention on Environmental Impact Assessment in a Transboundary Context, and the 1958 Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts and to other related UN/ECE regulations. These steps would be instrumental to furthering the successful implementation of the NEAP.

Recommendation 7.9:
Ukraine should accelerate its ratification of the environmentally relevant ECE conventions and protocols that it has already signed and develop appropriate strategies for their implementation. It should also envisage acceding to those that it has not signed and sign new instruments that could be instrumental in redesigning policies and strategies for air pollution abatement and implementation of urgent control measures within the NEAP. *See also Recommendation 3.2.*

Chapter 8

WATER MANAGEMENT

8.1 Water resources

Water resources are not equally distributed throughout Ukraine. Sufficient resources are found in the north and the north-west, while the south is poorly endowed. Average annual precipitation varies from east to west, with 300 mm in the semi-arid south-east Black Sea and Azov coastal zones to 1 500 mm in the Carpathians.

Surface water

The country's water network consists of the following main rivers: the Dnieper, the Dniester, the Siversky Donets and the Southern Bug. All drain south towards the Black Sea and the Sea of Azov. Other major rivers include the Zakhidny Bug, running north-west into Poland and the Baltic Sea; the Tisa, which flows into Hungary as a tributary of the Danube; and the Prut, another Danube tributary, flowing between Romania and the Republic of Moldova after leaving Ukraine. The largest of the three Danube branches which comprise the Danube Delta, the Kiliia, constitutes the border between Romania and Ukraine, although only a small portion of it drains directly from Ukrainian territory into the Danube.

Ukraine's main hydrological basin is the Dnieper catchment. The Dnieper is Europe's third largest river and runs for 2 200 km within Ukraine. Its average annual flow amounts to 53.5 billion m^3, draining almost half the country's surface area (293 000 km^2). There are six large reservoirs on the river, creating water reserves with a total volume of 43.8 billion m^3, for the industrial centres of Donbas and for irrigation purposes further downstream in Crimea and on the Black Sea coast. The respective capacities of these reservoirs are: 3.73 billion m^3 for the Kyiv reservoir, 2.50 for the Kaniv, 13.52 for the Kremenchug, 2.46 for the Dniprodzerzhink, 3.32 for the Dnieper and 18 for the Kahovske reservoir. At least 30 million people and the most important industrial areas depend on its water.

The Southern Bug drains 11 per cent of Ukraine's territory (63 700 km^2) and the Dniester 9 per cent (52 700 km^2). There are 950 small lakes, 4 lakes with a surface of 10-100 km^2 and 2 lakes of over 100 km^2. The inflow of transboundary rivers is estimated at 160 billion m^3 yearly, of which the river Danube contributes almost 80 per cent. Approximately 51 billion m^3 of water resources are formed annually on Ukraine's territory.

In 1997, 16.5 billion m^3 of surface water was abstracted from inland water bodies. Mostly due to a decline in industrial production, the abstraction of surface water was 34 per cent lower in 1997 than in 1994. Compared to 1991, the abstraction of surface water has decreased by 45 per cent.

Groundwater

Groundwater resources are available across Ukraine. The main groundwater reserves are located in the centre and the west; the south has the fewest reserves. As a result, the territorial pattern of available groundwater reserves and that of the most water-intensive activities do not match. The total resources of groundwater are estimated at 61.7 million m^3 per day.

Water abstraction from groundwater sources reached 3.7 billion m^3 in 1997, i.e. 16 per cent of available resources. Use of groundwater varies considerably by oblast. In the centre and the east of the country, 5 to 13 per cent of the groundwater resources are used, whereas in the southern oblasts water abstraction often exceeds 50 per cent of the available resources (Donetsk, Kirovograd, Mykolayiv, Odessa oblasts and Crimea). The decline in industrial production has entailed a reduction in groundwater abstraction: in 1997, abstraction was down 20 per cent on 1994, and 38 per cent on 1991.

Table 8.1: Water abstraction, 1991-1997

Million m³

	1991	1992	1993	1994	1995	1996	1997
Total	**34 905**	**32 461**	**29 709**	**29 499**	**25 852**	**23 477**	**21 091**
Surface water *	29 800	27 439	24 907	24 934	21 547	19 435	16 525
Groundwater	5 105	5 022	4 802	4 565	4 305	4 042	3 670
Water abstraction by activity							
of which:							
Energy production	9 388	8 290	7 430	7 122	6 701	6 097	5 155
Other industry	6 097	5 880	5 577	5 236	4 907	4 336	4 010
Irrigation	11 012	9 678	8 637	9 565	7 139	6 331	5 974
Agriculture	4 261	4 438	3 950	3 609	3 175	2 615	2 038
Households	3 887	3 922	3 884	3 801	3 765	3 962	3 839

Source: Annual statistical reports on water.

Note:
* Including about 3 to 5% of sea water.

Table 8.2: Water use, 1991-1997

Million m³

	1991	1992	1993	1994	1995	1996	1997
Total	**27 116**	**25 895**	**23 574**	**22 575**	**19 474**	**17 799**	**14 729**
Surface water	23 066	21 931	19 842	19 063	16 256	14 841	12 147
Groundwater	4 050	3 964	3 732	3 499	3 201	2 948	2 574
Water use by activity							
of which:							
Energy production	8 791	7 731	6 879	6 559	6 182	5 602	4 570
Other industry	4 011	3 778	3 387	2 969	2 652	2 314	1 979
Irrigation	6 289	6 197	5 419	5 516	3 469	3 381	2 444
Agriculture	3 913	4 071	3 755	3 483	3 154	2 598	2 007
Households	3 667	3 607	3 758	3 822	3 813	3 721	3 572

Sources: Annual statistical reports on water;
Statistical Yearbook on Environmental Protection and Use of Natural Resource, 1998, State Statistics Committee.

Water supply and use

Water supply is heavily influenced by seasonal variations in precipitation and river flow. The most heavily cultivated agricultural areas, as well as the most water-intensive industries, are situated in the south-eastern, dry regions.

In 1997, 20.2 billion m^3 of fresh water was abstracted from surface and groundwater. Of this, 14.7 billion m^3 was used for household, industrial and agricultural purposes. This is 73 per cent of the yearly freshwater abstraction. In 1997, the total abstraction of groundwater and surface water dropped 42 per cent, compared to 1991. In 1997, industry used almost half the water abstracted.

Surface water is the main source of supply of drinking water. Approximately 60 per cent of the population is supplied from the Dnieper river, 15 per cent from other surface waters and 25 per cent from groundwater (particularly in rural areas). Industry and agriculture also use more surface water than groundwater.

The data on water use in Table 8.2 indicate a general downward trend in different sectors of the national economy. By contrast, household use has remained stable. In 1996, drinking water use totalled 3.6 billion m^3, and consumption per head stood at 71.4 m^3 per year, i.e. around 200 litres/day.

Table 8.3: Water losses during transport

Million m³

	1991	1992	1993	1994	1995	1996	1997
Water losses	2 274	2 288	2 290	2 302	1 946	2 179	1 934

Source: Annual statistical reports on water.

In some oblasts, consumption per head exceeds 400 litres/day (among others Kyiv, Lugansk, Crimea).

Statistical data on water supply indicate high losses of water along the supply network (Table 8.3). The extent and physical distribution of these losses are not fully described, since no operational arrangements are in place for monitoring and controlling leakage.

8.2 Water quality and waste-water treatment

Water-quality monitoring

Surface water quality is monitored in 112 rivers, 15 reservoirs, 7 lakes, 1 canal and 1 estuary. Groundwater is monitored at about 7 500 boreholes. The following authorities are involved in State water monitoring and control:

- Ministry of Environmental Protection and Nuclear Safety
- Ministry of Agriculture and Food Production
- State sanitary and epidemiological service (Ministry of Health Protection)
- Committee on Water Resources
- Committee on Geology and Mineral Resources
- Committee for Hydrometeorology
- State Committee for Building, Architecture and Housing Policy

The situation in water resource management and control was confusing and there was no clear delineation of the responsibilities between the various entities. Resolution No. 391 of 30 March 1998 was meant to improve the coordination of monitoring activities. It regulates the responsibilities of the authorities involved and entrusts the Ministry of Environmental Protection and Nuclear Safety with the overall coordination. The effect this resolution has on the workings of the monitoring system is not yet clear. Further restructuring and responsibility sharing schemes are being discussed but have not been adopted so far (see Chapter 1, section 1.3).

Each institution involved in water monitoring uses its own software and data bank. As a result, the monitoring data are distributed over various sources, unintegrated, and not comparable. There is no harmonized methodology for monitoring.

Surface water quality

Surface water is classified into five quality classes, class I is the highest quality and class V the lowest. According to this system, most rivers in Crimea could be considered as satisfactory (class III). Almost all other river basins in Ukraine are classified as polluted (class IV) or very polluted (class V). It is expected that a new classification of the quality of surface waters and estuaries will replace the existing classification system in the course of 1999. The new methodology will aim at approximating the relevant EU legislation and practices.

The quality standards applied are the most stringent 'fish production standards', which are in some cases stricter than those applied in EU countries. The most frequently and heavily violated are those for biochemical oxygen demand (BOD_{total}), nitrogen compounds, oil products, phenols and heavy metals (in particular copper, zinc and manganese). The standard of 3 mg/l for BOD_{total} was a case in point, but was modified to 15 mg/l in March 1999. Other Ukrainian standards, like those for heavy metals, seem to be comparable with or less strict than those of the EU.

Observations of the Committee on Hydrometeorology for 1997 indicate that the Dnieper is particularly polluted with heavy metals and phenols. The water-quality standards for copper, zinc, manganese, chromium 6+ and phenols are not met. The Kyiv and Kaniv water reservoirs are polluted mostly with oil products, nitrite, phenols, copper, zinc, manganese and chromium 6+. Since 1996, the level of pollution with copper, zinc and manganese has to some extent increased in these reservoirs.

The Dniester is mainly polluted with ammonia, oil products, chromium 6+, copper, zinc and magnesia. The chromium and ammonia content is increasing.

In the river Siverskiy Donets water-quality standards are exceeded for oxygen-consuming substances, oil, phenols, ammonia, nitrite, copper, zinc, manganese and chromium 6+. Since 1996, particularly the copper concentration has increased. In comparison with previous years, the concentration of chromium 6+ has increased.

The Southern Bug is polluted with ammonia, nitrite, oxygen-consuming substances, copper, zinc, manganese and chromium 6+. Since 1996, the nitrite content has increased.

In general, the smaller tributaries are more heavily polluted than the main rivers mentioned above. The highest concentrations of pollutants are likely to be found in small rivers and brooks, due to their low water flow and dilution capacity during long periods. The pollution is chiefly due to agricultural activities. However, there are also many unspoiled water bodies in Ukraine, particularly in the mountainous areas.

Mining and processing generate pollution at different processing stages: mine drainage, ore beneficiation and mineral separation. Numerous heavy metals and other harmful substances are discharged, such as iron, cadmium, lithium, titanium, manganese, radionuclides, phosphorus, or sulphides. Some of them raise the salinity or acidity of the receiving water bodies (see Chapter 10 for details). Other industrial activities also release important volumes of waste water, although the industrial recession has implied a reduction of waste-water generation in general. The introduction of cleaner technologies is too slow to sustain hopes for a fundamental improvement of the potential for waste-water generation (see Chapter 5). Similarly, despite the drastic reduction in the use of pesticides and fertilizers in agriculture, nitrate concentrations in water remain high. Cattle-breeding and the household sector are the main sources of organic pollution – together with ineffective waste-water treatment.

Groundwater

In some places the drinking water of groundwater origin does not meet the freshwater quality standards. This is due to hydro-geological conditions, but also to the bad state of the pipe distribution network (losses are commonly 30%) and the inefficiency of purifying facilities. Organic pollution comes from agriculture and city run-off; and water salinization originates from irrigation.

The groundwater monitoring stations are primarily intended to assess groundwater levels (availability) and natural geochemistry (see Chapter 10 for a more detailed description of the monitoring activities of the Committee on Geology and Mineral Resources). There is no extensive monitoring and assessment of anthropogenic impacts on groundwater, although some occasional monitoring has been carried out since 1989 on heavy metals and pesticides. There are major gaps in the data on local groundwater quality, reflecting the lack of advanced monitoring and laboratory equipment, as well as the lack of monitoring requirements for landfills, waste impoundments and industrial sites.

Neither do the available data provide a comprehensive picture of the quality of the country's groundwater. Recent information seems to be available only on local and regional levels. An updated national overview of groundwater quality is expected to be published in the year 2000.

In 1990, the USSR Ministry of Geology estimated that nearly 4 per cent of Ukraine's groundwater resources were polluted. It is estimated that this percentage has since risen sharply, particularly in the upper aquifers. Major sources of groundwater pollution are industry, mining and agriculture, causing pollution with heavy metals, pesticides and nitrogen (NO_3, NH_4).

Drinking water

Drinking water increasingly fails to meet the State standards on drinking water, breaching the chemical, bacteriological and the sanitary standards. The reasons for this are the poor quality of water supply sources, the poor condition of the sewage systems and local water supply systems (up to 30 per cent of water may be lost there), frequent accidents, treatment installations not functioning properly and lack of disinfection. Pesticide pollution is prevalent due to leakage from unofficial pesticide dumps, and salinization and mineralization of groundwater in areas of agricultural irrigation pose a major threat to public health.

The water supply treatment plants can produce about 9.4 billion m^3 of drinking water a year, of which 8.8 billion m^3 a year are supplied in a

centralized way. The water is distributed through a water-pipe network of more than 175 000 km.

In 1997, 6 per cent of centrally supplied drinking water failed to meet the hygiene standards, as did 15 per cent of the water supplied by municipal pipes and 22 per cent of water supplied by pipes belonging to other bodies. In all, 260 settlements consume drinking water that does not meet the standards. Water supply in rural areas is especially alarming, due to the widespread chemical and bacterial pollution of local water resources. About 70 per cent of the population is connected to the centralized water supply, but only 4 per cent of rural households are connected to piped water systems. About 3.7 million people in rural areas enjoy piped water supply for household and drinking purposes (24 per cent of the rural population).

Waste-water treatment

Waste-water treatment is a major problem in Ukraine. First of all, there is a geographical imbalance in collection and treatment installations. In 1997, the country had a sewage network of 46 000 km, of which 30 300 km in cities and urban areas. The major problem in rural areas is that most waste water is discharged untreated. The urban problem, however, is the poor quality and inefficiency of waste-water and sludge treatment due to the technical state and capacity of existing installations. Insufficiently trained personnel is a more general problem: specific training in plant operation, process control and instrument operation would improve treatment performance.

Over 60 per cent of the population is connected to municipal waste-water treatment plants via the collection network, but a majority of the villages discharge their waste water without treatment. The total installed capacity for waste-water treatment is about 5.7 billion m^3 a year. Most waste-water treatment plants have the following basic treatment technology: mechanical screening, primary sedimentation in round tanks with mechanical scrapers and biological treatment using the activated sludge process. The effluents that the plants discharge are insufficiently purified. Sludge disposal is not really provided for in Ukraine: in general, sludge is disposed of in landfills, without biological stabilization.

At the moment many treatment installations do not work properly. Due to poor maintenance and the bad technical state of the other installations (22 per cent of the collection network is in a critical condition, 46 per cent of the pump units need replacing and 25 per cent of the installations have exceeded their technical lifetime), the situation can be expected to deteriorate even further in the near future.

In particular, the poor state of maintenance of waste-treatment installations in populated areas is a cause of concern. The main reason is the inappropriate use of available treatment installations, which have become overloaded and have even broken down completely in some regions. Purification plants in Kirovogradska, Zhytomirska, Mykolayivska, Luganska and Odessa districts and in the Autonomous Republic of Crimea are in poor condition. At the same time, the construction of new purification plants and the reconstruction or extension of existing plants is unsatisfactory or has been completely abandoned.

8.3 Environmental management of water resources

Policy objectives and legislation

The 'Principal Directions of State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety' identify the following two priorities that are relevant to freshwater management:

- environmental regeneration of freshwater bodies and improvement of drinking-water quality;
- (re)construction of communal and industrial waste-water treatment plants.

Three implementation stages are foreseen. The first phase (1997-2000) is focused on implementing urgent measures to reduce the most harmful impacts on the environment. The main tasks include improving the legal basis for water protection, developing and introducing economic mechanisms for environmental protection and the efficient use of natural resources.

In the second stage (10-15 years), comprehensive programmes focusing on general environmental regeneration are expected to start, in order to achieve a balance between the impact on the environment and its ability to recover. Part of this phase is the development and introduction of a system of State monitoring of the environment.

The aim of the third phase is to create a system of sustainable management of the natural resources. Fragmentary implementation of these measures started in 1996, and wider introduction depends on the pace of the country's economic stabilization.

In addition to the environmental strategies included in the 'Principal Directions', the Government considers the regeneration of the Dnieper of great importance. In 1997, the Rada adopted a national programme for improving the ecological state of the Dnieper river basin and the quality of drinking water. Its main goals are the permanent restoration of the Dnieper's ecological system, high-quality water supply, ecologically safe conditions for the population of the basin and their economic activities, and protection of the water resources from pollution and depletion. The cost of implementing the programme is estimated at 4 190 million hryvnias, which represents annually 500 million hryvnias by the year 2000. However, in 1997, only 90 million hryvnias were spent on the programme, and in 1998 only 113 million. Due to the lack of clear priorities, the few available funds have been divided over the measures to be taken, so that no single measure could be fully implemented. For instance, among the large number of water facilities under reconstruction, only few are completed.

The Ministry of Environmental Protection and Nuclear Safety has developed similar programmes for the Dniester and the Siversky Donets. For lack of funds, the programmes have not been approved by the Cabinet of Ministers. Their implementation will therefore have to be financed by regional and local authorities. No information is available on the progress achieved. Although generally part of the "Principal Directions", no similar programmes exist for the regeneration of other rivers or for the (re)construction of communal and industrial waste-water treatment plants.

The legislative framework for water management contains, among others, the Law on Environmental Protection and the Water Code of Ukraine. The Law on Environmental Protection (1991) lays down the basic principles of nature protection and, in particular, the principle that users must pay for the use of water resources as well as for the discharge of pollutants into water. The Water Code (1995) provides the basic framework for Ukraine's water legislation. The tasks foreseen in the Water Code are:

- management of legal relations to ensure water protection
- rational use of water for the population and businesses
- restoration of water resources
- protection of waters from pollution, littering and depletion
- prevention of accidental water pollution and floods and elimination of their consequences
- improving the condition of water bodies
- protection of rights of enterprises, institutions, organizations and citizens.

The Water Code specifies the ownership of groundwater and surface waters and regulates the management, conservation and use of the water resources. All the water resources belong to the people of Ukraine and are allocated for use. Furthermore, the Water Code regulates the competencies of the Verkhovna Rada of Ukraine, of local radas of people's deputies, and of central bodies with executive power for the management, control of use and renewal of water resources. Amendments to the Water Code have recently been proposed to the Parliament (Verkhovna Rada).

Institutional arrangements

Water management is shared by a number of State institutions: the Ministry of Environmental Protection and Nuclear Safety, the Ministry of Health Protection, the Committee on Water Resources, the Committee on Geology, the Committee for Hydrometeorology and the State Committee for Building, Architecture and Housing Policy. In April 1999, the structure of the Government was reviewed to subordinate some Committees for water (water management, geology and mineral resources, hydrometeorology) to the MEPNS (see Chapter 1).

The Ministry of Environmental Protection and Nuclear Safety carries out complex management of water resource protection, develops new legislation and regulations, conducts State environmental impact assessment, issues permits for special water use, conducts State monitoring of water resources and enforces the various water regulations. Moreover, it is entrusted with the overall coordination of monitoring activities.

The Ministry of Health Protection operates 'sanitary epidemiological' stations. It – rather – infrequently monitors drinking water and

recreational water sites along rivers, reservoirs and seashores. Its emphasis on the health impact of water quality is reflected in the importance of biological parameters in its monitoring programme. Furthermore, the Ministry is responsible for setting quality standards for drinking water.

The Committee on Water Resources assesses the permissibility of water abstractions in the framework of the permitting system for special water use. Furthermore, it maintains more than 200 monitoring stations for surface water. The Committee on Geology protects and monitors the geological sphere, including groundwater, whenever economic activities have an external effect. It operates an extensive monitoring network for groundwater and gives advice on groundwater abstractions in the context of the permits for special water use. The Committee for Hydrometeorology operates the most extensive water-quality monitoring network. The State Committee for Building, Architecture and Housing Policy is responsible for a set of construction norms and regulations for, among other things, the construction of sewage treatment plants and waste-water collection systems.

Regulatory instruments

As elsewhere, the current water management in Ukraine is a combination of command-and-control (standards, norms, environmental impact assessment, permits for water use and discharge, State inspection) and economic instruments (charges for water use and pollution discharge, fines).

At present, the former USSR water standards are still in force for:

- water used for drinking, communal, recreational and other economic needs of the population
- water used for fish farming.

A new, additional standard for water used for healing, recreational and other purposes is under development.

The standards for water used for fishing are currently the most stringent. There is one environmental standard: maximum allowable concentrations (MACs). They are given for a fixed time period, on the basis of zero human health damage. There are MACs for more than a thousand different substances.

The number and, in some cases, the strictness of MACs are impractical. The resulting complexity of the system undermines enforcement and also overwhelms understaffed and underequipped regulatory authorities. The question of revising environmental standards and monitoring parameters is currently being addressed in the framework of harmonizing Ukraine's environmental legislation.

According to the Water Code, groundwater and surface water use (for both abstraction and discharge) requires a permit. The licensing procedure depends on whether the water resources are of national or local significance. Water bodies of State significance include, among others, sea water, surface waters located on the territory of more than one oblast and groundwater used for centralized water supply. The permits for water resources of national significance are granted by the Ministry of Environmental Protection and Nuclear Safety, while abstraction from and discharges into local water resources are permitted by local authorities. The permit determines the volume of raw water that can be taken and used and also the amount of pollutants that can be discharged (concentration as well as load). Ambient standards are used to set effluent limits, via algorithms or modelling exercises that try to calculate the contribution to ambient pollution of an individual source.

The permit also defines the rate of the two fees (abstraction and pollution charges) that the user has to pay. If operating above the permissible limits, the polluter has to pay five times more. The licensing procedure provides for cooperation with the Committee on Water Resources (abstraction of surface water), the Committee on Geology (abstraction of groundwater) or the Ministry of Health Protection (abstraction of water for medical purpose and health resorts). The permit may be granted for a short- (up to 3 years) or a long-term period (from 3 to 25 years).

The State Ecological Inspectorate reviews compliance. If regulations or permit provisions are violated, it is authorized to temporarily close down the polluting activity and to fine and sue the polluter (enterprise or person). However, the complexity of the permits and the lack of staff hinder enforcement of permit provisions. For

details regarding the permitting system, see also Chapter 2.

Economic instruments

In Ukraine, the population does not pay for the water resource itself; it only bears the treatment cost. The cost for the preparation and supply of water is approximately 0.30 hryvnia per cubic metre. Some population groups (war casualties, Chernobyl casualties, the unemployed) pay only 50% of total cost for drinking-water supply. Enterprises, organizations and institutions pay for the resource according to the water supply source. Charges apply only to operational costs and maintenance costs. Metering of piped water is rare.

The water permits establish two environmental charges: an abstraction charge and a pollution charge. The charges for abstraction differ for each river basin. The charges, laid down in Resolution 164 of 1997 of the Cabinet of Ministers, range approximately from 0.01 to 0.09 hryvnia per cubic metre for surface water and from 0.03 to 0.09 hryvnia per cubic metre for groundwater. The charge on the use of waters of local significance goes to the local budgets, while 80 per cent of the charge on use of waters of State significance goes to the State budget and 20 per cent to the local budget. When the quality of the drinking water supplied infringes hygiene standards, the responsible local authorities (municipalities or concessionaires) are fined up to 10% of the charges collected for water supply.

No information was available on the pollution charges or on charges for the collection of waste water, except for the city of Kyiv. There, the charge for domestic discharges is 0.2 hryvnia and for industrial discharges 0.4 hryvnia per m^3.

A budget line for investment in water protection works used to exist, but it has been suppressed. The gap is currently huge between the available funds and what is needed. This is partly the reason why Ukraine is considering a basin management approach. Today, the policy focuses on measures that are not too expensive. The basin approach, which is worked out for the Dnieper basin with the assistance of France, will try to optimize the mechanisms for water payment collection. The first objective will be to spend the funds on combating pollution from point sources, as the funds collected will not be sufficient to start to resolve all issues at once.

8.4 Conclusions and recommendations

Ukraine has strengthened its water management efforts in recent years and is continuing to do so. The Government outlined its important objectives for water management in the 'Principal Directions of State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety'. Much attention is given to the reformulation and extension of the legislative and regulatory framework, i.e. charges for water use and coordination of State monitoring. Furthermore, problem-oriented programmes and projects for their implementation are being developed (e.g. National Programme for sanitation of the Dnieper river basin and improvement of drinking-water supply). However, despite all regulations and programmes, only few concrete measures have so far been taken to reach the water management objectives.

At least three ministries and four State committees share water management tasks. The split of responsibilities together with poor communication between these authorities sometimes cause 'gaps' in the activities to be undertaken, duplication of activities or even contradictory actions. It should be possible to overcome this problem, possibly by concentrating the mandates in fewer institutions and entrusting explicit responsibilities for coordination. To better harmonize actions and streamline standards among the different institutions, one institution should be responsible.

Recommendation 8.1:
The institutional responsibilities for water management and standard-setting should be streamlined. Clear responsibility for coordination should be assigned and a coordination mechanism should be created.

Recommendation 8.2:
The establishment of a national agency responsible for unifying the standard system and methods, i.e. a standardization agency, should be considered. See also Recommendation 1.5.

To improve the management of water resources, the river basin approach should be further implemented. National action plans have already been developed for some river basins, e.g. the Dnieper. In developing the National Programme for sanitation of the Dnieper river basin and improvement of drinking-water supply, the role of regional and local authorities was restricted to providing information on (stretches of) the Dnieper

to the national authorities. Obviously, measures taken (or not taken) upstream will affect the measures to be taken downstream. It is surprising that, within a river basin, no formal consultation between national, regional and local authorities takes place. Such cooperation would help general cooperation between these authorities, and would certainly also provide for a more coherent integrated water management approach in the basin concerned. This suggestion should be taken into account in the new (April 1999) proposal of the MEPNS to establish a basin council for the implementation of the National Programme for sanitation of the Dnieper river basin and improvement of drinking-water supply. The corresponding draft resolution of the Cabinet of Ministers has been submitted to all interested national and regional authorities and scientific and environmental organizations.

According to the Water Code, revenues from water abstraction from and discharges of waste water into waters of local significance are paid into the local budgets. Revenues from water abstraction from waters of State significance benefit the national budget (80 per cent) and the regional budgets (20 per cent). As most of the population is supplied from waters of State significance (the Dnieper alone supplies 60 per cent of the population), most revenues will benefit the State budgets, whereas the investment, operation and maintenance costs of water supply, sewerage and treatment are to be ensured at the local level. A more balanced decentralization of both responsibilities and budgets would seem to be a prerequisite for more effective water management.

Recommendation 8.3:
Basin (or catchment) structures and committees should be created for each significant river basin, and integrated water management principles introduced at basin level. All affected national, regional and local authorities should participate, possibly together with international partners (i.e. the Republic of Moldova in the case of the Dniester). The institutional responsibilities of the basin structure should be matched by sufficient funding provisions, so that the (local) water management objectives can be achieved, in particular with regard to waste water. Financial resources from water charges collected at the basin level should be reallocated to improving the water management situation on the same territory. See also Recommendation 9.6.

A number of monitoring networks have been set up under various ministries and committees. The monitoring networks are intended to meet the particular purposes of these various authorities and mostly operate independently. Duplication of work is very likely, especially in the monitoring of chemical and bacterial parameters.

The monitoring of surface waters is quite good and complete, except regarding diffuse pollution sources. The monitoring of groundwaters is less satisfactory. The various monitoring networks generate a large volume of data, which are stored in different data banks, using different software. Consequently, it is very difficult to compare the monitoring data of different networks. Furthermore, many of the monitoring data do not serve regulatory objectives, and in some cases data do not even seem to be available to the regulatory authorities. Often, monitoring data are collected and stored by regional offices and not made available to the State level for decision-making.

Under Regulation No. 391 of 1998, the Ministry of Environmental Protection and Nuclear Safety is authorized to take responsibility for coordinating these monitoring activities to ensure their better integration and quality control. The implementation of this provision would not only save substantial costs and make the monitoring data obtained from different programmes more consistent, it would also allow for the full use of monitoring results in decision-making at all levels.

Recommendation 8.4:
The Ministry of Environmental Protection and Nuclear Safety should coordinate monitoring activities as foreseen in Resolution No. 391 of 1998. See also Recommendations 1.5 and 9.5.

Ukraine has a large number of, in some cases, very strict water-quality standards (e.g. BOD_5). This results in a very complex system of permits. It undermines enforcement and overwhelms understaffed regulatory authorities.

Recommendation 8.5:
The number of water-quality standards should be reduced and they should be set at realistic levels, making enforcement possible. See also Recommendation 2.2.

Ambient water standards are used to calculate

maximum allowable discharges of pollutants into water bodies. Although provided for in the Water Code, best available technologies (not entailing excessive costs) are not established so far. The rationale underlying technology-based standards is to try to reduce, with available technology, such discharges to the extent possible. By contrast, Ukraine's current practice consists in asking industry to discharge waters that reach the ambient standard targets of the receiving streams. This does not encourage it to reduce water consumption, as the ambient standard targets can be achieved by diluting the waste water. Moreover, as the permit is a single-medium permit, it could be tempting to divert pollution from water into another environment compartment such as air or solid waste. That is why the introduction of an integrated permitting system in industry should also be seriously considered (see Chapter 1 and Recommendation 1.4). The current Europe-wide introduction of technology-based emission standards is thus beneficial to environmental protection.

Recommendation 8.6:
The best available technologies not entailing excessive costs and/or technology-based emission standards should be at the heart of abatement strategies. See also Recommendations 5.5 and 10.1.

Water consumption is too high in Ukraine, which parallels the fact that water prices for households and industry are relatively low. That is not surprising, since Ukrainian legislation prescribes that waters are the exclusive property of the people of Ukraine and that the use of water is free of charge. Only the distribution of drinking water and the collection and treatment of waste water are moderately charged. These charges do not fully cover all costs, including investments. A big effort should be made to recover the cost of investing, operating and maintaining water facilities. Increases in user and discharge rates are important steps to promote adequate funding of infrastructure, e.g. (re)construction of sewage treatment plants. Putting a price on water that fully covers the cost of its treatment and metering water in order to charge for what has really be consumed would certainly bring in considerable water savings. At the same time, the users' bills would not be particularly affected, as they would consume less water, although they would pay more for it. This would also improve the functioning of water-supply facilities and waste-water treatment units, as they will have less water to treat.

Recommendation 8.7:
The cost of water should be transparent and realistic. Metering should be introduced for all users and payments made proportional to the water quantity really consumed. Water prices should cover the full cost of investing, operating and maintaining the water and waste-water infrastructure. Provisions should be made for those people who cannot afford it. See also Recommendation 2.1.

Most towns in Ukraine appear to be connected to treatment facilities for municipal and industrial waste water. Due to the capacity and the technical state of the existing facilities, the quality and efficiency of waste-water treatment should be improved. In particular, a reduction in water consumption would entail better conditions for operating treatment facilities. It would reduce the load to treat and therefore improve the performances of the facilities. This remark is valid for supply plants as well as for waste-water treatment plants. Also, the current practice of treating sewage sludge is far from satisfactory and should be rationalized. This sludge should on no condition be discharged back to the river. The preferred option would be to use it as fertilizer if it does not contain an excess of heavy metals. This means that some industrial waste water should be pretreated to eliminate the toxic elements or diverted away from the waste-water treatment plant. Treatment plants should therefore be managed by capable people. Insufficiently trained personnel is a more general problem: specific training in plant operation, process control and instrument operation will improve treatment performance.

Recommendation 8.8:
To improve the efficiency of waste-water treatment, the staff should be trained further in plant operation, process control and instrument operation.

Recommendation 8.9:
There must be clear responsibility for the urban waste-water management and sewage sludge disposal. The preferred use of the sludge should be as fertilizer. The European Directives on urban waste water and on use of sludge in agriculture should serve as guidance.

Finally, the quality of surface water is in general insufficient for drinking purposes. This is the consequence of municipal and industrial waste-water discharges, and diffuse pollution from

agriculture and air pollution deposition. This problem is not likely to be solved in the near future. Groundwaters are less vulnerable. Therefore turning as much as possible to groundwater for drinking water is certainly a reasonable and sustainable objective.

Recommendation 8.10:
Supplying the population with sufficient quantities of drinking water that meets hygiene standards should be seen as a priority. The public should have access to information on the quality of drinking water. The use of suitable groundwater sources should be increased and drinking-water resources should be protected accordingly. See also Recommendation 14.1.

Chapter 9

MANAGEMENT OF THE ENVIRONMENT OF THE BLACK SEA AND THE SEA OF AZOV

9.1 The Ukrainian sector of the Black Sea and the Sea of Azov and their coastal zone

Geography and geomorphology of the coast

The Black and Azov seacoast constitutes a significant part of Ukraine's southern border. It covers seven administrative regions (Donetsk, Zaporozh'ye, Kherson, Mikolayiv and Odessa), as well as the Autonomous Republic of Crimea and the city of Sevastopol. The entire coastline is 3 009 km long. The Black Sea coast in Ukraine is 1 802 km long. Its geomorphologic structure is a result of intensive tectonic transformations of different kinds, primarily in the Neogene-Quaternary period. The structure is very complex, but in general geomorphologic terms the Ukrainian coast is in the Black Sea area of layer-accumulative and layer-denudative plains.

Some parts of the coastal zone are exposed to substantial geological risk, due to seismic activity, especially on the Crimean peninsula. The region's modern geomorphology is also affected by slow latitudinal subsidence, estimated at 0.25 m per 100 years.

The relief of the coastal zone is typically plain, except on the Crimean peninsula. The mouth of the Danube is the only delta. The other rivers usually have special estuaries or "limans", especially in the areas where the coastline has sunk below the sea level. In the hilly or active cliff zones, landslides are common.

The Sea of Azov's coastline is 825 km long (without Sivash). Like the Black Sea's, its geological conditions are also complex, but the main relief-forming factor is coastal erosion. Due to the sinking of the coast and its mineral composition, the process is intensive. In the accumulative zones along the Azov coast, the most important "building materials" are the shells of benthic organisms.

Basic information on the natural marine water composition and dynamics

Ukraine's inland waters cover 10 881 km^2, its territorial waters 29 454 km^2 and the first 200 m of the shelf comprises 55 750 km^2, which amounts to 57 per cent of the total Black Sea shelf. The Black Sea is on average 830 m to 1 600 m deep and the Sea of Azov 3 to 15 m.

The Black Sea's physicochemical and biological features are to a very great extent affected by the large rivers like the Danube, the Dnieper and the Dniester. They substantially reduce the water's salinity, transparency and temperature, notably near the Danube delta, the estuaries and the shallow shelf. The rivers also cause an enormous organic load of both anthropogenic and natural origin. The Black Sea has the biggest specific watershed in the world. As a result it receives some of the pollution generated by more than 170 million people, of whom 6.5 million live on Ukraine's coast. The vulnerability of the Sea is a result not only of anthropogenic factors. Some of the region's natural characteristics have had adverse effect since antiquity and have converted it into the biggest anoxic water body in the world. Consequently, there is a very clear stratification of the marine water. The upper layer is the most important in terms of bioproductivity. In the intermediate layer the oxygen content decreases and in the lowest the conditions are totally anaerobic. The volume of the intermediate and lowest layers in Ukraine's part of the Sea is estimated at 95.6 per cent of the total volume of sea water.

The salinity of the Black Sea varies from 12.2 to 22.4 per thousand in the bottom layers to 5 to 10 per thousand near the mouths of the Danube and the Dnieper. The surface water is the most saline (up to 18.2 per thousand) in the central part of the Sea. Below the layer in which surface water mixes (300 m), salinity rapidly increases up to 21 per thousand, and then less rapidly to 12.2 to 22.4 per thousand.

The vertical water exchange in the Black Sea is slow. Estimates differ, but it is generally accepted that it takes hundreds of years. The Black Sea exchanges its water with that of the Sea of Marmara through the Bosporus Straits. The mass balance (in terms of salinity) remains the same over time because more water flows into the Black Sea than evaporates from it.

The Sea of Azov is an integral part of the Black Sea basin. It is linked with the Black Sea through the Kerch Strait. It is shallow and has subsurface slopes. Its northern part is very shallow (a 20-30 km wide zone that is only 2-3 m deep); the southern slope is steeper. The depths there reach 11-12 m.

There are two major zones in the Sea of Azov that, together with the Gulf of Taganrog, have their own distinct hydrodynamic regime. They are very much affected by the weather conditions, because they are small and shallow. The drift currents in the Sea form two systems (clock-wise in the Gulf of Taganrog – north-east winds, and anticlockwise – north-west winds). The structure is multi-layer and depends on the direction of the wind, and the coastal runoff. During storms, the current's velocity can reach up to 3.5 km per hour, and the storm waves in the Gulf of Taganrog can reach up to 5 m.

The Sea's hydrochemistry is influenced by the inflow of the Don and Kuban rivers, and by the ineffective water exchange with the Black Sea.

9.2 Environmental conditions and sources of environmental degradation

Environmental conditions

During recent years the environmental conditions of the Black Sea and the Sea of Azov have improved slightly. The water's nutrient content is reported to be stable, remaining below the maximum allowable concentrations (MACs) for ammonia nitrogen, nitrites, nitrates and phosphates. This has a positive impact on the state of the sea ecosystem as a whole and is reducing the number of algae blooms.
Detergent pollution is certainly a problem near Crimea and Odessa, where it exceeds the MAC 1.2 – 2.2 times. The highest concentrations are detected near Mariupol, but on average the detergent content there is below the MAC.

The phenol content in some areas is high. The average concentrations reach 2.2 times the MAC near the mouth of the Dnieper River, 3 times the MAC in Suchiy Liman, in the southern part of the Kerch Strait and near Mariupol and 6 times the MAC in the port of Odessa. The highest concentration has been measured in Buzkii Liman and the port of Odessa, where it amounts to 15 – 17 times the MAC.

The heavy metal content breaches the limit in the regions of Alupka, Yalta and Gurzuff. The copper concentration is 4.2 times the MAC, cadmium 8.8 times, zinc 5.6 and mercury 1.5. The chromium content is within the MAC. The highest concentrations have been detected near the deep-water sewerage discharge of Yalta. In general, the manganese, cobalt and lead concentrations are below the MACs.

The PCB concentration in the Bay of Sevastopol is reported to be, on average, 14 ng/l and maximum 33 ng/l.

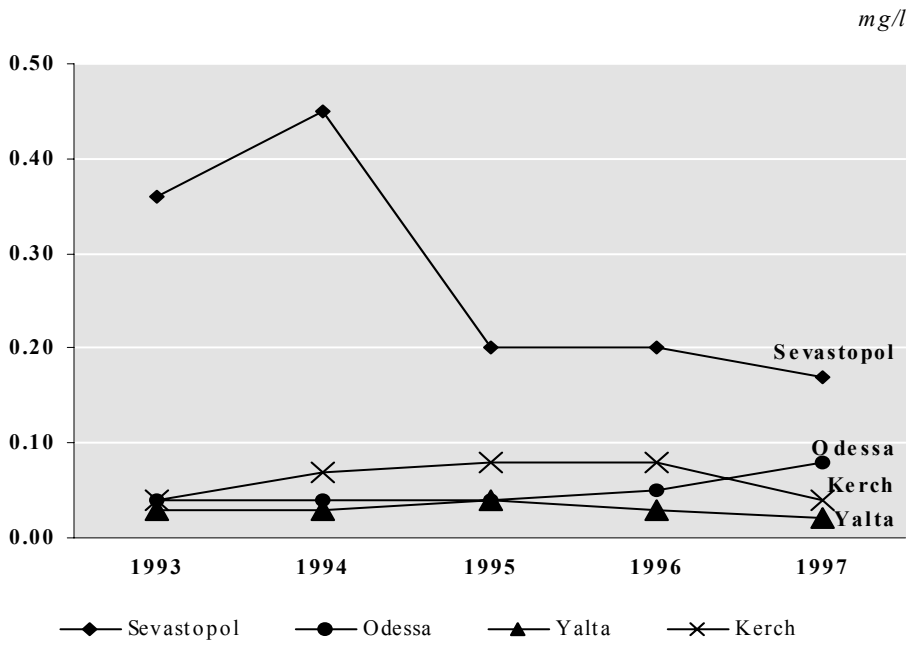
Chlorinated pesticides have been found in some parts of the Black Sea, mostly near the Danube delta.

The most dangerous pollutants in the sea water are oil products. According to the regular monitoring results and those of scientific research in the region, the oil product concentration is most often below the MAC (0.05 ppm). The cleanest sea area is near Yalta, where the average oil product concentration is about 0.02 ppm. The Sevastopol Bay region is the most endangered, as a consequence of the activity of the fleet, both onshore and offshore. In the bays of Pivdenna, Kamishova, Golandiya, Karantinna and Pivnichna, petroleum hydrocarbons are constantly exceeding the limits 3 – 10-fold.

Land-based point sources of pollution

The coastal zone is highly developed and industrialized. The typical sewerage systems are combined (storm water is carried together with domestic sewage). Sixteen waste-water treatment plants operate in the coastal zone, providing primary and secondary treatment. They use conventional technologies, designed in compliance with the technical standards of the former USSR. The treatment plants in the coastal region are no different than the ones elsewhere in the country (see Chapter 8). The lack of funds for new investments and for proper maintenance means that the purification facilities are ineffective and cannot operate at full capacity. A significant part of the sewerage system is in poor technical condition, for

Figure 9.1: Oil product concentration in the most important parts of the Ukrainian Black Sea, 1993-1997



Source: Environmental Conditions of the Black Sea in 1997, Report of the State Inspectorate for the Protection of the Black Sea, Odessa.

Table 9.1: Pollution loads from municipal sources in selected regions

tonnes/year

	BOD5	TSS	Total N	Total P	Oil
Totals	**18.64**	**33.84**	**16.87**	**6.32**	**24.14**
Mykolayiv region	2.52	4.52	8.92	4.16	4.83
Odessa region	10.57	20.02	3.74	1.02	5.17
Republic of Crimea	5.55	9.30	4.21	1.14	14.14

Source: Assessment of Land-based Sources of Water and Land Pollution in the Ukrainian Black Sea Coast, 1996.

instance in Mariupol, Simferopol, Sevastopol, Kerch, Mykolayiv and Odessa. Accidents in the outdated sewers and pumping stations are an additional source of pollution.

As Table 9.1 shows, the high nutrient load from domestic waste water is the main problem. Given the financial shape of the water sector, it is unlikely that the waste-water treatment plants will be upgraded anytime soon to remove nitrogen and phosphorus.

The local industrial waste-water treatment facilities are often obsolete and not in a position to meet effluent standards. Apart from the typical pollutants, given in Tables 9.1 and 9.2, the heavy-metal content in the discharges is a particular problem. This applies to copper, zinc, cadmium, cobalt, nickel and chromium. Moreover, the maximum allowable concentrations are exceeded for iron and mercury (up to 2-fold), phenols (3- to 7-fold) and detergents (2- to 3-fold). Sometimes the high copper content in the coastal water is the result of the use of copper-containing pesticides.

In 1997, the Black Sea received 4.5 million m^3 of untreated waste water, 90.2 million m^3 of partially treated waste water and 157.5 million m^3 of waste water treated to the standard. The waste-water flow to the seas is diminishing, mainly as a result of Ukraine's lower economic activity.

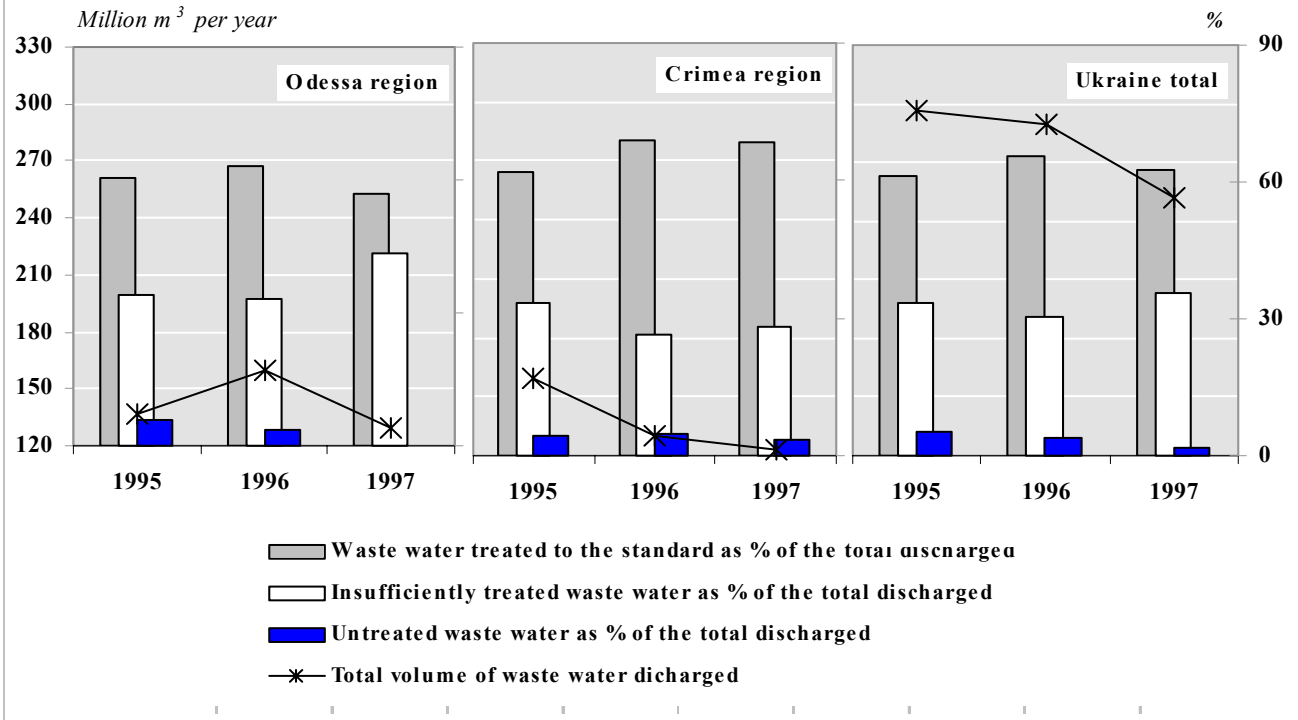
Table 9.2: Pollution loads from industrial sources – selected regions

tonnes/year

	BOD5	TSS	Total N	Total P	Oil
Totals	**36.56**	**70.43**	**31.21**	**17.68**	**280.70**
Mykolayiv region	0.67	2.64	0.29	1.00	210.00
Odessa region	29.89	13.05	26.11	15.00	62.70
Republic of Crimea	6.00	54.74	4.81	1.68	8.00

Source: Assessment of Land-based Sources of Water and Land Pollution in the Ukrainian Black Sea Coast, 1996.

Figure 9.2: Waste water discharged into the Black Sea, 1995-1997



Source: Environmental Conditions of the Black Sea in 1997, Report of the State Inspectorate for the Protection of the Black Sea, Odessa.

Inflow from the rivers

The river inflow, as explained in Chapter 8, is an important factor for the environmental state of the Ukrainian part of the Black Sea and the Sea of Azov. The annual load from Ukraine's rivers to the marine environment is estimated to be 653 000 tonnes of suspended solids, 8 030 tonnes of organic matter, 1 895 tonnes of nitrogen and 1 163 tonnes of phosphorus. The biggest marine water polluters are the Danube, the Dnieper, the Dniester, and the Pivdeni Bug. The input from a number of smaller rivers is of local importance. It has an impact especially on recreation, fisheries and aquaculture and sometimes undermines the biological diversity.

Non-point sources of pollution

There are two major types of non-point sources of pollution along Ukraine's coast – the runoff from residential areas and settlements and that from agricultural land. The most important problem related to the former is the bacterial and oil pollution of the coastal waters. This is especially true in the regions of Odessa, Mariupol, Mykolayiv and Kherson. The incidental character and the short duration of the storm-water discharges make them difficult to assess and treat. Normally the sewerage systems of combined type are equipped with overflows at the waste-water treatment plant's inlet, so that most of the storm water bypasses the

facilities. There are no retention tanks. The studies carried out by Ukraine's scientific institutes in the coastal area prove that, for this type of pollution, the state of some other environment components is important, especially air and soils.

The amount of fertilizers and pesticides coming into the sea from agricultural land is estimated at 1.3 – 2.8 kg of nitrogen fertilizers, 0.05 – 0.1 kg of phosphorus fertilizers and 1 – 3 g of pesticides per ha. This pollution comes directly from the coast, as well as via small coastal rivers, gorges and ravines. Often the irrigation systems contribute to the nutrient and pesticide contamination of the marine waters. The measures to tackle the problem should involve not only the environmental authorities, but also the agricultural and forestry sectors, and be combined with coastal erosion protection.

Navigation and related activities

Navigation in the Ukrainian sector of the Black Sea and the Sea of Azov is intensive. More than 30 marine-transport facilities are situated along the coast. The most important are the ports of Odessa, Pivdenna, Illichovsk, Ust-Dunaisk, Izmail, Yalta and Kerch, and a number of shipbuilding and ship repair yards, such as Odessa SRY "Ukraine", Odessa SRY N2, Illichivsk SRY, Kiliya SRY and Izmail SRY. The total volume of the annual discharges from these facilities is estimated at 7.5 million m^3 of untreated and 200 million m^3 of partially treated waste water, so that their average load to the coastal waters is up to 120 000 tonnes of suspended solids and 50 tonnes of oil products.

The ports are equipped with reception and purification facilities for the domestic and bilge waters from the ships. However, pollution from shipping still occurs, due to accidents or illegal discharges. The number and magnitude of the shipping-related emergencies has increased during recent years. In the past five years there were 4 accidents with significant oil spills and 30 minor ones in the region of Odessa. Another "hot spot" in terms of environmental safety of shipping is the Kerch Strait. Ports are supplied with facilities for combating accidental oil pollution, but there is no equipment for emergency response in the open sea.

Airborne pollution

Airborne pollution and its impact on the marine environment in the Ukrainian sector are substantial. It has been estimated that the annual nitrogen input into the Black Sea amounts to 190 000 tonnes and the phosphorus input to 17 000 tonnes. For the Sea of Azov the quantities are 18 000 tonnes and 1 600 tonnes respectively. The air along the coast of the Sea of Azov is particularly polluted owing to such important industries as the Azovstal metallurgical complex. The contribution of the highly industrialized region of Donets should also be taken into consideration. Air pollution is increasing and is expected to continue to have a negative impact on the marine environment, because in recent decades the share of coal in the energy balance has risen.

Dumping, dredging and deepening of the navigation channels

Dumping solid wastes, dredged materials and soil has an adverse impact on the photosynthesis and the biological productivity of marine ecosystems. According to the health authorities of the coastal region, more than 5 million m^3 of solids have been dumped in the north-western part of the Black Sea alone in the past 20 years. In the same part of the Sea, 5 million m^3 of soil are dumped each year. Most dumped soil and dredged materials come from ports and navigation-related activities. In the whole Black Sea zone there are about 30 dumping areas, where the accumulation of solids exceeds the natural sedimentation rate by more than 1 000 times. An additional factor for mobilization of solids is the sand extraction for construction purposes.

9.3 Impacts of environmental degradation in the coastal zone

Impact on human health

The sanitary parameters of the waters of the Black Sea and the Sea of Azov in the Ukrainian sector are poor. The most widespread microbial species (determined as conditionally pathogenic or pathogenic) are the intestinal bacillus, staphylococcus and salmonella. There has been a drastic increase in the average presence of the intestinal bacillus (500 times higher than in the 40s). Several cholera outbreaks have been reported in the south (see also Chapter 14).

From the environmental point of view, it is important to evaluate the population's health in the region as a complex index for the state of the environment. This applies, in particular, to diseases that are not caused by bacterial pollution. Food contamination, poor water quality and unsanitary conditions are typical in the country's coastal

region. High concentrations of DDT, HCH and lindane in several kinds of food products, such as fish, fresh and canned vegetables, are frequently reported. The unhealthy state of the coast is confirmed by the mortality rates in Odessa, Mykolayiv and Kherson, which are the highest in Ukraine. Also, child mortality in the south is at its highest level for 15 years.

Impact on fisheries

Fisheries used to play a significant role in the economy of Ukraine's coastal region. The most important commercially exploited fish species were sprat, anchovy, roach, Black Sea shark, bream, as well as some other sea products, such as mussels and seaweed (*Phyllophora* and *Zoostera*). The facilities for processing the fish and other sea products are concentrated in Odessa, Kerch, Vilkovo, Bilgorod-Dnistrovsky, Illichivsk, Mikolayiv, Sevastopol, Mariupol, Yalta and Genichesk.

The fishery activities in the region are closely linked to the conditions in the marine environment. The sharp decrease in bioproductivity owing to increasing water pollution has caused this sector of activity to collapse. As Table 9.4 shows, the decline in the catches is drastic. At present, the Black Sea fisheries maintain about 80 per cent of their 1997 catch, but the Sea of Azov, being very productive in global terms, has lost more than 90 per cent of its productivity. Studies have proven that the primary reason for the decline in fish stocks in the Black Sea and the Sea of Azov is not overexploitation of the marine living resources. Much more important are the consequences of water contamination, like the destruction of the spawning grounds and the decrease in the food base, decisive for fish reproduction. The valuable commercial species are at the same time the most affected. In general the loss of the sector is estimated to be at least US$ 75 million annually.

Table 9.3: Development of fish catch, 1980 - 1996

Annual average 1960-75 = 100

	1980-1989	1990	1991-1996
Fish catch	37	26	18

Source: Statistics of the Ministry of Fisheries.

Coastal erosion

It is estimated that about 2 600 km of the coastline is affected by abrasion or erosion. More than 100 ha of land are lost to different kinds of development each year. This reduces the area for urban and tourism development and sometimes has adverse effects on the coastal ecosystem, which is highly vulnerable. The coastal protection facilities do not constitute a single system to protect the entire Ukrainian coast. About 150 km have been fortified after numerous decrees by the central Government.

When setting priorities in coastal protection, the following criteria, based on economic and social factors, are considered: the cost-benefit ratio (total amount of money spent on protection against the total price of the land and all assets), social and economic values of the architectural, historical and ecological assets of the threatened area, possible reduction in the risk to human life. It is clearly understood that common coastal protection practice should be changed. Instead of the typical engineering constructions, which often undermine the environmental conditions, new techniques should be introduced, taking into account their environmental impact.

At present, the existing coastal protection facilities are in good condition, but in recent years few investments have been made to improve the system.

Tourism

The Black and Azov coastal region is traditionally considered to be Ukraine's most valuable tourism resource. It has more than 540 km of beaches. It is suitable for recreation and has many mineral water springs (estimated total water flow is up to 13 000 m^3/day) and many deposits of curative mud. It is estimated that Ukraine's Black and Azov coast can receive about 1.5 million tourists at a time. The most important recreational regions are the Crimea and Odessa region on the Black Sea, and Donetsk, Zaporizhya and part of the Kherson regions on the Sea of Azov. In general, the tourism infrastructure on the Azov seacoast is not well developed.

There are many so-called unorganized tourists. These visitors create additional problems, as their wastes are not collected or treated in the municipal systems. Frequently their stay on the coast has a direct adverse impact on the environment.

In recent years water pollution has been gnawing away at tourism as an economically important sector. This has resulted in a decline in recreational activities and a relocation of the tourist flow to other destinations, with significant losses for this industry nationwide. The frequent closure of beaches is mainly due to the poor bacterial state of the bathing water. There is no information on the total financial loss in tourism in Ukraine, but only in 1994 there was a decrease of 600 000 tourists in the Odessa region as a consequence of an epidemic. At the same time, according to data from the Ministry of Health Protection, in the Mykolayiv region alone the cost of cholera prevention amounted to US$ 6 million and about 50 000 tourists had to leave the recreation area.

9.4 Policy objectives and management practices

National legal instruments

The Law on Environmental Protection of 1991 sets up a general framework for the development of legal instruments for the conservation and rehabilitation of the components of the environment, including the Black Sea and the Sea of Azov.

The Water Code of 1995 develops further the tools for protecting water and, in particular, the Black Sea and the Sea of Azov. The Code states that intrastate sea waters and the territorial sea are part of water bodies of national significance. Its most important features, related to marine protection, are that it introduces special requirements for sea transport, laying down how vessels have to be built and equipped to prevent any spill of untreated water. It also defines the types of activities that are allowed on the sea bottom. The Code defines the water protection zones and strips and sets specific restrictions in these zones of regulated economic activity.

The Regulation on the Protection of Internal Sea Waters from Pollution and Litter stipulates the measures that need to be taken to protect the marine environment against pollution by industrial and domestic waste water, industrial wastes and oil products. It aims to prevent the deterioration of the marine water quality, ensure the water is clean and can sustain fish and other economically valuable resources. The Regulation is also intended to safeguard biodiversity and prevent any negative change in the water's physical and chemical regime or any reduction of its natural self-purification ability. Above all, it regulates the onshore activities related to marine transport and port operation and also some emergency response measures. The Ministry of Environmental Protection and Nuclear Safety has a coordinating and supervisory role. The Regulation also contains some common provisions about land-based sources of pollution. These are general, so in practice legal instruments designed to protect inland waters are often applied.

Various resolutions of the Cabinet of Ministers complement the above instruments. For instance, there is one resolution that lists the types of activities and facilities that pose a high threat to the environment. Another lists those sections of bodies of water where commercial fishing is allowed. The former defines ports as environmentally hazardous facilities (but it does not say anything about the navigation itself or the related cargo operations). The latter states that the Black Sea and the Sea of Azov are important for their living resources. This constitutes the legal ground for applying the most stringent water-quality norms to them.

The lack of specific norms and standards for marine water quality hampers control activities, permitting procedures and environmental assessments. For the time being, the general norms for surface waters are being applied.

International instruments and cooperation

The magnitude and complexity of the degradation of the Black Sea's and the Sea of Azov's ecosystem surpass the boundaries of the individual coastal States. Ukraine has made substantial efforts to establish an adequate international legal framework and ensure effective cooperation to conserve the marine environment. Ukraine is a Contracting Party to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which states that the Black Sea and the Sea of Azov are a "special area".

The basic international document that outlines the framework for common regional principles is the Convention on the Protection of the Black Sea against Pollution. Ukraine signed the Convention in 1992 and ratified it in 1994. The main objective of the Convention is to set up favourable conditions for concerted action to preserve the Black Sea's and the Sea of Azov's environment and living resources, taking into consideration the economic, social and health aspects of their pollution. It lays down primary measures to prevent, mitigate and

control marine pollution resulting from both onshore and offshore activities, and to cooperate in emergencies. It also envisages that the Parties will cooperate in scientific research and in developing national legislation to assess environmental damage and liability. Protocols on diminishing pollution from land-based sources, on prohibiting dumping and on pollution with oil products and other hazardous substances are an integral part of the Convention. This makes it a practical document with real impact on the regional management of the environment.

The Ministerial Declaration on the Protection of the Black Sea (Odessa, 1993) outlines the political framework for the implementation of the Convention. It is based on the Rio Declaration and calls for immediate, reasonable and continual actions at all levels to protect and, where necessary, rehabilitate the marine environment and ensure the sustainable development of the Black Sea.

The Odessa Declaration contains a timetable for actions aimed at conserving and protecting the Black Sea's environment. It was the basis for the International Programme for the Environmental Management and Protection of the Black Sea - the Black Sea Environmental Programme (BSEP, 1993-96). Implementation of the Bucharest Convention and environmental programmes such as the BSEP has been difficult, primarily for reasons of funding. The Convention foresees the establishment of a commission and a standing secretariat to coordinate the activities. In May 1995, an expert meeting and a meeting of the Parties to the Bucharest Convention were held in Bulgaria and proposals for the establishment of the secretariat were drafted and discussed. However, no final agreement has yet been reached on the establishment of the secretariat or the commission.

The Declaration approved at the Monaco Ministerial Meeting (October 1998) provides for more intensive pollution monitoring and assessment, and, in particular, for incorporating the monitoring of radioactive substances. There is strong need to improve coordination between the "Plan of activity", envisaged in the Declaration, and the various monitoring activities within the Black Sea Environment Programme and the respective region-wide monitoring network, in compliance with the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea.

The international Black Sea Environmental Programme (BSEP) started in 1993. Its main objective is to coordinate the endeavours of the Black Sea coastal countries to implement the Bucharest Convention on the Protection of the Black Sea against Pollution. Till 1996 the Programme was funded by GEF and a substantial contribution from the EC. Then it was funded by UNDP and the TACIS and PHARE programmes. In 1998 the coastal States, including Ukraine, provided some funding themselves. BSEP Activity Centres were set up in every participating country and have started to work. Focal Points for the following six activities were established in Ukraine:

- Emergency Response Centre
- Centre for Routine Pollution Monitoring
- Centre for Biodiversity Conservation
- Centre for Development of Fisheries and Marine Aquaculture
- Centre for Special Pollution Monitoring, Impact Assessment Programmes and Environmental Quality Standards
- Centre for Integrated Coastal Zone Management.

The Programme focuses on the environmental and safety aspects of shipping, pollution monitoring and assessment, control of pollution from land-based sources, development of common methodologies for integrated coastal zone management, conservation of the biological diversity and fisheries and other marine living resources. The Ministry of Environmental Protection and Nuclear Safety coordinates the Programme's activities at the national level, whereas the Centre for Marine Ecology in Odessa coordinates the monitoring activities within the Black Sea region. The Programme's most important achievements are:

- The establishment of a network of experts and institutions throughout the region, and the renewal of the links between the scientific community and the environmental administration, which were lost during the political and economic changes in the early 90s.
- The collection and interpretation of a significant amount of information on the environmental state and trends of the Black Sea and its coastal zone. Drafting of national reports on all the Programme's main areas of activity.
- Study on Black Sea environmental investment priorities.
- Preparation of the Transboundary Diagnostic Analysis Report and the Strategic Action Plan

for the Rehabilitation and Protection of the Environment of the Black Sea (together with the other coastal States).
- Draft national programme for the protection and rehabilitation of the Black Sea and the Sea of Azov.
- Modernization of the monitoring laboratories, supply of state-of-the-art analytical equipment, staff training.

The basic problems to be overcome are the lack of a sustainable funding mechanism and of an executive body for the Istanbul Commission. One of the options for solving the Programme's financial difficulties is to establish a Black Sea environmental fund. The EC is currently providing financial and methodological assistance to study the feasibility of such a regional fund.

The first phase of the BSEP ended in 1996 and the Strategic Action Plan was signed in November. A second BSEP phase was adopted in 1997 to implement national strategic action plans. Ukraine has developed its Concept of the Protection and Rehabilitation of the Environment of the Sea of Azov and the Black Sea, with support from the TACIS Funds 1995/1996 for the Black Sea Environmental Programme and the Black Sea Environmental Project Implementation Unit, finally approved in July 1998. This is the first phase in the development of the National Programme for the Protection and Rehabilitation of the Environment of the Sea of Azov and the Black Sea in response to Ukraine's international obligations.

The Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (including the Sea of Azov) was adopted in 1996. As a basis for cooperation, the Plan provides for the application of the concept of sustainable development and the precautionary principle. Its most substantial policy actions concern the reduction of pollution, living resources management and sustainable human development. Ukraine is responsible for coordinating the Advisory Group to the Istanbul Commission on Pollution Monitoring and Assessment and for maintaining the corresponding activity centre in Odessa.

Some tasks stemming from the Convention and the Action Plan have not yet been fully implemented. These are the development of regional environmental quality criteria, the coordination of the national programmes to reduce the discharge of hazardous substances and nutrients, the introduction of a harmonized monitoring system for the sea waters, and the approximation of the criteria used in environmental impact assessment. An important obstacle to the implementation of the joint activities is the lack of an executive body (permanent secretariat) for the Istanbul Commission.

The Black Sea Economic Cooperation (BSEC) was established in 1992 as a comprehensive multilateral cooperation process and has now become a regional economic organization. Ukraine participates in all working groups, including the group for environmental protection. This group deals mainly with the environmental problems of the Black Sea. At its latest meeting (Sofia, 14-15 September 1998), the group decided to take measures to harmonize the environmental monitoring systems. BSEC will support the establishment of the Black Sea environmental fund and the introduction of a common system for State control over ports in the region. Some of the projects proposed in Ukraine within the framework of the BSEC overlap with certain parts of the Black Sea Environmental Programme, so there is clear need to improve coordination between the two.

The contaminants that flow from the Danube river basin into the Black Sea determine the Sea's environmental conditions. Ukraine participates both in the Black Sea and in the Danube programmes and contributes actively to the efforts to achieve a consistent, region-wide approach in their implementation. A joint Black Sea and Danube Working Group has been established to define the required reduction in nutrients needed to improve the marine ecosystem. Ukraine has presented national reports on the biological indicators for the assessment of its part of the Black Sea.

Ukraine has also signed other international conventions that have an impact on the marine environment, such as the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, the Convention on the Protection and Sustainable Use of the Danube River Basin, and ratified the Convention on Environmental Impact Assessment in a Transboundary Context and acceded to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

National policy documents

The Ministry of Environmental Protection and Nuclear Safety has approved the Strategy for the Conservation of Ukraine's Biological Diversity. It pays special attention to the coastal and marine ecosystems. The Ministry, together with the Inter-agency Coordination Commission on Conservation of Biological and Landscape Diversity, has also prepared a Concept for the Protection and Rehabilitation of the Environment of the Black Sea and the Sea of Azov. Its goal is to prevent an increase in human pressure on the environment of the Black Sea and the Sea of Azov, promote the development of environmentally safe human activities in the region, and safeguard and enrich biological diversity so that it can guarantee sustainable development in the coastal area. The Concept identifies the priority objectives and the principal measures and directions necessary to reach its goal. According to the Concept, environmental management should be based on the following principles:

- Reduction in the amount of pollutants discharged into the seas with the river flows
- Reduction in the adverse impact of air pollution on the environment of the Black Sea and the Sea of Azov
- Reduction in the adverse impact of waste-water discharges on the environment of the Black Sea and the Sea of Azov
- Reduction in the risk of marine pollution from the international transport of hazardous substances
- Prevention of pollution of the marine environment by solid industrial and household wastes
- Reduction in the ecological and economic losses for the population in the coastal zone
- Protection and rehabilitation of the marine biodiversity
- Improvement of the marine habitats
- Sustainable use of the biological marine resources
- Providing conditions for society's sustainable development
- Integrating management of natural resources within the coastal zone.

Based on the Concept, a draft national programme for the protection and rehabilitation of the environment of the Black Sea and the Sea of Azov has been developed. It should meet the requirements and conditions for national plans set out in the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea. The Cabinet of Ministers is expected to adopt the programme shortly.

Monitoring and control activities

Water monitoring is part of the national environmental monitoring system. It is organized in compliance with a special Regulation on Conducting State Water Monitoring, approved by the Cabinet. The principal institutions involved in marine water monitoring are the Ministry of Environmental Protection and Nuclear Safety, the Ministry of Health Protection and the Committee on Hydrometeorology. The monitoring applies not only to ambient water quality in the inland seas, territorial waters and the exclusive economic zone, but also to various sources of water pollution, such as waste waters and accidental discharges of liquids. Attention should be paid to drainage from agricultural fields and the release of harmful substances from sediments (secondary pollution).

Monitoring consists of: background monitoring, general monitoring (including monitoring of anthropogenic impact and monitoring of water where it is used) and emergency monitoring conducted in high-risk zones and in areas influenced by unusual events. The Ministry of Environmental Protection and Nuclear Safety is responsible for the overall coordination of the monitoring activities. It issues annual reports on the state of the environment, including that of the Black Sea and the Sea of Azov. Two marine inspectorates, in Odessa and in Mariupol, also publish special annual reports on this subject.

The Committee on Hydrometeorology runs the most developed component of the marine monitoring network. This network should comprise 160 monitoring stations, but due to financial difficulties only about 120 of them are in operation at present. The typical sampling programme covers 16 to 23 parameters, depending on the abilities of the laboratories, which vary largely. The Ministry of Health Protection monitors the beaches and the bathing waters. The Scientific Centre of Marine Ecology in Odessa, which is also an activity centre on monitoring for the Black Sea Environmental Programme, carries out some monitoring too.

The biggest problems undermining the effectiveness of marine monitoring in Ukraine arise from the system's complexity. Each governmental

agency has designed its own network to serve its own objectives and sometimes the environmental data are a mere by-product. Extra efforts are needed to achieve the necessary coherence for all the sub-components of the system. This will make it possible to make optimal use of the limited funds allocated to maintaining the monitoring networks by avoiding any duplication and introducing a common methodology. There is still significant scientific potential in the country, enough to fulfil the task of fully optimizing the monitoring networks and practices.

The State inspectorates for the protection of the Black Sea and the Sea of Azov have specific environmental control over both Seas. They have their own monitoring system. Their responsibilities include monthly sampling and analyses of all pollution sources located along the coast, control of the navigation and of the prospecting and operational activities for oil, gas and construction materials on the shelf, as well as of the exploitation of the marine living resources. In this area the Ministry of Environmental Protection and Nuclear Safety, through its State inspectorates for the protection of the Black Sea and the Sea of Azov, has the right to supervise the other agencies.

According to a 1998 resolution of the Cabinet of Ministers, a State Inspectorate on Shipping of the Ministry of Transport has been founded. This Inspectorate:

- implements Port State Control and Flag State Control according to MARPOL 73/78 requirements and the IMO Convention on marine and river transport;
- supervises (directly and in cooperation with harbour masters) all ships in marine and inland waters, in particular regarding their compliance with environmental requirements;
- supervises maritime and river ports, State and private shipping activities in connection with MARPOL 73/78 requirements;
- represents Ukraine at IMO;
- Other environmental activities of the State branch of maritime industry are under the supervision of SAMIWT.

Integrated coastal zone management

The Ministry of Environmental Protection and Nuclear Safety accepts integrated coastal zone management as an effective environmental management tool, since it takes into consideration all the functional, geographic, ecological, economic and demographic features. The coastal zone is an area of very high biological productivity and intensive biochemical processes. At the same time it is extremely vulnerable to the consequences of human activity. During recent years the coastal zone has been a matter of increasing concern to environmentalists in the country, because its economic value means that it is subject to strong development pressure.

There is so far no legal document proclaiming that the coastal zone is a single unit that needs to be managed as such, but work on a law for coastal zone management started in 1998. Substantial efforts in the direction of integrated management have been made, mainly in the framework of the GEF Black Sea Environmental Programme. The Odessa Declaration of the Environment Ministers of the coastal countries and the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea foresee the introduction of integrated coastal zone management. The basic principles of integrated coastal zone management are developed in the draft national programme for the protection and rehabilitation of the environment of the Black Sea and the Sea of Azov. They include the drawing-up of legal instruments, the transformation of the coastal resources use structure, the establishment of financial mechanisms, institutional capacity building, the drawing-up of effective national programmes for demographic, social, economic and environmental development in the coastal zone.

9.5 Conclusions and recommendations

The Ministry of Environmental Protection and Nuclear Safety is keenly aware of the magnitude and the importance of the problems related to the state of the Sea of Azov and the Black Sea. It has gained substantial experience in marine environment management. There are a number of important prerequisites for good management of the seas. Their conservation is included as a priority in the national environmental strategy and in the Ministry's programme of action, as well as in the Concept for the Protection and Rehabilitation of the Environment of the Black Sea and the Sea of Azov, which give the main directions of work. It is therefore time to convert this experience and knowledge into a comprehensive set of policy objectives.

Recommendation 9.1:
To improve marine environment management

based on the principles set out in the 'Principal Directions', clear environmental policy objectives should be set and included in the national programme for the protection and rehabilitation of the Black Sea and the Sea of Azov.

An extensive network of administrative and scientific institutions has been developed to facilitate the management of the marine environment. Nevertheless, the notable institutional capacity at regional and local level does not compensate for the lack of a specialized management unit at the national level.

Recommendation 9.2:
To better coordinate the efforts of the numerous institutions and to make marine environmental protection more effective, the Ministry of Environmental Protection and Nuclear Safety should set up a special unit for the protection of the Sea of Azov and the Black Sea.

During recent years much work has been done to prepare new environmental legislation. The new Water Code and the specific Regulation for the Protection of Sea Water from Pollution and Litter lay down the basic requirements for marine protection. The lack of specific norms and standards for marine water quality hampers control activities, permitting procedures and environmental assessments. The general norms for surface waters are being applied. There is also a need to work out a common methodology for issuing permits for discharges into the sea, which could be used by the regional staff of the Ministry, instead of assigning special tasks to the scientific institutes. The new environmental legislation does not include mechanisms to finance environmental management.

Recommendation 9.3:
The specific needs of the marine environment should be reflected in special legislation on marine environmental protection. It should go hand in hand with all relevant national regulations and internationally accepted norms and include new mechanisms for raising and allocating funds.

The national environmental authorities are fully aware of the need to integrate environmental policy-making and management in the coastal areas. Draft documents to introduce the principle of integrated coastal zone management have been drawn up mainly within the Black Sea Environmental Programme.

Recommendation 9.4:
The Ministry of Environmental Protection and Nuclear Safety, together with all other relevant authorities and with the participation of all stakeholders, should explicitly make integrated coastal zone management a full part of its new policy. This should also entail the creation of adequate instruments for institutional cooperation and involvement of the scientific community, local business and the general public, especially through NGOs, in the implementation of integrated coastal zone management.

The quality of information is decisive in environmental decision-making. In Ukraine there is an extensive environmental monitoring network involving different governmental agencies and scientific institutions. Its survival is in jeopardy, above all because its ties with its former Soviet counterparts have been severed and because its monitoring system is disintegrating. It has also lost some methodological guidance, suffers from serious budgetary restrictions and frequently duplicates the activities of its different entities. It is therefore necessary to better integrate the monitoring system and optimize its cost. There are no self-monitoring routines in the country.

Marine environment monitoring is often a by-product of the main activity of some agency or scientific institute, and this predetermines how it is carried out. According to the legislation, the Ministry of Environmental Protection and Nuclear Safety is in charge of the overall coordination at the national level, but in practice it cannot take part in the preparation of the budget for all monitoring activities.

Recommendation 9.5:
The Ministry of Environmental Protection and Nuclear Safety should strengthen its role as the coordinating governmental agency for marine environmental monitoring. It should, for instance, develop a mandatory common national programme for sea monitoring and should participate in the budgeting of all monitoring entities. It should also look for other sources of funding and organization mechanisms. See also Recommendations 1.5 and 8.4.

Nutrients and oil products, which come mainly from the rivers or from land-based sources of pollution, undermine the environmental conditions in the Sea of Azov and the Black Sea. Although

there are many waste-water treatment plants within the coastal zone, a significant amount of untreated or insufficiently treated domestic and industrial waste water is still discharged. To a great extent, this pollution is a consequence of the poor technical condition and of the decrease in the effectiveness of the treatment facilities, as well as of the frequent accidents in the networks and the treatment plants. The reasons for this are mostly financial - stemming from the general economic difficulties of the country in the transition period. However, in the interest of protecting marine waters, sewerage networks and waste-water treatment plants must be repaired and upgraded urgently. Funding may have to be raised, provisionally, through an obligatory contribution from profitable economic activities in the coastal zone.

Recommendation 9.6:
A new funding mechanism for the construction and maintenance of the sewerage networks and waste-water treatment plants should be developed, which should clearly specify the responsibilities of polluters in this regard. See also Recommendation 8.3.

Navigation and navigation-related activities are an important source of contamination of the marine environment, especially with petroleum hydrocarbons. Another major threat for the sea ecosystem is the penetration of exotic species, most frequently through the removal of ballast. That is why the development of specific recommendations and the implementation of respective measures are needed. Also, it is necessary to strengthen the control over the regulation, development and construction of the structures and facilities for loading, reloading and storing petroleum products, chemicals and other dangerous substances. Ukraine's ports are equipped with waste-water treatment plants for oil-polluted waters and the necessary means for combating oil spills in their own area. Both the Ministry of Environmental Protection and Nuclear Safety and the Ministry of Transport have the capacity to control the activities in the coastal zone, within their responsibilities, defined by the national law.

Recommendation 9.7:
Ukraine should participate in the further development and enforcement of a harmonized Port State Control system in the Black Sea region and in the development of a regional emergency response action plan, in order to establish new effective instruments for marine environmental management.

Considering the semi-enclosed character of the Black Sea, the high anthropogenic load and the vulnerability of its ecosystem, it is obvious that only actions coordinated at the regional level can genuinely improve its state. The Ministry of Environmental Protection and Nuclear Safety actively participates in several international initiatives, such as the Black Sea Environmental Programme, the Danube Programme, or the Working Group on Environmental Protection within the Black Sea Economic Cooperation. Ukraine has already signed some international agreements in this field and the Ministry is now working hard to ensure their ratification and application. Using the international agreements that Ukraine has signed and their existing structures, the further management of the Sea of Azov's and the Black Sea's environment should involve the entire basin.

Recommendation 9.8:
Ukraine should consider initiating a basin-wide programme and/or seeking close cooperation between the Black Sea Environmental Programme and all existing or planned programmes for the rivers flowing into these two Seas, in order to promote basin-wide coordination of environmental management affecting the Black Sea and the Sea of Azov. Adequate coordination mechanisms should also be developed for the drainage area of the Baltic Sea in the country.

Chapter 10

MANAGEMENT OF MINERAL RESOURCES

10.1 Mineral resources: endowment and recent use

General overview

Ukraine is one of the world's largest mineral producers, accounting for 5 per cent of global mineral raw material production in 1995 – a figure that has, however, dropped to 1.7 per cent. Nearly 8 000 deposits of 94 different minerals of commercial value are prospected in Ukraine (see Figure 10.1). More than 40 per cent of explored reserves are under exploitation, including oil, gas, iron, manganese, titanium, uranium ores, coal, sulphur, kaolin, graphite, refractory clays, construction materials and drinking and mineral waters. In recent years, important mineral deposits, for instance of gold, zinc, lead, fluorite, alunite, beryllium, lithium, niobium, scandium, barite, apatite, phosphorite, zeolite and rare earth elements, have been discovered. Many deposits are sited in favourable geographical, geological and environmental conditions, which increases their economic value compared with regions in other countries that are difficult to access. The approximate value of extractable deposits of basic minerals is estimated at US$ 7.0-7.5 trillion.

Due to its extraordinary wealth in mineral resources, Ukraine was considered as a cornerstone of the economic and industrial development of the former Soviet Union. In the mid-1970, the intensive extraction of mineral resources from Ukrainian deposits to meet the immediate short-term demand of the former Soviet Union depleted some of them (e.g. oil, gas, sulphur, mercury). As a result, major oil and gas fields (e.g. Leliakivske, Glynske-Rozbyschivske) were quickly exhausted. These patterns of exploitation influence the country's current economic and environmental situation.

Mineral reserves and production

Ukraine is the world's fifth-largest producer of iron ore and has the world's second-largest reserves of manganese. The largest iron ore deposits are located in Kriviy Rig, in Kremenchuk, and in Kerch and Belozerskie (Donetsk region), with total reserves estimated at 26 billion tonnes (Table 10.1). There are ten open pit iron ore mines in Ukraine: nine in Krivbass and one small mine in Poltava. The Ingulets Mining and Enrichment Plant (InGok) is the main iron ore mining and processing plant in Krivbass. The largest manganese deposits are located around the Nikopol area, with estimated reserves of 2 billion tonnes. They represent 66 per cent of the world's manganese reserves.

Ukraine's gold deposits were discovered during the Soviet era and were considered a State secret. The current lack of investments and the high sulphur content of the gold deposits, which is detrimental to the environment and to miners' health, constitute major obstacles to the exploitation of this resource.

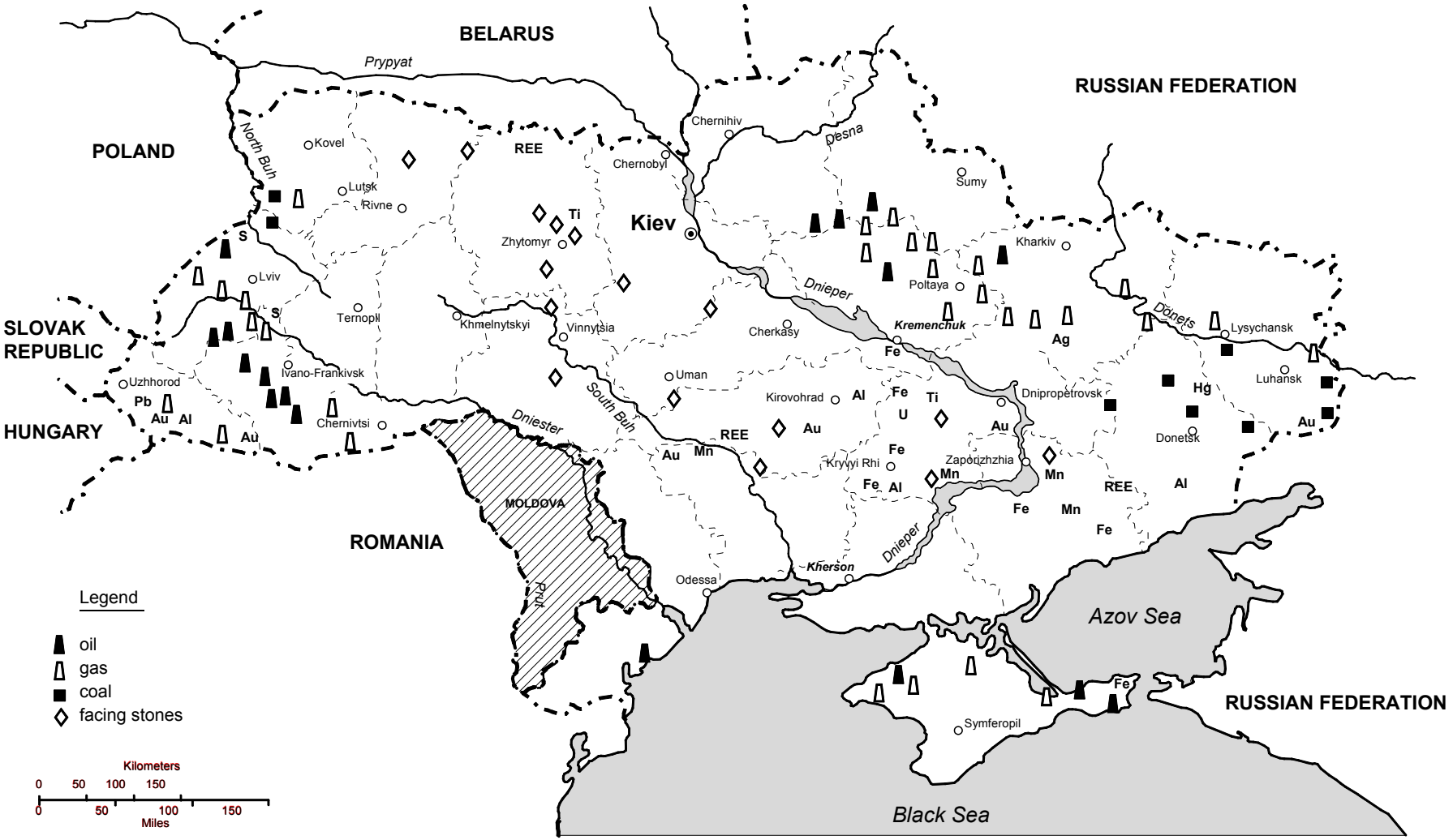
Table 10.1: Principal mineral reserves and deposits of Ukraine

Million tonnes

Mineral resource	Total reserves	Total deposits	Active deposits	% of total deposits
Iron ore	26 321	52	28	54
Manganese ore	2 276	3	2	67
Graphite	126	5	1	20
Kaolin	454	34	21	62
Native sulphur	665	12	5	42
Facing stones *(million m3)*	363	140	72	51

Source: The State of the Environment in Ukraine, 1997.

Figure 10.1: Deposits of main minerals



The industrial demand for gold in Ukraine is covered by imports and chemical separation technologies. Half a tonne of gold is currently extracted annually from ores and their wastes at chemical and high-purity metallurgical plants. Although Ukraine had no active gold mines in mid-1998, the Government predicts that 15 tonnes of gold could be mined annually within 8 to 10 years. The total investment required to reach full capacity is estimated at US$ 250 million over 12 years. At present, the Ukrainian geological companies DGP Tsentrukrgeologia, Pivdenukrgeologia and Kirovgeologia are carrying out gold surveying in Kirovohradska, Dnipropetrovska and Odesska oblasts. This work is financed exclusively by the Ukrainian Government. Despite the financial difficulties, the Ukrainian Government intends to create a structure for the development of the gold industry and to allocate the necessary funds for its growth with the participation of foreign investors. In the near future, a draft law on the exploration and mining of gold deposits is expected to be prepared. At present, however, gold mining is just in its initial phase and is not expected to contribute substantially to the solution of the country's economic problems in the short run.

Ukraine's copper deposits, which are mostly concentrated in the Donetsk and Volyn region, have great potential. At present, Ukraine's industrial demand for copper is satisfied by imports and the separation of scrap metals. The country's annual demand for copper in 1993 was estimated at 240 000 tonnes and it will probably increase by the year 2000 to 320 000 tonnes. Recently, governmental efforts to promote commercial copper mining have attracted foreign companies.

Uranium is mined at Kirovograd oblast (Inguletskiy and Vatutinskiy mines) industrial sites, with reserves estimated at 42 600 tonnes. Since 1950, Zhovti Vody city, in Dnepropetrovsk oblast, has been the centre of uranium mining and processing. At present, uranium ore is mined at the Ingul'skii and Vatutinskii mines and processed in the Zhovti Vody mills, both in the hands of the State-owned VostGok company. In 1997, 1 200 tonnes of uranium ore was produced, with no significant changes in the output since 1995. The Government approved a nuclear fuel industry plan in April 1995, scheduling a threefold increase in uranium production by the year 2003.

Ukraine's largest mercury deposits are located in the Nickitovka ore field, in the Donbass region. These deposits were mined for over 100 years, and more than 10 000 tonnes of mercury were extracted. Mining stopped when the mercury contents in the ore decreased to 0.2 per cent. The Donbass region also has lead-zinc deposits, with reserves estimated at 1 million tonnes. Ukraine has deposits of chalk and limestone, in the Crimea and Donbass areas, and in Elenovskoye. There are sulphur deposits mainly in the Lvov area, granite deposits in the Zhytomyr region, and china clay deposits in Hluhovestie and Turbovske areas. In addition, Ukraine has graphite, kaolin and phosphorus deposits. There are also rock salt deposits, mainly concentrated in the Donbass, Prykarpatia and Zarkarpatia regions, making up 45 per cent of all salt reserves of the former Soviet Union.

Mining industry

The mining industry is affected both by Ukraine's overall macroeconomic situation and by the years of neglect. The Ukrainian mining sector comprises more than 2 000 mines and processing plants, and remains State-controlled. It accounts for a third of Ukraine's industrial potential, employing around a fifth of the workforce and receiving nearly 40 per cent of capital investments. After the Second World War, Ukraine received a smaller share of Soviet industrial investment than before the War, so that at independence its industrial plants were on the whole outdated, energy-intensive (reflecting low Soviet energy prices) and heavily polluting. Furthermore, due to inefficient mining and processing technologies, and problems with the integrated exploration of deposits, significant amounts of minerals such as oil (70 per cent), salts (50 per cent), coal (40 per cent) and metals (25 per cent) remain in the soil or get wasted.

The mining industry is mainly concentrated in the central and eastern parts of the country, including Donetsk and Lugansk oblasts, both located in the Donbass region, and Dnepropetrovsk and Zaporizka oblasts. The industrialization of these areas with their coal and ferrous metal deposits dates back to the 1890s, when the first steel mills opened in Kriviy Rig. Metallurgical capacities were enlarged in the 1920s and 1930s, creating new cities such as Dnepropetrovsk and Zaporozh'ya. In addition, the western part of the country is also a centre of the mineral industry, including Lvivska, Volynska, Ivano-Frankivska and Poltavska oblasts. The technogenic pressure of the mining industry in these areas is up to 318 000 tonnes/km^2.

Table 10.2: Mining output in Ukraine, 1993-1997

1 000 tonnes

	1993	1994	1995	1996	1997
Iron ore	174 800	145 500	112 900	103 100	115 500
Manganese ore	13 100	10 000	7 600	7 200	7 200
Uranium ore*	-	-	1	1	1
Graphite	22	6	6	6	7
Kaolin	4 800	3 200	1 900	1 500	1 300
Native sulphur	1 530	430	390	200	420

Sources: The State of the Environment in Ukraine, 1997.
* Annual report of the German Atomic Industry, 1998.

Production in virtually all industrial sectors declined in Ukraine throughout the 1990s. As a result, by the end of 1995, seasonally adjusted industrial output had declined to 43.8 per cent of the 1990 level, with mining output down to 89.6 per cent of the 1990 level. Iron ore extraction in Krivbass began to slow down in 1975 as the Soviet Government failed to invest in it. At present, the entire iron ore mining sector is in decline because of previously high inflation and massive inter-enterprise debts, which are unlikely to be paid off soon. In 1997, iron ore production in Ukraine had decreased to 34 per cent of the 1993 level and manganese ore production to 45 per cent of the 1993 level (Table 10.2). Ukraine exports 13-22 million tonnes of iron ore, up to 1.5 million tonnes of manganese ore, around 14 million tonnes of coal, 30 000 tonnes of graphite, 1.1 million tonnes of kaolin and significant amounts of facing stone and construction materials each year. Exports of ferrous metals and metal products, as rolled ferrous metals, pig-iron and steel pipes, account for 36.2 per cent of total export earnings, whereas mineral ores and coal represent 10.5 per cent. Ukraine currently imports 3.5 times more minerals and their products than it exports. Besides the traditional import to supply the energy sector (e.g. oil, gas, coking coal), Ukraine also imports non-ferrous and rare metals.

Mining and energy: oil, natural gas and coal

Ukraine has several underexploited oil and gas fields, and some small reserves remain at considerable depths (over 4 500 metres deep). Its reserves of oil and gas are estimated at 1.3 billion tonnes (of which 147 million tonnes are proven) of oil, 6.8 trillion cubic metres of natural gas and 381 million tonnes of condensate (Table 10.3). Oil and gas deposits are mainly concentrated in three regions (see Figure 10.1): Donetsko-Pridniepovsky (east), Carpathians (west) and Crimea (south). The Donetsko-Pridniepovsky region is considered Ukraine's principal hydrocarbon producing area, which extends about 900 km from Belarus across central Ukraine near Kyiv to the east. The Carpathian oil and gas basin hosts hydrocarbon deposits in a geological structure that extends from eastern Europe along the Carpathian Mountains. This region has been exploited for over 100 years and is fairly mature. The Crimean region is an extension of the larger North Caucasus-Mangyshlak Trough. Most of the region is in the northern shelf area of the Black Sea, so that less than 5 per cent of the (potentially resource-rich) area is explored. Although around 10 gas fields in waters less than 60 metres deep produce some gas, no significant oil deposits have been found in the Crimean region so far. The most promising geologic structures were identified at depths of 200-300 metres. As the Ukrainian equipment is able to work only in shallow depths (up to 70 metres), new technology, expertise and investments are necessary to explore and extract these resources. In 1996, 37 000 metres of exploratory drilling were carried out for gas and 6 000 metres for oil, which is 8.9 times (for gas) and 14.3 times less (for oil), respectively, than in 1991. Exploratory drilling in the Sea of Azov is also planned in the long-term oil and gas programme, which envisages a substantial increase in the hydrocarbon output by 2000.

According to the Committee of Geology and Mineral Resources, only about a third of Ukraine's recoverable hydrocarbon resources have been extracted. In 1997, Ukraine produced 4.1 million tonnes of oil and 18.1 billion cubic metres of natural gas. The country has to import about 60 per cent of the primary energy it consumes, with 80 per cent of oil and gas mainly coming from the Russian Federation and Turkmenistan.

Table 10.3: Oil, gas and coal reserves of Ukraine

Millions tonnes

Mineral resource	Total reserves	Total deposits	Active deposits	% of total deposits
Oil	1 326	129	87	67
Condensate	381	149	91	61
Natural gas *(Billion m3)*	6 800	281	208	74
Coal	45 808	762	268	35

Source: The State of the Environment in Ukraine, 1997.

Coal is mined mainly in the Donetsk basin (Donbass region), which contained 60 per cent of the bituminous coal reserves of the former Soviet Union and 90 per cent of the coal reserves of Ukraine. There are 226 mines in Donbass, producing mostly anthracite and bituminous coal. Run-of-mine coal, with a 25-50 per cent ash content and 2.5 per cent of sulphur, is heavily mixed with rock as the coal seams are thin. Other important coal basins are the Lviv-Volyn basin in western Ukraine, with around 12 deep mines producing bituminous coal, and Alexandria, with 2 surface mines producing mostly sub-bituminous brown coal. Ukraine's total coal reserves are estimated at 46 billion tonnes (Table 10.3). However, coal deposits in eastern Ukraine are found in unfavourable geological conditions, which increases the costs of mining, and those of western Ukraine are far away from major consumption areas and the major export markets located in the east.

Ukraine's coal industry is run by the Ministry of the Coal Industry. Though it still makes up 12 per cent of Ukraine's industrial production, coal mining is in decline, with output falling from a peak of 164.8 million tonnes in 1990 to 76.3 million tonnes in 1997. The coal industry has been badly hit by cuts in subsidies and non-payment for output. Companies have not been able to invest in new equipment and technology to maintain earlier production levels. Moreover, wage arrears are high, strikes are frequent, an average of 200-400 miners die in pit disasters each year, and the depth of mines has increased dramatically.

10.2 Environmental issues in the mining sector

At present, Ukraine has to handle numerous environmental problems associated with the exploitation of mineral resources. Besides waste accumulation, the negative impacts of ore mining and processing include air pollution, surface water and groundwater contamination, destruction of vegetation and soil contamination. It also has serious social, health and safety consequences.

Air pollution

Mining and processing of mineral resources contribute to air pollution at almost all stages of operation. Dust is produced by open pits and by crushing and grinding operations. Dust can also be given off by tailing dams. Mines are also sources of greenhouse gas emissions. CO_2 is produced by energy use and methane is sometimes released from underground. Smelting (the processes in which ore is heated for the purpose of separating it from the gangue) produces very large amounts of air pollutants, such as sulphur dioxide, arsenic, lead, cadmium and other heavy metals.

Gas emissions from burning dumps of poor-quality coal (e.g. brown coal and lignite) are a major air pollution problem. They consist mainly of sulphur dioxide and nitrogen oxides as well as particulate matter. Moreover, around 3 to 3.5 billion cubic metres of methane are emitted directly into the atmosphere through air vents from coal mines. Decontamination plants extract between 0.6 to 0.8 billion cubic metres of methane, of which only 15-20 per cent is used.

In the Kriviy Rig iron ore mining region, emissions of harmful substances into the atmosphere in 1997 reached 443 800 tonnes, of which 75.3 per cent were carbon monoxide, 16 per cent particulate matter, 6.5 per cent sulphur dioxide and 1.5 per cent nitrous oxide emissions. In addition, in major ferrous metallurgy centres (e.g. Kriviy Rig, Dneprodzerzhinsk, Donetsk, Zaporizh'ya, Mariupol), the atmospheric air pollution with benzo(a)pyrene is 12 times higher than in other towns.

Water pollution

Potential sources of water pollution from mining include drainage from surface and underground

mines, waste water from beneficiation and surface run-off. The discharge of acid mine waters from mining operations, especially coal mines, is an important source of water pollution in Ukraine. The natural oxidation of sulphides through exposure to air and water may produce acidic and metal-bearing solutions. The combination of acids and metals can have severe effects on the ecology of local watercourses, and metals can enter the food chain. Furthermore, acid waters are highly corrosive, and if used for industrial or municipal purposes need to be treated first. However, waste-water treatment facilities in mining and processing plants are quite scarce in Ukraine today.

Mineral separation processes that use dangerous and toxic chemicals such as sulphuric acid or cyanide (e.g. leaching) or organic reagents (e.g. flotation) can be serious sources of contamination if appropriate control systems are not in place. Furthermore, such mining waste water contains large amounts of suspended solids (ranging from colloidal to settleable materials) or radionuclides originating from the ore itself, from waste material or from surface installations. These solids and radionuclides can affect aquatic flora and fauna and physically choke local waterways and lakes.

Waste water with radionuclides from the Zhovti Vodi uranium ore plant is discharged without any treatment or with low-efficiency treatment into the Inghul river. The concentration of radium-226 exceeds the legal limits in this watercourse. The Zaporizh'ya iron ore plant discharges between 18 to 20 million cubic metres of mining waste waters per year into the Utlyuksky estuary, north of the Sea of Azov. These waste waters contain insoluble iron at 10 to 50 times the MACs. In areas around evaporation ponds, dust-containing iron contaminates the environment and kills birds that are listed in the Red Book of Ukraine.

Coal mines in the Donbass region produce 75 million cubic metres of effluent a year, of which 46 per cent is from western Donbass. About 20 per cent of mining water discharge has a higher salt concentration than sea water, ranging from as little as 30 mg/l to an environmentally hazardous 4 000 mg/l or more. Discharge of this water has raised the saline concentration in some rivers to levels that severely limit the use of the water for water supply or irrigation. More than 10 harmful components (e.g. cadmium, phosphorus, lithium, titanium, manganese) are fixed in surface waters and groundwaters of the coal mining areas of Donbass, with concentrations exceeding MACs. In some cases mining water is used to dilute municipal waste water, including sewage, before disposal in the nearest river system.

Solid and hazardous waste

Open pit mining operations produce far more waste per tonne of ore than underground operations, where there is no overburden and where some of the removed material can be used to backfill excavations as work progresses. Although Ukraine has several underground mines (e.g. coal and iron ore mines), backfilling techniques are not commonly employed. Slag heaps disfigure the landscape and are also a source of dust, hazardous emissions and water pollution. Emissions of noxious gases, including carbon monoxide, hydrogen sulphide and nitrous oxides, from tailings of Donbass coal mines are a serious health hazard for local residents. In some heaps of coal mine wastes, combustible material can start a smouldering fire through self-ignition. In addition, inert material carried away in run-off water can

Box 10.1: The Kriviy Rig mining belt

Kriviy Rig city, located in Dnepropetrovsk oblast, is the centre of a densely populated industrial and mining belt, measuring about 140 kilometres from north to south. The iron ore mining and processing complex of Kriviy Rig comprises 9 open pit mines and 5 ore-processing plants. This huge complex is spread over 30 000 hectares, of which 26 per cent is covered by 3 billion cubic metres of tailings from mining operations. Re-cultivated lands account for 0.5 per cent of the total 1 700 hectares of degraded land that was rehabilitated. The iron ore mines and plants produce almost 220 million cubic metres of effluent a year. Of this, 50 million cubic metres are directly pumped from mines. Acid waste waters are discharged without any treatment into local rivers. Though the volume of water is much smaller than that discharged from coal mines, it is far more toxic in the short term, given its high concentration of heavy metals.

Despite the high-quality ore produced, with up to 66 per cent of iron in the concentrate, these mines are not making a profit. Ingulets, the largest mining and processing company in Krivbass, produced 10 million tonnes of iron ore in 1997, generating total revenue of 194 million hryvnias. In the same year, 5.6 million cubic metres of wastes were generated by the company, which is 63.5 per cent more than in 1996. Ingulets has no water-treatment facilities for mining and ore-processing operations and the equipment is outdated. In addition, wage arrears are high and new investments scarce.

clog rivers and streams. If the wastes contain sulphides, acid drainage can occur after reaction with rainwater.

The tailings that remain after extraction and processing are mostly muds and slurries containing a very high proportion of extremely finely ground material (coal and ore). The separation processes for most metals do not extract all of the minerals. Tailings therefore contain quantities of metals and other minerals, as well as residues of the chemicals used to extract them. The finely ground material from processing makes contaminants formerly bound up in solid rock (e.g. arsenic, cadmium, copper, lead, zinc) accessible to water. Acid drainage, which exacerbates contamination by heavy metals, is often a problem when tailings are exposed to the atmosphere. Tailings are more usually dumped in heaps, released into ponds, or retained by tailing dams. In some cases, tailings are released directly to rivers, introducing large amounts of suspended solids and contaminants into aquatic habitats. In addition, due to the large storage volumes, structures may easily become unstable, and tailing dam accidents can happen.

Mining and beneficiation industries constitute major sources of waste in Ukraine. The largest amounts of waste are generated in Dnepropetrovska, Donetska, Luganska and Lvivska oblasts, which have a high concentration of mining industries. In 1996, 256 million cubic metres of wastes were generated by mining companies in Ukraine, of which only 5 per cent was used as construction material (Table 10.4). Waste sites take up much land and contribute to water and agricultural land pollution. For example, for every million tonne of coal extracted in Ukraine, roughly 400 hectares of land are required for the deposit of related waste. In the coal mining areas of the Donbass region, soils and sediments are badly contaminated with arsenic, lead, fluorine, mercury, phosphorus, zinc and barium. The concentrations of these elements increase considerably in the proximity of mines and coking plants. In 1996, the coal industry generated a total of 29 million cubic metres of waste (Table 10.4), which is 25 per cent less than in 1995. Despite the decline in waste generation, its accumulation rate rose 4.4 per cent in 1996, which corresponds to 3.7 million cubic metres, revealing its low use. Moreover, coal combustion creates about 14 million tonnes of ash and slag wastes each year.

'Technogenic' deposits of minerals from mine waste heaps as well as wastes from mineral raw material processing contain valuable minerals for industrial use, which usually get lost. For example, some amounts of vanadium, scandium and rare earth elements could be recovered from titanium-zirconium ore tailings. Wastes from Kriviy Rig's iron ore mines and concentration plants contain up to 10 g/tonne of gold, which could be recovered. The volume of these wastes in Ukraine is over 25 billion tonnes, covering an area of 50 000 hectares. According to the Committee of Geology and Mineral Resources, the potential value of 'technogenic' deposits is estimated at tens of billions of US dollars. On the other hand, many experts doubt that recovery under environmentally acceptable conditions is economically advisable.

Uranium mining and processing operations are major generators of radioactive waste, with an accumulated amount of 65.5 million tonnes in 1996. Almost all wastes (i.e. effluents and releases) of uranium mining and processing are radioactive and constitute potential causes of environmental damage. Only 15 per cent of total ore radiation is extracted with final uranium products. Seepage

Table 10.4: Generation and use of mining and processing wastes, 1996

1 000 m³

	Mining wastes			Processing wastes		
	Generated	Used	Used for construction material	Generated	Used	Used for construction material
Total	**197 898**	**153 839**	**4 085**	**58 583**	**12 100**	**4 533**
Coal industry	27 366	12 774	62	1 577	55	38
Metallurgical industry	162 980	134 818	3 483	56 467	11 757	4 489
Petrochemical industry	2 329	1 787	42	370	119	6
Construction material industry	5 223	4 460	498	169	169	-

Source: Statistical Yearbook of Ukraine, 1997.

from uranium mining and processing tailings is a major hazard, which may contaminate groundwater and surface waters. Radium-226 and other hazardous substances like arsenic contaminate the local drinking water supply and fish. Tailings are also subject to many kinds of erosion, which may disperse radioactive material (e.g. radioactive dust) over villages located in the vicinities. Occasionally, because of their fine sandy texture, dried tailings have been used for construction of buildings or for landfills. High levels of gamma radiation were found in buildings built on or from such material in Zhovti Vodi city. In addition, uranium mining and milling release radioactive gas radon and radon daughters, which are potential occupational hazards.

Uranium ore processed in the InGok hydrometallurgical plant, Zhovti Vodi, Dnepropetrovsk region, produces 22.5 million cubic metres of tailings, covering 256 hectares. The Prydniprovski chemical plant, Dneprodzerzhinsk, Dnepropetrovsk region, was closed in 1991. However, 43 million tonnes of radioactive wastes spread over 286 hectares still remain on this site, and are in a desolate state. According to the State Ecological Inspectorate, gamma radiation and radon concentrations exceed normal levels in almost 70 per cent of the plant's grounds. Radon releases from this plant may constitute health risks.

10.3 Policy objectives and management instruments

Policy objectives

The main policy objective for the sustainable management of mineral resources is to ensure their efficient use and protection, and the rehabilitation of mining territories. To achieve this broad objective, normative and legal instruments, economic mechanisms and environmental requirements have been developed. Despite the Government's efforts to create favourable conditions for the sustainable management of mineral resources, implementation and enforcement problems remain the main obstacles to reaching policy objectives.

The main directions of the environmental policies in the mining industry are:

- modernization and introduction of cleaner technologies in mining enterprises;
- development of effective environmental monitoring systems at facilities with high ecological risk;
- development and implementation of environmentally safe requirements for closing mines;
- improvement of technology and equipment for the exploitation of 'technogenic' deposits;
- reduction of mine waste dumping and promotion of backfilling of mines with waste rock;
- development and implementation of techniques for the treatment of mine waste water.

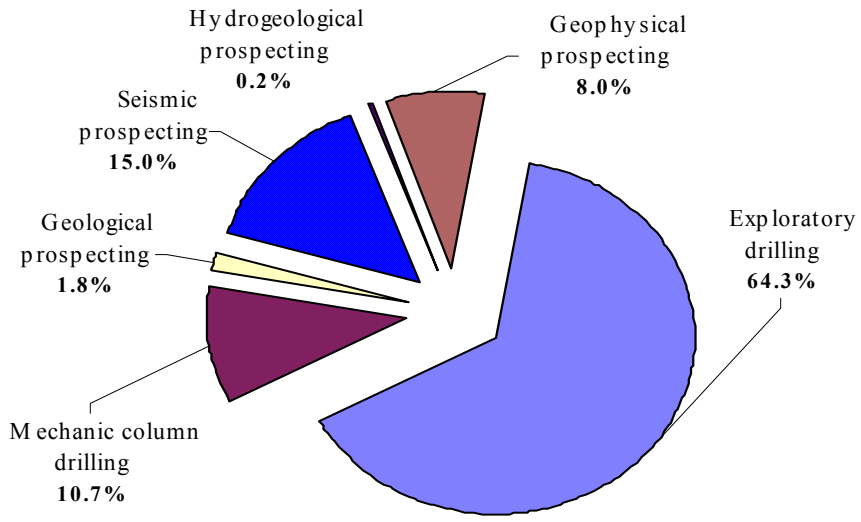
In 1995, the Committee of Geology and Mineral Resources, in cooperation with mining authorities, prepared the "Development programme for the mineral resource base of Ukraine till 2005". Its main targets are:

- expansion and strengthening of the current mineral reserves for operating enterprises that use indigenous (e.g. oil, coal, natural gas, uranium) or imported mineral raw materials (e.g. lead, zinc, copper, tin, niobium, tantalum);
- development of a mineral resource base of the most strategic minerals for which there is a high demand on the world market, such as gold, precious metals of the platinum group, scandium, rare earth elements;
- better recovery of mineral raw material from 'technogenic' deposits.

The implementation of this programme should boost the country's mineral export 1.5-2 times, and reduce its imports 60-70 per cent (except hydrocarbons). Due to the lack of funding for geological exploration, this programme could not be implemented as planned. According to the State Committee of Geology and Mineral Deposits, expenditure for geological exploration is 3-4 times less than in previous years. In 1996, 156 million hryvnias were spent on mineral prospecting, of which 64 per cent was used for exploratory drilling (See Figure 10.2).

Policy reforms, closure of unprofitable mines and institutional re-organization in the coal sector are included in the Coal Sector Restructuring Project, of which the total cost of US$ 120 million is partially covered with the help of a World Bank loan worth US$ 80 million. Though many mines have already been identified for closure in the Donbass region (e.g. Pravda, Krasniy Oktyabr,

Figure 10.2: Mineral prospecting activities by category, 1996



Source: Statistical Yearbook of Ukraine, 1997.

Removskaya), the Ukrainian Government is taking its time in implementing this project. The principal targets of the coal sector restructuring project are:

- modernization of profitable mines in 1995-2000, to increase production by 2 million tonnes;
- construction of shallow mines near coal seam outcrops with a capacity of 300 000-500 000 tonnes;
- separation of coal mining from coal washing enterprises;
- conversion of State mining enterprises into joint-stock companies;
- introduction of differentiated payments for coal mining based on the mining and geological conditions;
- closure of certain unprofitable State mines and mitigation of social and environmental impacts.

Legal instruments

Environmental protection in Ukraine is regulated by the Law on Environmental Protection. Legal instruments are applied under constraints, which are derived from environmental legislation. They include the rules for the protection of natural resources (e.g. mineral resources, groundwater, land) as well as maximum allowable concentrations of specific environmentally hazardous substances in soil, air, groundwater and surface waters. Most of these norms and standards are still under development.

The legislative basis for the sustainable management of mineral resources is provided by the Mineral Resources Code as well as by a number of regulations. The Mineral Resources Code (27 July 1994) regulates mining-related issues, ensuring the rational use and protection of mineral resources, as well as mining safety, property rights and environmental rehabilitation of mining areas. It also provides preventive, operative, incentive and coercive measures with respect to legal entities and citizens for the use of mineral resources and their wastes.

At present, the main regulations related to the management of mineral resources in force in Ukraine are:

- Resolution No. 150 of 2 March 1993 on the State Fund of Mineral Resources of Ukraine
- Resolution No. 200 of 17 March 1993 on Confirming the Statute of the State Geological Supervision of the Conduct of the Work relating to the Geological Study of the Mineral Resources of Ukraine
- Regulation No. 785 of 23 September 1993 on the Adoption of the Regulations for State Monitoring of the Natural Environment

- Resolution No. 85 of 8 February 1994 on the Temporary Procedure for Collecting Fees for the Special Use of Mineral Resources.

Institutions

Verification of compliance with environmental legislation and other rules for the use of mineral resources is part of the regulatory system and is performed by the Committee of Geology and Mineral Resources (geological control), by the State Committee for Occupational Safety Supervision (mining works control), and by the Ministry of Environmental Protection and Nuclear Safety (environmental control).

The Committee of Geology and Mineral Resources is the main institution in charge of managing Ukraine's mineral resources. One of its main tasks is issuing licences for geological surveying, and for the exploration and exploitation of mineral resources. Furthermore, it also supervises these activities and checks their environmental implications. The Committee employs 30 000 staff, and its structure is quite complex, comprising 14 State geological and geophysical companies, 6 research institutions, 4 specialized plants and other supporting services spread around the country. It also includes the State Geological Information Fund "Geoinform", which provides geological, economic and geo-ecological information about mineral deposits, and draws thematic maps on industrial impact, seismo-geological conditions, radionuclide concentration and chemical pollution of groundwaters.

The oil and gas industry is run by the Ukrainian State Committee of Oil and Gas, whereas exploration and production licensing and tendering are the responsibility of the Committee of Geology and Mineral Resources. The State Committee of Oil and Gas is in charge of 15 of the largest industrial associations in Ukraine, including Ukrnaft, Ukrgazprom and Chornamorneftagaz, which are the country's major oil and gas producing enterprises.

The State Committee of Occupational Safety Supervision verifies occupational safety requirements in mining companies. It also issues licences for the exploitation of mineral resources.

In the Ministry of Environmental Protection and Nuclear Safety, the State Department of Environmental Protection carries out the State environmental policy for the use and control of soils, groundwater and surface waters, and the atmosphere. The State Department of Nature Use and Regulation is also part of the Ministry, and includes the Mineral Resources Division. This Division is responsible for the development of policies and regulations, and the preparation of legal instruments related to the use and protection of mineral resources.

Other governmental institutions involved in the management of mineral resources are the Ministry of Coal Industry (coal mining), the Ministry of Industrial Policy (iron ore mining) and the Ministry of Energy (uranium ore mining). In addition, universities in major cities (e.g. Kyiv, Lviv, Kharkiv, Odessa, Dnepropetrovsk) have geology departments, which are usually the focal points for research and education in fields related to environmental geology.

Environmental monitoring

The Department of Hydrogeology and Geo-ecology, which is a subdivision of the Committee of Geology and Mineral Resources, is in charge of monitoring groundwaters. Its network comprises 11 geological, one hydrological and one prospecting teams working in all oblasts. In addition, the Committee of Geology and Mineral Resources carries out the following geological-environmental monitoring:

- radio-geochemical monitoring of groundwater, bottom sediments, and biological resources, to mitigate the consequences of the accident at the Chernobyl NPP;
- groundwater monitoring near other active NPPs, including the study of the conditions and regime of surface and underground radionuclide migration;
- monitoring of exogenous and endogenous geological processes (landslides, karst, erosion, seismic processes, etc.) and dangerous trends in their development.

Natural geological processes are monitored as follows: information is collected at local and regional observation centres (stationary sites), and analysed and processed (special groups, expeditions). There are 205 stationary sites for exogenous geological process observations, including 30 points for karst processes, 127 points for landslides, 8 points for earth flow, 5 points for lateral erosion, 15 points for ravine erosion, 15 points for sea erosion, and 5 points for banks of water reservoirs.

The State observation network for groundwaters comprised about 7 000 observation points on 200 test grounds before 1991 They were spread over the country's territory 30 per cent of them performed chemical analysis. Only few continue to function normally under present economic conditions. The network is made up of individual observation sites at the national (21 per cent), regional (43 per cent) and local (36 per cent) levels. The Committee also has monitoring sites for soil and river sediment pollution with heavy metals, oil products, radionuclides and pesticides. However, its laboratories do not perform geochemical analysis of soils and muds, and there is a lack of new equipment and analytical techniques.

The study of the dynamics of groundwater at polluted areas can be carried out at 63 basic sites, corresponding to 875 observation wells. They are mainly located in major industrialized centres (e.g. Donetsk, Kriviy Rig, and Crimea). Specific pollutants are observed in individual points and microelements are determined only at a few points and, as a rule, irregularly. Observations of mine water formation can be carried out at 58 mine sites and for quarries in 443 observation points. Special attention is paid to groundwater quality analysis in order to determine deviations from the standards.

Decision-making, ownership and pricing policies

Mining is one of the most State-controlled sectors of the Ukrainian economy. The State has given mine management new decision-making powers, yet the mines still do not have the freedom to set prices for their products. Currently, the manager of a mine is theoretically free to take decisions (e.g. equipment purchase) which used to be taken by the Government, with the crucial exception of pricing policies for extracted minerals.

Mining seems to be moving towards increased private ownership. However, privatization is still far from being achieved at any significant level. Little has changed despite some efforts to privatize parts of the mining sector. Controls may even have increased. For example, previously, the manager of a mining equipment plant had to consult with his relevant ministry before taking decisions. Today, that same manager receives guidance on most major decisions not only from the ministry, but also from the State Property Fund, which functions as the State landlord.

The prices of extracted coal, oil and gas are formally fixed by the State, yet field investigations indicate that prices are actually subject to monthly changes due to inflationary corrections. Moreover, the competitive prices of gas and oil have seriously distorted the coal market and forced mines to sell coal at low prices. The State in principle subsidizes coal mines mainly to support prices, wages and general social benefits for miners. Coal price subsidies were set to cover the loss between revenues received for coal sales and production costs. However, in practice, mines are receiving less financial support from the Government, which cannot afford the huge subsidies. In 1994, wholesale coal prices were adjusted six times by the State administration and reflected world market levels. Since then, wholesale coal prices have soared to an average of about US$ 24 per tonne in 1995, with average production cost at US$ 26 per tonne in the same year. In 1997, average production costs reached US$ 38 per tonne, reflecting the high cost of extracting Ukrainian coal. With the liberalization of the import regime, the price advantage of US$ 7-10 per tonne of imported steam coal over domestic steam coal, together with the unreliability of coal deliveries by local suppliers, may be considered as major reasons for the rapid increase in coal imports. In addition, there is a persistent imbalance between prices for mining equipment and coal. Changes in the price of domestic coal, which can be raised only by government decision, consistently lag behind those for mining equipment, which are market-based, and this discrepancy continues to grow.

Regulatory and economic instruments

The creation of efficient economic mechanisms to regulate the use of mineral resources is one of the major goals of Ukraine's environmental policy. At present, the main economic tools of its regulatory system regarding the use and protection of mineral resources are: (1) compensation for geological explorations, (2) payments for the use of mineral resources, (3) payments for environmental pollution, and (4) fines for violation of environmental legislation. The first two are mainly used for geological explorations to recover the mineral and raw material base of the country. The last two contribute to the non-budgetary fund for environmental protection, and should be used for the following purposes: (1) study of the groundwater regime and hazardous geological processes, (2) geological and environmental

mapping, and (3) further environmental and geological field investigations.

Regulatory instruments related to the use of mineral resources comprise licences, permits, limits and quotas (see also Chapter 2). They are applied to ensure an environmentally balanced and economically efficient use of mineral and raw material resources. The Committee of Geology and Mineral Resources is responsible for the registration of all prospecting activities. This Committee issues special permits or licences for activities related to the exploration and exploitation of mineral resources, including groundwaters, after examination of previous licences from the State Committee of Occupational Safety Supervision, relevant environmental institutions and local authorities. The Law on Environmental Protection provides for environment impact assessment (EIA) in mining companies. The assessment is conducted by the authorities of the Ministry of Environmental Protection and Nuclear Safety. It consists mainly of feasibility studies for the construction of tailing dumps and the future reclamation of these sites, as well as the installation of waste-water treatment facilities. However, the terms and conditions of the EIA are not systematically enforced, and environmental audits are not yet common. Besides, Ukrainian mining companies are not required to apply the concept of environmental management planning. This concept has been widely applied in other countries to establish environmental objectives and targets and to clarify the company's responsibilities to achieve them.

10.4 Conclusions and recommendations

The current desolate state of the environment in Ukraine's major mining regions, notably in the Kriviy Rig and Donetsk regions, is a consequence of a long history of inefficient mineral resources management. Metals and other materials provided by the mining industry are indispensable inputs for the Ukrainian economy and thus essential for the country's development. However, mining operations are not carefully designed and managed, resulting in severe environmental and social consequences. Most mining companies use outdated technologies, especially for waste-water treatment and tailing management. For instance, about 1 billion cubic metres of waste water is discharged without any treatment into the environment annually in Ukraine. The introduction of appropriate water-treatment facilities at mines and ore-processing plants is crucial to reducing or eliminating continuous environmental damage in local ecosystems. Moreover, effluents from mining tailing, particularly from coal, iron and uranium ore mines, are also potential sources of groundwater and soil pollution with heavy metals and radionuclides. Since there is no appropriate management of tailings in place so far, the large volume of wastes from mining and ore-processing operations represents a serious environmental and safety problem. The currently envisaged national programme for the environmental rehabilitation of Ukraine's mining should be extended to include plans as well as funding provisions for the introduction of waste-water treatment and tailings management technologies at mines.

Recommendation 10.1:
A programme to improve the environmental performance in mining and mineral processing should be developed and implemented. It should focus on the introduction of best available techniques for waste-water treatment and tailing management, as well as on the training of staff at all levels of mineral resources management. See also Recommendation 8.6.

Advances in mining technology should result in higher environmental standards. Realizing the full benefits of technology nevertheless requires the parallel development of environmental management policies and practices. Although there is some progress in managing mining's environmental impact, Ukrainian mining companies do not have any kind of environmental management plan. Such a plan should detail the methods and procedures the company will use to achieve environmental targets and objectives, including responsibilities for fulfilling the different requirements. Furthermore, surface mine reclamation or rehabilitation is a major environmental issue in Ukraine today. During the active period of a mining company, land reclamation and environmental protection measures are the responsibility of the company. However, after the closure of a mine, it is not clear who should rehabilitate the land. The current system of environmental funds for reclamation or rehabilitation of mines should be considered as a priority, including the determination of methods for calculating rehabilitation costs and of reliable procedures for the use of rehabilitation payments for actual rehabilitation. The rehabilitation programme should also envisage suitable reporting and reviewing of environmental performance at the site during both operational and post-operational phases.

Recommendation 10.2:
Environmental management should be adopted as a requisite for the issuing of licences to mining companies. This plan should include a system of environmental funds for mine rehabilitation according to world mining standards. Special payments for this purpose should be established after the cost-benefit of such rehabilitation is analysed as part of the environmental impact assessment of mining companies. See also Recommendation 5.1.

The Ministry of Environmental Protection and Nuclear Safety charges for the use of mineral resources in accordance with the mineral resource type. However, these charges do not take into account such important factors as the deposit's geological particularities, the scarcity of the mineral resource and its exploitation conditions. The Ukrainian regulatory system foresees fines for the violation of environmental legislation and payments for environmental pollution by the mining industry. They are not systematically enforced, though. Moreover, the charges for environmental pollution have not been adjusted for inflation, which has considerably eroded the paid amounts in real terms. For example, the basic emission charge for both SOx and NOx was set at 105.06 karbovanets in 1993 (about US$ 30/tonne at the time). In 1995, this charge amounted to less than US$ 1/tonne. Thus, environmental pollution charges should be increased immediately to keep pace with inflation (see Chapter 2). This may induce mining companies to stop neglecting environmental protection.

Recommendation 10.3:
The current regulatory system for the management of mineral resources should continue to be developed. Particular attention needs to be paid to the development and implementation of differentiated charges in accordance with (a) geological particularities, (b) scarcity of the resource, and (c) exploitation conditions. Furthermore, charges for environmental pollution should be increased and regularly adjusted to inflation. See also Recommendation 2.1.

The State Committee of Geology and Mineral Deposits has a very complex structure, making efficient management difficult at all levels. The Committee drew up a restructuring plan, aimed at cutting 80 per cent of jobs and keeping highly skilled professionals on the staff by paying better salaries. Given the importance of mineral resources for the Ukrainian economy, the creation of a national geological survey (for the systematic exploration and documentation of geological conditions prevailing in Ukraine) should be part of the restructuring plan. It will improve efficiency in the accomplishment of national goals in the mineral sector. The plan should have been adopted at the beginning of 1998, but no progress seems to have been made so far.

Recommendation 10.4:
The restructuring of the State Committee of Geology and Mineral Deposits and the creation of a national geological survey should be seen as a top priority. The existing restructuring plan should be implemented as soon as possible.

The environmental monitoring carried out by the network of the State Committee of Geology and Mineral Deposits does not appear to be effective. The number of observation sites and laboratories is too high, and some of them are inappropriately located. The total number of sites should be reduced. At the same time their concentration in the key areas should be intensified. The redistribution of sites should take into account specific geological and environmental requirements. The low concentration of observation sites for the national level should be reconsidered. Moreover, there is a significant lack of institutional and laboratory support to maintain such a wide monitoring network. Another obstacle for the development of a comprehensive monitoring system in Ukraine is the lack of technical, information and processing standards in agencies performing environmental monitoring.

Recommendation 10.5:
The current monitoring system run by the State Committee of Geology and Mineral Deposits needs to be (a) reduced overall, and (b) more concentrated in the most relevant areas (e.g. Donbass). The introduction of a plan aiming to reduce and redistribute the monitoring network, modernize laboratories and develop environmental monitoring standards should be envisaged.

During the Soviet period, the Donetsk coal mining region was a hub of economic activity, attracting labour and investment. However, the region has not kept pace with the dramatically changed economic environment, and both the surplus of labour and the deteriorated plants now contribute to the poor state of the regional economy. At present, the coal sector is severely overmanned, capital stock is low and there is little new investment. Furthermore, the use of coal resources for energy production requires

more advanced environmental technology and stricter pollution controls than Ukraine so far possesses. The implementation of the coal sector restructuring project, including the closure of unprofitable coal mines, is a matter of urgency. Funding for mitigating the huge social and environmental impact of the closure of more than 20 mines is included in the project. The slow implementation of such an important project will aggravate the dismal situation in the coal mining regions, with serious environmental and social consequences.

At the same time, insufficient preparation of mine closures implies very substantial and sometimes irreversible environmental risks, primarily with regard to the local and regional water regime. The proposals for rapid closure that Ukraine receives, sometimes from foreign funding institutions, do not always seem to recognize these risks. It is, therefore, necessary to carry out investigations in this regard, so that mitigation measures can be determined before a mine is closed down.

Recommendation 10.6:
To reduce the environmental impact of the coal industry and the large subsidies from the national budget to the coal sector, and to give profitable mines a chance to succeed, the Government should implement the coal sector restructuring project after the necessary environmental investigations for each individual mine have been undertaken, and the corresponding environmental mitigation measures are determined, included in the closure plans, and financed.

Chapter 11

MANAGEMENT OF BIORESOURCES AND NATURE CONSERVATION

11.1 Current state of nature

Landscapes and ecosystems

Ukraine is essentially a flat country, flanked by two mountain regions to the west (Ukrainian Carpathians) and to the south (Crimean Mountains), and largely open to the sea in the south. Ukraine's flatland is constituted of three main morphologic zones (see Figure 11.1): mixed forests (Ukrainian Polissya in the north), forest-steppe (in the centre) and steppe (in the south). Almost the entire territory lies within the temperate climatic zone, with the exception of the south coast along the Black Sea and the Sea of Azov and the Crimean peninsula (submediterranean zone with some subtropical features). The highest altitudes in the plains reach 300-475 m above sea level; the highest peaks are Hoverla (2 061 m) in the Carpathians and Roman-Kosh (1 542 m) in the Crimean Mountains.

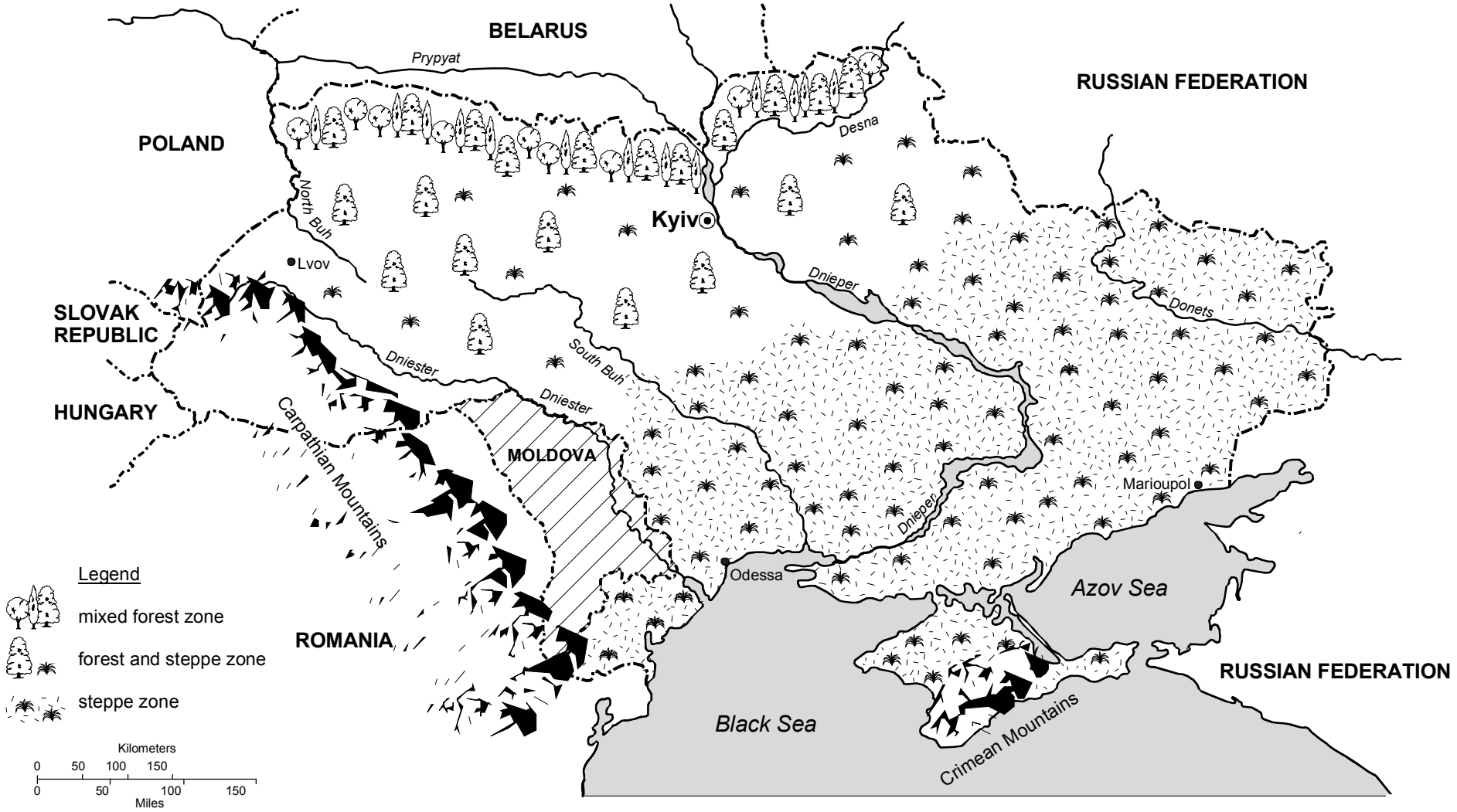
Since the beginning of the century, Ukraine's nature has been strongly modified by anthropogenic factors. As early as 1909, Stolypin's land reform stimulated strong agricultural expansion. It resulted in the destruction of forests (45 per cent of the territory at the eve of the second millennium and only about 15 per cent in the beginning of the 20th century), ploughing of virgin land, and drastic modification of natural ecosystems. In 1929, collectivization was forcefully introduced in agriculture. This profoundly changed landscapes and habitats. The steppes almost disappeared as a natural biome. Mires, swamps and wetlands in the northern forest regions were drained; others threatened by human activities. On the other hand, southern steppes were irrigated. In addition, pollution from agriculture and industry, not to mention the Chernobyl nuclear catastrophe, affected vast territories. All this led to drastic modifications in the genetic, biological and ecological diversity and stability.

For instance, the Polissya region was a swamp ecosystem until the 1960s, when extensive drainage projects turned 1.4 million ha into new agricultural land. The hydrological regime of water bodies was completely changed. As marshes disappeared, so did their typical plant and animal species. The number of fish species has reportedly fallen by four fifths in the past 20 years. Furthermore, the soil has been degraded as a consequence of improper agricultural techniques, the inappropriate use of chemicals and the deregulation of the water regime. Now soils with low humus content, acidic and leached soils, and eroded topsoils predominate (see Chapter 12). The environmental situation deteriorated further after the Chernobyl accident. Eight million ha have been contaminated by radiation, of which about 2 million are forests and 6 million agricultural land. The regeneration of the Polissya region, including the recovery of the natural marshland ecosystem by halting any further drainage of swamps and rebuilding the existing drainage systems, is a national priority.

Another example is the important wetland zone and marine ecosystem of the Black Sea/Sea of Azov coast, which is also threatened by anthropogenic activities, transport infrastructure and pollution. The ten most significant wetlands there cover 760 000 ha. The Lebednyi Islands and Karkinitska Bay (37 300 ha), Kazantip Bay (15 000 ha), Obitochna Kosa (8 800 ha), Sivash Bay (45 700 ha) and the Yagorlitska/Tendrvska Bay (113 200 ha) are important breeding and wintering grounds for waterfowl and spawning grounds for fish. Recreational activities, fishing, hunting and tourism are the most pressing threats to these areas, as well as pollution from agricultural run-off and from human activities. The regeneration of the Black Sea/Sea of Azov coastal environment has triggered a regional environmental programme and is a national priority. Nature protection and rehabilitation of biological diversity are among the programme components (see Chapter 9).

In short, natural or semi-natural vegetation is still important in Ukraine. It covers 29 per cent of the territory. Wetlands, mires and bogs have shrunk to 2 per cent of the territory, except in Polissya, where

Figure 11.1: Biogeography of Ukraine



this figure still reaches 6 per cent. The percentage of arable land, although declining, remains high (57.5 per cent). Meadows cover 9.7 per cent. Intensive erosion and wash-off of soil affect 18 per cent of the territory, floods 17 per cent, salinization of irrigated lands 11 to 25 per cent. Also, 30 per cent of the territory is affected by karst processes, 50 per cent of the disturbed slopes are subject to landslides. Marine ecosystems are severely perturbed. Moreover, industrial activities and transport infrastructure take up ever-larger areas.

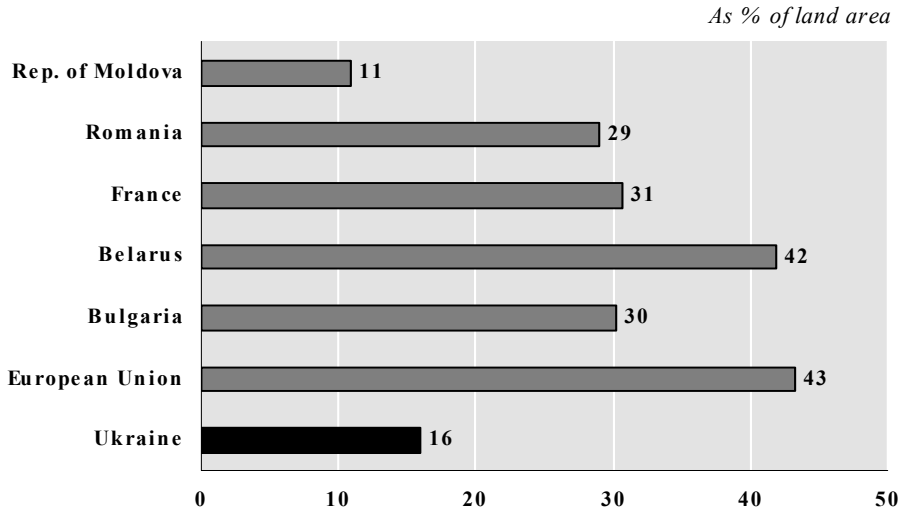
Forests

Ukraine has become a forest-deficient country with extensive steppe zones. Forests cover 15.6 per cent of the territory on average, and are currently slightly expanding. They are very unevenly distributed: 41 per cent of the land in the Carpathian Mountains, 26 in Polissya, 10 in Crimea and only 4 in the steppe region. In the Ukrainian Carpathian Mountains (4 per cent of the territory), forests are considered to be the green lungs of this densely populated area. They are adversely affected by outdated logging and transport technologies leading to soil erosion and destruction of natural vegetation, and also by overgrazing, chemical contamination and acid rain. The Polissya forest zone in the north occupies about a fifth of the territory. Twenty-five per cent of this zone is covered by dry-valley forests of oaks and coniferous species, which alternate with swampy meadows. Forest logging and procurement of non-wood products have decreased as a result of the contamination from the Chernobyl catastrophe.

Now that their technical exploitation is limited, forests mainly perform water-protective (floods), soil-protective and sanitary-hygienic (natural drainage) functions. They shelter a large part of the national biodiversity and are a source of timber and other resources (foodstuffs, including mushrooms, technical and medicinal raw materials, etc). More than 30 tree species grow in Ukraine's forests. According to the State Land Cadastre, of the 9.4 million ha covered with forests, non-coniferous forests represent 58 per cent (oak *Quercus robur L* and beech *Fagus silvatica L* representing 32 per cent), coniferous forests make up 42 per cent (essentially *Pinus sylvestris L.*).

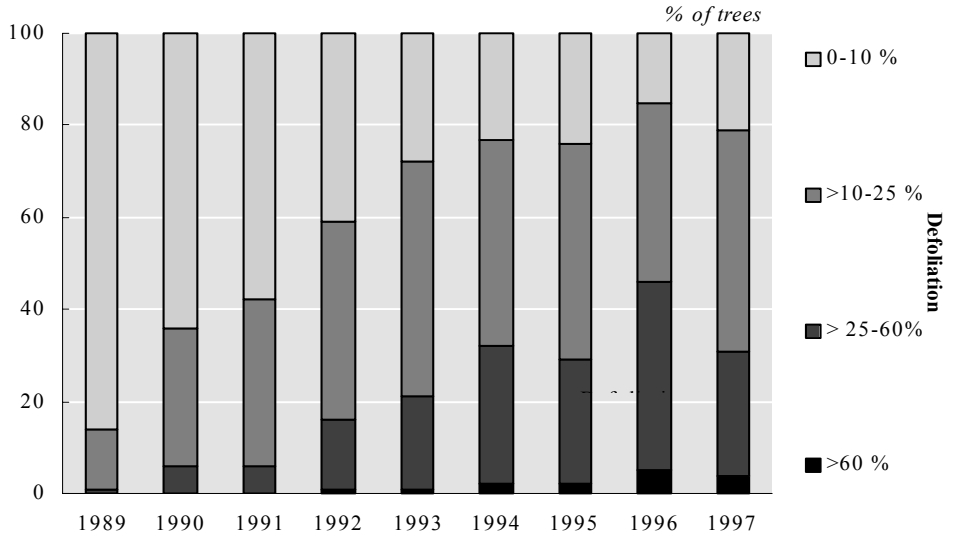
Forest health is undermined because almost the entire forest stock is located within zones where industrial air emissions exert a severe impact (see Chapter 7). Forests steadily lose their natural resistance and self-regulation abilities. By the end of 1996, the total area of forest infected by pest and tree diseases was more than 396 000 ha. Figure 11.3 shows how the defoliation process is rapidly progressing (mostly on oak and conifers). Forests suffer considerable damage not only from

Figure 11.2: Forest and other wooded land area in selected European countries and Ukraine, 1996



Sources: Forests and forest industries - Country fact sheets, Geneva Timber and Forest Study Papers, UN-ECE/FAO, United Nations, New York and Geneva, 1997; State of the World's Forests - 1997.

Figure 11.3: Defoliation of trees (all species) in Ukraine, 1989-1997



Source: Federal Research Centre for Forestry and Forest Products (BFH), 1998.

pollution (including radionuclide pollution: 150 000 ha are contaminated), but also from forest fires and natural disasters (droughts of 1995 and 1996). Because they became more vulnerable, they have been attacked by insect pests (*Diprion pini, Dendrolimus pini, Ocneria dispar L.*, *Totris viridana* and others). They are also suffering from pathogenic fungi and pathogens: butt-rot fungus (*Fomes annosus Fr.*), honey fungus (*Armillaria mellea Quell.*) and oak mycosis (*Ophiostoma quercus Naunfeld*). The apparent recovery of forest condition in 1997 is to be interpreted with care for the moment.

Most trees are still young, as a result of recent afforestation policy. Thirty-one per cent of the forest stand is constituted of young trees, 45 per cent of medium-age trees, 13 per cent are approaching maturity and only 11 per cent are mature. After the Second World War, the country's forest stock covered as little as 11 per cent of the territory. A vigorous afforestation policy was started then. This has allowed the creation of 4.5 million ha of new forest land, aiming first at diminishing erosion in intensive agricultural zones (for details see Chapter 12). So half the forests have been artificially created by replanting, the percentage of artificial forests now reaching 60 per cent in the steppe zone. In the 80s, forest belts were planted in particular to stabilize steep slopes and protect the banks of water bodies. At present, 13 million ha of arable lands are protected by anti-erosion forest (1.2 million ha) and protection belts (430 000 ha). Nevertheless, reforestation in Ukraine has plummeted over the years. In the period 1951-1960, 177 000 hectares were replanted annually; in the period 1961-1970 only 136 000 hectares; in 1981-1990 58 000 ha; and since then 28 000 ha. Reforestation remains a national priority, in particular with a view to stabilizing eroded soils unsuitable for agriculture, which represent about 4 million hectares.

Flora and fauna

Ukraine's flora and fauna are very rich, counting about 70 000 species. A third (mostly insects and fungi) have not yet been described. Some are threatened. The Red Data Book of Ukraine (1994 for fauna, 1995 for flora) lists the species that are threatened (see Table 11.1). It includes 383 animal species: hydrozoans (2 species), nematodes (2), annelids (7), crustaceans (26), arachnidans (2), myriapods (3), insects (173), molluscs (12), cyclostomes (2), fishes (34), amphibians (5), reptiles (8), birds (67), mammals (41). 541 plants and fungi are also listed, including 439 vascular plants. About 9 per cent of vascular plants and as much as 38 per cent of amphibians, reptiles and mammals are threatened.

Almost 25 per cent of flora species are concentrated in forests (15.5 per cent in broadleaved forests) and 20 per cent in steppes. The Carpathian and Crimean Mountains are particularly rich in flora (more than 2 000 species of vascular plants), the

Table 11.1: Fauna and flora species by group, 1994-1995

	Species	Endangered, vulnerable or rare species*	
	(Number)	*(Number)*	*(%)*
Mammals	108	41	38.0
Birds	400	67	16.8
Reptiles	21	8	38.1
Amphibians	17	5	29.4
Fishes	200	34	17.0
Invertebrates	>44 000	227	<1
Vascular plants	5 100	439 **	8.6
Mosses	800	28	3.5
Fungi and myxomycetes	>15 000	30	<1
Lichens	1 000	27	2.7
Algae	4 000	17	0.4

Source: National Report on Conservation of Biological Diversity, 1997.
Notes:
* listed in the Red Data Book of Ukraine, classification is according IUCN.
** of which two species extinct in Ukraine.

Crimean Mountains sheltering many endemic taxa. The Black Sea and the Sea of Azov shelter as many as 221 species of green, red and brown macroalgae. Overall, there are more than 5 100 vascular plants, of which 100 tree species. Of the 439 vascular plants listed in the Red Data Book, as many as 35 per cent are endangered (IUCN cat. I) and 39 per cent threatened (IUCN cat. II); 2 species are extinct (IUCN cat.0). These figures show how strong the anthropogenic pressure is on vascular plants.

While only 250 species of plants are officially recognized as medicinal, almost 1 100 species contain biologically active components of potential medical value. A majority of these medicinal plants are found in forests and shrubs. Another 25 per cent occur in meadows and steppes; 20 to 25 per cent of them are ruderal weeds. There are many other useful plants, potentially producing vitamins (200), oils (300), melliferous substances (1 000), tannin and dye (100).

The animal world is particularly rich as well. Much attention is paid to protecting terrestrial vertebrates, in particular game, and fish. Their catches are regulated by hunting quotas and fishing licences (see sections on hunting and fishing). The changes in landscape, due to agriculture and urbanization, have threatened some of these species as they have destroyed their habitat. Bird species are numerous in Ukraine, as the country is on one of the large migratory flyways of international importance. More than one hundred migratory bird species (out of the 170 listed in the AEWA Agreement of the Bonn Convention) stop there to nest or rest. Some of them are listed in the Red Data Book as being endangered (e.g. the slender-billed curlew *Numenius teniurostris*, the common crane *Grus grus*, the black-winged stilt *Himantopus himantopus*, the Kentish plover *Charadrius alexandrinus*). As some eagle/falcon species seem to be disappearing, control on their catch has been reinforced, but monitoring is insufficient to know the status of their population. A special programme is implemented to protect the pelicans of the Black Sea (*Pelecanus crispus* and *P. onocrotalus*), but the programme is likely to be interrupted because of a lack of funds.

The seas' aquatic populations are rich and specific as well. There are more than 2 000 marine animal species, 237 endemic or subendemic to this region. Ecological conditions there have also worsened. The habitat of some 190 invertebrates of the Black Sea and the Sea of Azov belonging to the Pontic-Caspian complex needs to be protected urgently so as to ensure their conservation. Some ad hoc regulations, for instance the ban on dolphin, seem to give good results, even if the lack of monitoring means that it is not possible to quantify them exactly. For similar reasons, it is also not possible to follow the spreading of new diseases that affect animal populations.

In 1985, 29 mammal species were categorized as endangered, rare or vulnerable, and in 1994 there were 41 (Red Data Book); birds and invertebrates are even worse off. In 1994, 67 birds were registered as endangered or rare species -- up from 28 in 1985 -- and 227 invertebrate species compared to 18 in 1984, of which 173 insect species. However, comparing these figures should be done with caution as methodology changed in between. In 1997, Ukraine started to study the current status of the 150 endangered or vulnerable species of plants and animals found on its territory that are listed in the Bern Convention's appendix. This is the first step in implementing the Convention, which Ukraine ratified in 1996. Today, about half the species have been reviewed, including some 10 mammals, 40 birds and over 20 plants.

11.2 Pressures on bioresources and nature conservation

Forest exploitation and forest fires

As seen above, timber resources are scarce in Ukraine and the proportion of mature stands is low. Forests are classified in two groups. Group I are forests with no or limited economic use. They represent 56 per cent of the State forest fund, including most forests of the forest-steppe zone, green belts around cities or along water bodies, and trees planted for soil protection. 11 per cent of group I forests are strictly protected. Group II mostly includes forests of commercial use. Currently, 76 per cent of forests belong to the State, the rest to associations of forestry enterprises. Forest resources are subdivided into those of national and those of local importance. 28 per cent of their exploitation is assigned to various forest users, the remaining 72 per cent to State forestry enterprises. The commercial use of forest is regulated by a permit and subject to payment (see Chapter 2).

Till the sixties, reforestation was important and felling low, as timber for domestic use was imported from other USSR republics. Afforestation was performed to compensate for the low forest cover. In the mid-eighties, land improvement programmes in agriculture were started. They were designed to reconstitute green belts along water bodies and create green barriers to stop erosion and landslides. About 40 per cent of this programme had been implemented. During recent years it was halted owing to the economic crisis. Before 1997, for every hectare cut in category II forests, 2 hectares were replanted. Since then, one hectare is replanted per hectare felled (Table 11.2). Fires are another cause of large forest losses (Figure 11.4).

Trade in timber and timber products is centralized. There is a need to obtain an authorization and to pay for using forest resources (see Chapter 2 for a description of charges). The State Committee for Forestry reports to the central planning authorities of Ukraine (including the Forest Planning Service) about the timber resources exploited by themselves and by the forest enterprises. These central authorities plan timber deliveries to consumers. The authorities set quotas for forest material exports. Fuel wood resources are managed in the same manner, but at the local level.

Annual timber logging satisfies one third of domestic wood consumption (Table 11.3). After the Chernobyl disaster and its impact on forests, local logging diminished. In recent years, the import of wood has dropped due to the economic difficulties, and Ukraine has reacted by increasing its timber felling by almost 25 per cent in 1996 and 1997 to satisfy domestic demand.

Nevertheless, forestry practice is striving to shift from a «resource-oriented» to a «biosphere-oriented» approach, as forest ecosystems are regarded as important shelter of biodiversity. In 1997, the Government developed a programme for the development of forests and forestry till the year 2015 to improve forest management and protection, and introduce principles of sustainable development step by step. Ukraine also participated in the IUCN Programme of Conservation and Wise Use of Forests in Central and Eastern Europe (1995-1996), and signed the 1993 Helsinki Declaration on the sustainable use of forest.

important landowners. By January 1998, 61 per cent of land was collectively owned, and more than 10 million citizens had received land under private ownership. The organizational structure of farms, their management and agricultural practices have changed little. Large farms (the average farm is 2 200 ha) are still the rule in most areas (see Chapter 12). Protected nature assets are located within the territories of large properties. The implementation of the protection measures is the responsibility of their owners.

Table 11.2: Regeneration and afforestation, 1961-1996

Unit: 1000 ha

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991-96
Forest regeneration	771	415	283	260	238	221	212
***of which:* Sowing and planting of trees**	722	385	262	240	219	209	192
Afforestation	168	191	199	136	77	85	74
Establishments of field shelter-belts	22	42	82	33	19	22	13

Sources: Forest and forest products Country Profile Ukraine UNECE (ECE/TIM/SP/4);
Europe's Environment: Assessment Ukraine;
Ministry of Environmental Protection and Nuclear Safety.

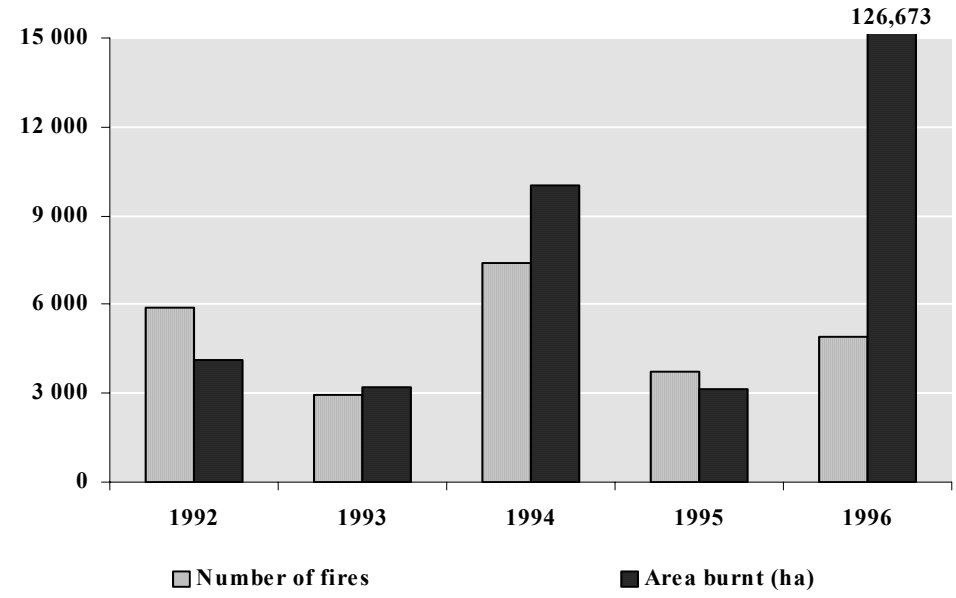
Table 11.3: Forest resources, 1991-1997

	1991	1992	1993	1994	1995	1996	1997
Forest area surface *(million ha)*	9.9	9.9	9.9	9.9	9.9	10.8	10.8
By ownership *(as % of total area)*							
State forests	*100*	*100*	*100*	*100*	*100*	*100*	*100*
Private forests	-	-	-	-	-	-	-
Other forests	-	-	-	-	-	-	-
Protected forest areas *(1000 ha)*	5.1	5.1	5.1	5.1	5.1	6.0	6.0
Fellings *(Million m3)*	..	..	..	..	..	11.6	..
Afforestation *(1000 ha)*	12.0	12.0	11.3	12.3	14.2	12.1	..
Area covered with forest* *(as % land area)*	14.3	14.3	14.3	14.3	14.3	15.6	15.6

Source: Ministry of Environmental Protection and Nuclear Safety.

Note:
* Forest and other wooded land.

Figure 11.4: Forest fires, 1992-1996



Source: State of the Environment report of Ukraine, 1997.

Agriculture

Ukraine is an intensively cultivated country. More than half the territory is ploughed land (see Table 12.1). The heritage of previous agricultural management practices is still exerting a negative impact on nature, such as the modification of hydrographic river regimes, drainage of wetlands and marshlands, felling of bushes, cutting of vegetation cover along water bodies, overuse and inappropriate use of pesticides and ploughing of steppes. All this induced morphological changes (wind and water erosion, landslides, salinization, drop in fertility), biodiversity impoverishment and shifts in ecosystems.

Ukraine has long been aware of the severe impact agriculture exerts on its nature. Protective green belts and green lungs have been replanted. Today, 5 million hectares are forbidden for agricultural use, as a protective measure. A draft national programme for soil protection till the year 2010 was completed in 1997. The document contains provisions on conserving, rationally using and restoring lands whatever their property regime and mode of use. Forest areas should be expanded by 2 per cent, protected areas should reach 6 per cent of the territory, and 6 million ha of land should be kept as a reserve fund. Also, in spite of the current hardship, the State strives to develop sustainable agriculture and introduce good agricultural practices. A project on Sustainable Agriculture and Biodiversity Conservation in the Steppe Zone of Russia and Ukraine (1996-1998) was worked out in cooperation with IUCN. Another project on sustainable agriculture was developed by USAID and an interministerial working group, leading to a code of good agricultural practices. An agricultural environmental management system and other measures, such as the classification of land according to its specific use and the agrochemical 'passportization' of land, are also envisaged (see Chapter 12).

Fishing and fish resources

Because of its important hydrographic system and long coastlines, freshwater fishing and marine fishing have always been an important activity in Ukraine. Most fishing takes place in the Black Sea and Sea of Azov and in the water reservoir of the Dnieper. Nominal fish catches have dropped since 1990. The drop is particularly severe for inland catches, which declined by more than 40 per cent between 1990 and 1995 (Table 11.4). The direct causes of the decrease are the economic situation, but also the ecological modification of water bodies due to anthropogenic pressures. The degradation of the water quality because of pollution discharges, inappropriate water management such as drainage of small rivers and of spawning areas, and hydrographic modifications of river regimes have badly affected ecosystems and fish populations. The situation in reservoirs is especially acute because of the excessive variation in the water-table. Illegal poaching and insufficient control of fish populations have contributed to the decline in fish stocks. The introduction of cultivated fish species, the establishment of fish reserves and the introduction of fishing quotas (1996) have not been sufficient to restore the situation so far.

For similar reasons, the situation of marine fish species in the Black Sea and the Sea of Azov is no better. The degradation of marine habitats due to coastal pollution, the decline in sea-water quality, the critical reduction of freshwater input into the Black Sea and the Sea of Azov, the accidental or intentional introduction of exotic species in marine ecosystems (for instance, grey mullet, salmonids, shrimp species, oyster and sea bass from the Sea of Japan and the Atlantic Ocean) also cause serious problems and threaten native species.

Hunting and game

As shown in Figure 11.5, the populations of European hare and fox, pheasant and partridge have been fairly stable since 1991. Over the same period, the populations of roe, European deer and wild boar have decreased and that of elk has halved. It is worth mentioning that Ukraine is home to the largest population of free-living European bison. The country traditionally takes a combination of measures to stabilize or reintroduce game populations in regions where they have tended to decline. In 1994, quotas for the hunting of birds (pheasant and partridge) were introduced. However, illegal hunting, which tends to increase as the economic situation worsens, undermines the game management strategy. The trend in the elk population is of concern. The number of animals legally killed does not seem to explain the large overall decline.

Chemical and radioactive pollution

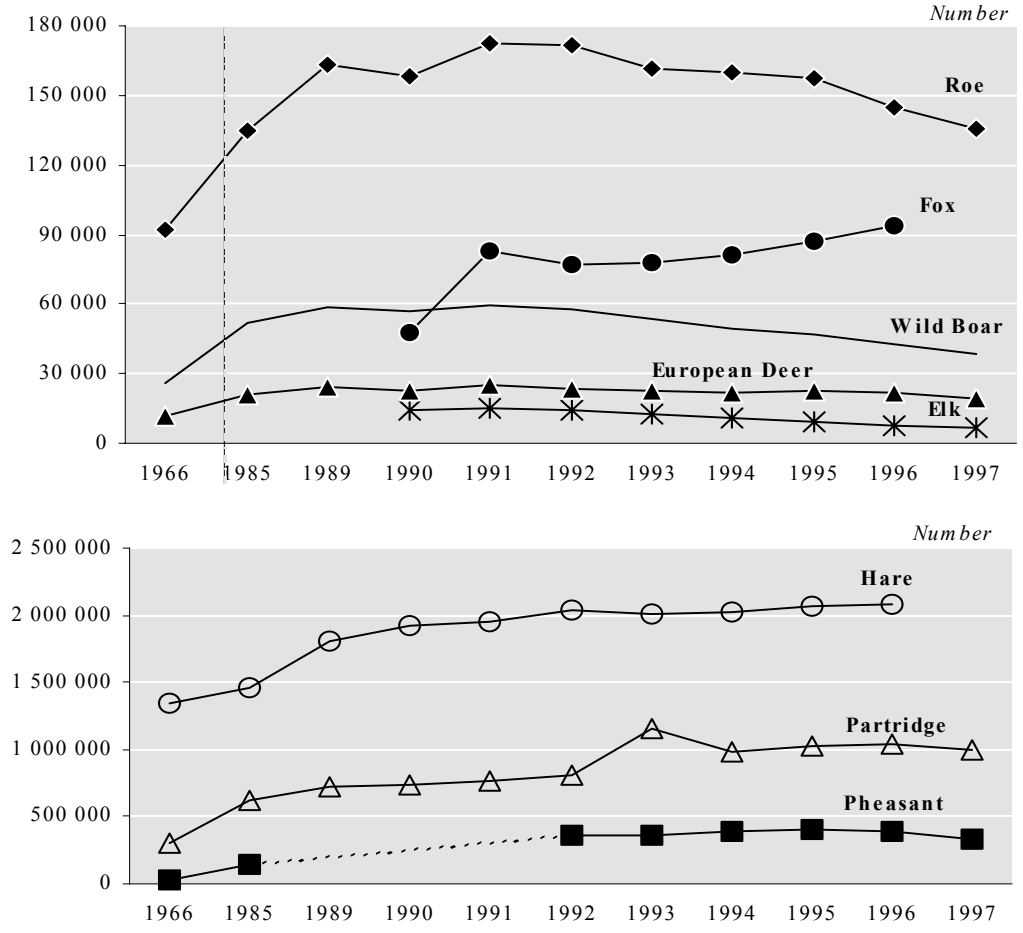
Studies of the impact of radiation from Chernobyl on nature have been carried out by several international and national research centres, but there are not enough of them and they lack coordination. Large populations of many species

Table 11.4: Nominal fish catch, 1990-1997

	1990	1991	1992	1993	1994	1995	1996	1997
Nominal fish catch *(tonnes)*	110 492	69 720	55 152	40 791	63 545	64 237	...	69 400
Inland* fishing *(as % of total)*	29.1	36.6	43.6	38.0	24.0	18.9	9.4	15.4

Sources: IEDS database; Ministry of Environmental Protection and Nuclear Safety.

Figure 11.5: Population of the main hunted species, 1966-1997



Source: IEDS database.

have been exposed to considerable doses of radioactivity. The consequences have been either immediate, as with the destruction of species, or deferred, as with gene mutations, following the build-up of radioactivity levels along the food chain and over long distances. The negative impact of the catastrophe will last a long time and many effects are still largely unknown. Out of the 109 000 ha of contaminated forest, 1 500 ha of Scots pine died because of the high direct doses of radiation. Other trees suffer long-term damage, such as «the red forest» in the exclusion zone, where tree leaves turn red in the summer well in advance of analogous species elsewhere. Some plants concentrate radioactivity from the soil, e.g. mushrooms. New strains of phytopathogenic fungi parasitizing grasses have appeared. To limit the spreading of contaminated soils, severely affected areas were covered with a layer of sand sown with special mixtures of grass and herbacea seeds. Some side effects are visible. For instance, as the drainage system of this forest area has not been maintained since the catastrophe, water is

stagnating to the detriment of oaks, whose health is deteriorating.

After the disaster, human activities were substantially reduced in the exclusion zone. Growing crops, hunting and fishing are prohibited, but are nevertheless taking place. Abandoned agricultural crops and orchards are an excellent food supply for many animal species. The populations of wild animals and in particular of elks are increasing in the zone. Birds are back for nesting. Of course, animals migrate, and the radioactivity of their tissue is not monitored, except for fish. Ad hoc studies of radioisotopes in tissue of animals show a wide range of deviations (e.g. from 478.4 to 101 493 Bq/kg in boar muscle tissue, from 666.3 to 273 450 Bq/kg for roe). Game killed in the vicinity of the exclusion zone is known to enter the human food chain (see also Chapter 4).

Management of water resources and drainage of soils

The deteriorating water quality and the modification of freshwater regimes (irrigation, drainage, hydroelectric installations, etc.) have resulted in important modifications to habitats and ecosystems. In the early 90s, the afforestation of river banks was meant to restore the aquatic ecosystems, but the programme's implementation has slowed down recently. More attention is paid to improving the management of the hydrologic regime of rivers, which has been severely changed by the creation of reservoirs. The fluctuation of their water level and that of their inflowing rivers has destroyed many spawning areas and reduced fish populations. The National Programme for Ecological Optimization of the Dnieper River Basin (1997) primarily aims at restoring the quality of water, which will in turn improve living conditions for aquatic species.

11.3 Nature protection policy and management

Policy objectives

A peculiarity of Ukraine is that it has developed its national environmental policy mostly in its laws and also, although not so much, in conceptual papers and strategic documents. Therefore, all documents are closely linked and contribute to the overall strategic orientations.

The key long-term document regarding orientations is the Strategy of Conservation of Ukraine's Biological Diversity, adopted in May 1997 by the Cabinet of Ministers. Its priorities will underpin the National Action Programme for Biological Diversity Protection for 1998-2015, which is still in draft form.

The Strategy builds on the principles of the Biodiversity Convention, the Pan-European Biological and Landscape Diversity Strategy and other important international agreements. It is intended to solve the environmental situation described in the National Report of Ukraine on Conservation of Biological Diversity, issued in 1997.

The major objectives of Ukraine's Strategy are to:

- Conserve and restore Ukraine's main ecosystems, i.e. coasts, marine ecosystems, rivers and their flood plains, lakes, wetlands, grasslands, steppes, forests and mountains;
- Conserve species and populations;
- Safeguard the environment of urban landscapes and territories where intensive economic activity is taking place;
- Integrate environmental considerations into agricultural activities, in particular forest exploitation, fishing, hunting, irrigation and farming practices;
- Establish a national ecological network.

In line with the Strategy, the Action Programme 1998-2015 will promote the sustainable use of natural resources and the minimization of direct and indirect negative impacts on ecosystems. It will call for better public information on biodiversity issues. It will also call on the authorities to alert all users of natural resources or entities having an adverse impact on nature about their responsibilities. The role of local authorities in preserving biodiversity will be enlarged. Reliable information regarding nature use and ecological safety will be provided to decision makers. The Programme will contain not only programme elements, but also a cost estimate of the various related actions, their source of funding and the administration (level) which will be responsible for their implementation.

In 1998, Ukraine confirmed its main environmental priorities regarding nature protection in a document entitled «Principal Directions of State policy in environmental protection». It highlights the necessity to improve monitoring (forests included), to map the habitats of rare and endangered flora

species, to regulate their import/export and to introduce a permit system and payment for the use of (valuable and medicinal) plants. It envisages preserving the biological and landscape diversity and strengthening protection activities in national parks, increasing forest sustainability and its ecological functions, and working out a nature utilization scheme/plan. Its targets are to have 17-20 per cent of the territory for meadows, hay and pasture lands, 20 per cent for forests and 5 per cent for protected areas. It stresses the need to integrate these goals into sectors of activities.

A few years ago, a number of actions were started under the 1993 National Programme for the Protection of the Environment, mainly in zones of strong anthropogenic pressure. In general, these programmes are continuing. They aim at regenerating the environment in (i) the Donets/Donbass region, (ii) the Polissya region, (iii) the Black Sea/ Sea of Azov region; and at better protecting the Carpathians. All these programmes include nature protection components, but are giving their implementation uneven importance (more in the Black Sea and Sea of Azov programme than in the Donets programme).

Legal framework

The 1996 Constitution assigns responsibility for ensuring ecological safety, ecological stability and equilibrium to the State, and for causing no harm to nature and for compensating for any damage caused to the citizen. There is no specific law on biodiversity. However, the Law on Environmental Protection (1991) stipulates that all plants and animals are subject to State protection, and any use of living natural resources is limited and gives rise to compensatory payment and the delivery of special permits and licences (for instance, licences for logging and for hunting, fish quotas, fees for special use of wild animals). There is a Forest Code of 1994, a Law on the Animal World (1993) and a Law on the Plant World (1999), which all handle particular aspects of species conservation. The commercial use of fauna and flora is subject to permits and charges. Penalties are imposed when fauna and flora are harmed.

Conservation in protected areas is covered in the Law on the Nature Reserve Fund (1992), and preservation and protection of rare, threatened or endangered animal and plant species is regulated by the Regulation on the Red Data Book (1992). These species are classified according to international requirements and definitions, and the lists are updated every five years (latest updates: 1994 for flora and 1995 for fauna). A recent Statute provides for the publication of the Green Data Book of Ukraine (1997), which aims at protecting rare plant communities. It provides a legal justification for conserving rare plant communities, by establishing a relevant regime for their protection and rational use. 126 rare plant communities in need of protection are included, of which forest (51), steppe (26), meadow (16), water vegetation (16), mire and swamp (12) and shrub (5) plant communities. This book is the sole example of such conservation practice in the world. So far, there are no laws on biotechnology and genetically modified organisms, but a draft is being drawn up.

Ukraine is a Party to many international conventions. It has ratified the Convention on Biological Diversity, the Washington Convention (CITES), the Bonn Convention (see Chapter 3) and other international instruments regarding nature protection. It also follows the requirements of the Pan-European Biological and Landscape Diversity Strategy.

The existing legal framework as it now stands sustains Ukraine's current policy orientation and strategy in nature protection sufficiently. It allows for the development of a network of natural territories and assets under some protection regime, with a potential future increase in protected areas. The ultimate goal is the creation of a national ecological network as part of the pan-European ecological network.

Institutional arrangements

The Ministry of Environmental Protection and Nuclear Safety defines the State policy for nature protection and rational use of natural resources, including biodiversity conservation. It draws up strategies, programmes, laws and standards (norms) on the issue. It gives the permits for the use of natural resources (se Chapter 2). Its Department of Nature Conservation manages biodiversity conservation programmes (protection of species and development of ecological corridors) and protected areas of national importance (national parks, biosphere and nature reserves). An Inter-Agency Coordinating Commission on Conservation of Biological and Landscape Diversity has been set up to help integrate biodiversity considerations into all economic activities. Its first task was to draw up the Biodiversity National Report and the biological diversity strategy. It also plays a role in drawing up the action programme and in implementing it.

In agreement with the Cabinet of Ministers and the MEPNS, the State Forestry Committee determines the State policy in forest management, organizes forest use and conducts forestry operations. The Forest Planning Service keeps an inventory of all forests and plans the development of forestry. It is also responsible for hunting and hunting control throughout the territory. The Committee consists of State Regional Associations and departments of forestry. There are 2 700 forest inspectors.

Since the 1992 Law on the Nature Reserve Fund, all the newly created protected zones are put under the Ministry of Environmental Protection and Nuclear Safety, while, for historical reasons, a few protected areas of national importance are still under other bodies, such as the National Academy of Sciences of Ukraine, the Ukrainian Academy of Agricultural Sciences or the Ministry of Education. Others are under the State Committee for Forestry and the Committee for Fishery. Most of these protected areas have their own management boards. Their operating budgets are attributed by their governing bodies. However, budgets for managing protected areas are tight.

The management of protected territories and assets is ensured by the Central Board for National Natural Park and Reserve Management of the Ministry of Environmental Protection and Nuclear Safety, which is an organ of State executive power. The Board ensures the implementation of the State programme on protected assets and applies State policy to protect, develop and use them.

Within their respective fields of competence, the State Committee for Forestry and the Committee for Fishery, for Water Management and for Land Resources, and their regional and local agencies manage, restore and protect natural resources (game, category I forests, fish stocks, protected river belts, urban green lungs). A number of other State bodies with executive power are engaged in nature protection as well; they deal directly or indirectly with the conservation of animal and plant species and their habitats

At regional and local levels, functions are performed by various local authorities that take decisions on regional policy. Regional parks and a number of other protected assets are under the regional agencies of the Ministry of Environmental Protection and Nuclear Safety in oblasts and the cities of Kyiv and Sevastopol. Nature protection in coastal areas and the national marine zone is the responsibility of the State Environmental Inspectorate for the Protection of the Black Sea and the Sea of Azov. At regional level, certain protected areas have their own management boards. Others do not, in particular those that are entirely included in collective farm lands and which are formally under the responsibility of the landowner. Nature protection in the Autonomous Republic of Crimea is managed by the Republic's Committee on Protection of the Environment and Natural Resources.

Monitoring

Monitoring, surveys and scientific observations of populations of species are currently reduced to a minimum. Legal provisions exist for the monitoring and surveying of species. There is a project for a cadastre of species on which the proposals for conservation and recovery of species should be based. But because of the lack of money, even species of economic value (game and fish) and endangered species are hardly monitored.

Box 11.1: Nature monitoring and NGOs

The Ukrainian Union for Bird Conservation is the Ukrainian chapter of the IBA Programme (Important Bird Areas) of Birdlife International, sponsored by the Netherlands. It counts 2 000 members who contribute in cash (fee) or in kind (transmission of information/data by scientists). The data include the main characteristics of the habitats, threats (flora cutting, pesticides,…), biodiversity, list of bird species, etc. Interested members draw up some sort of local inventories. The aim is to gather all data needed for establishing new protected areas so as to protect birds where necessary. The ultimate objective is to propose these new projects to the Ministry of Environmental Protection and Nuclear Safety, which is mandated to submit proposals to Parliament. Recently, the organization has submitted a series of prospective sites, about 10 of them coinciding with lands put aside as land reserves. Some of the organization's data transmitted to the Ministry have been used when establishing the Black and Azov Sea ecological corridor (ECONET) for the GEF. This is a good example of coordinated and focused action to collect and make use of monitoring data for decision-making. It also shows how cooperation can be fruitful in times of economic restrictions.

Measures for protecting habitats and species

Protection of areas. Over the past years, priority has been given to nature conservation at the highest political level. In 1993, a resolution affirmed the willingness of the State to « optimize the management of nature reserves and national parks ». In 1994, a presidential decree was issued « on reserving valuable territories for subsequent conservation ». For this purpose, 700 000 ha of scientifically and ecologically precious land was excluded from privatization with a view to

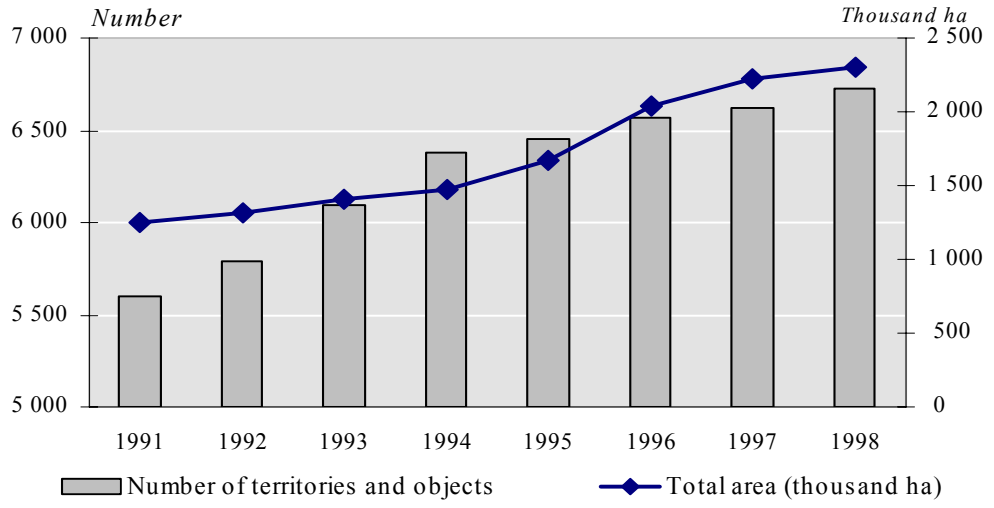
subsequently putting it under some protection regime. The National Programme of Future Development of Nature Conservation Protected Sites in Ukraine till 2005 was adopted by parliamentary resolution in September 1994 (177/94-BP). The Ukrainian policy is to expand areas of protected territories, optimize the network for nature protection, improve its management and prevent privatization of valuable natural assets and territories. Preserving unique and typical landscapes, biological diversity, the genetic fund of plants and animals are also key objectives of the Programme, which puts emphasis in parallel on nature monitoring, training high-skilled specialists and raising citizens' awareness.

As a result, protected territories have significantly increased since 1991 (Figure 11.6) -- an effort which goes on today. In 1998 alone, 10 new prospective territories for protection were proposed to the Government, of which six have already been adopted. Two new nature reserves were established in the Republic of Crimea (Kazantipsliyv and Opukskiy reserves), as was a biosphere reserve on the Danube delta in Odessa oblast and a national park in Lviv oblast (Yavorivskiy National Park). Moreover, the Black Sea Biosphere reserve was expanded and new sanctuaries and nature monuments were designated. Overall, the network of protected areas expanded by 145 000 hectares. Proposals for other new protected monuments till 2005 were also formulated and backed by a Presidential Decree of April 1998.

6 728 territories and assets are protected in Ukraine, covering 4 per cent of the territory (September 1999). Among them 11 national parks (583 000 ha), 5 biosphere reserves (285 000 ha), 287 natural reserves of national importance (360 000 ha) and 21 regional landscape parks form the core of areas where major features of biodiversity are protected (i.e. coasts, marine ecosystems, rivers and their flood plains, lakes, wetlands, grasslands, steppes, forests and mountains). Other protected assets include botanical gardens (17), arboreta (19), memorial parks (88) and zoos (6), 15 nature reserves with a strict protection regime (total area 114 000 ha), and many protected assets of local importance.

Most of the typical biogeographic features of Ukraine's provinces are quite well protected, perhaps with the exception of the forest-steppe of the Middle Russian and the steppe of the Crimean plains (Figure 11.5). The Steppe Nature Reserve Fund was created in 1961 to protect the still virgin steppes. It includes a number of small reserves. Thousands of vascular plants grow there, of which more than 40 are rare; 30 rare species of animals, 140 of birds and 10 of fish also live in these areas. Today, almost 80 per cent of the vascular plant species of Polissya and steppe regions are represented in protected territories.

Figure 11.6: Evolution of the protected territory fund in Ukraine, 1991-1998



Source: National Report on Conservation of Biological Diversity, MEPNS, 1997.

Efforts are also under way to prevent more water bodies, mires and bogs from being modified or drained, and to protect those that remain. Ukraine ratified the Ramsar Convention in 1996 and recognizes its responsibility for the conservation of 22 wetlands (678 000 ha) of international importance (resolution of the Cabinet of Ministers in 1995). The country intends to strengthen its protection of such areas, in particular in the southern coastal zone.

Box 11.2: The Carpathian Biosphere Reserve (CBR)

The CBR is included in the UNESCO World Network of Biosphere Reserves. Located in the west of the country in the Carpathian Mountains, it covers 63 700 ha, 90 per cent occupied by forest, and consists of 6 separate massifs and two botanical sanctuaries of national importance. It protects more than 1 000 higher plant, 64 mammal, 173 bird, 7 reptile, 13 amphibian, 34 fish and about 10 000 invertebrate species. Large areas of virgin beech old-growth forests are located there, which constitute the genetic bank of this type of resource for the whole of Europe. In 1993 the Global Environmental Facility (GEF) awarded a grant of US$ 585 000 to fund the Transcarpathian Biodiversity Protection Project. Slovakia and Poland are associated with this project as they share boundaries with Ukraine along the reserve. The project included several programmes: scientific, managerial and educational. It also has a significant impact on the social and economic development of the region, opening it up step by step to recreational tourism.

Nature conservation is also reasonably well ensured in the Carpathian and Crimean Mountains. In 1997, the Carpathian Biosphere Reserve received the diploma of the Council of Europe, which is a recognition of the quality of its protection regime (Box 11.2). The state and classification of the nature protection areas in the south, notably coastal ecosystems on the Black and Azov Seas, are less clear. It seems that many of them are not adequately protected. Likewise, there is no information on the international recognition of their status.

Green belts are also protected. They have been planted to split over-sized cultivated fields, to protect the banks of water bodies (including wetlands) and to create green lungs in urban and industrialized places. In January 1997, green belts within cities and towns totalled 500 000 ha, including 118 000 ha of plantations of general utility. Overall in Ukraine, only 12.5 per cent of all existing green belts are planted with appropriate care, and 23.4 per cent of general utility plantations. In 1995 these indices were 15 and 30, respectively. Since 1991, efforts to create new or reconstitute old green belts have steadily declined. By 1996, these efforts had reduced 2.6-fold compared to 1995, and 3.3-fold compared to 1990. To protect the coast, there is a ban on building and a limitation on land use within a 2-kilometre belt along the shore. The first 50 metres from the sea are strictly protected.

Protection of species. The rich genetic resources of wild species, varieties, breeds and strains of animals, plants and micro-organisms representing both native and non-native taxa are preserved in 478 different places (natural habitats, collections, gene banks, arboreta, botanical gardens, zoos and institutes). Several rare and endangered species of trees are protected in this way, such as *Pinus stankewiczii*, *Pinus cembra*, *Taxus baccata*, *Arbutus andrachne*, *Pistacia mutica*. For instance, the Nikita State Botanical Garden has a unique

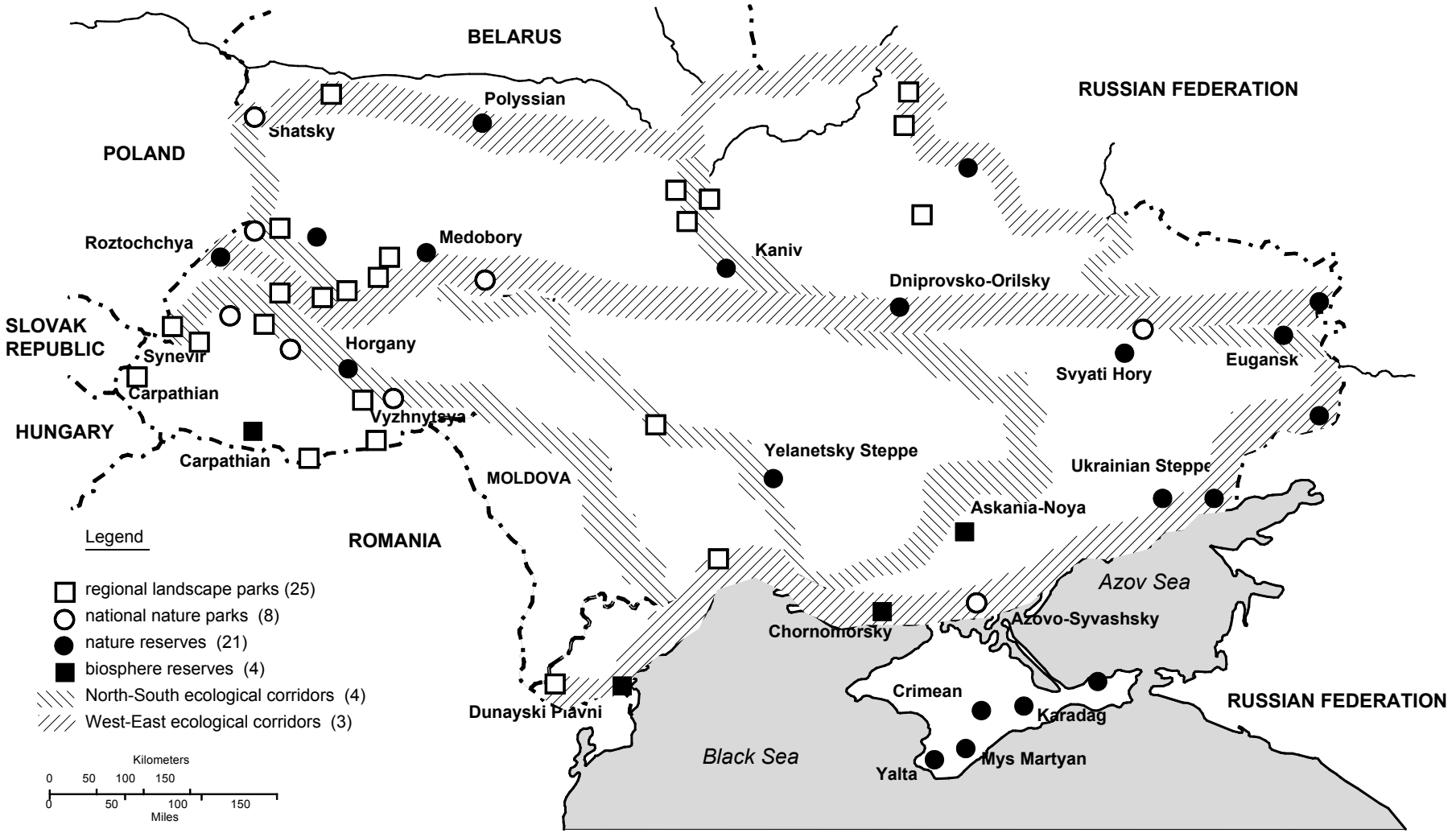
Table 11.5: Protected areas, 1999

	IUCN classification	Number	Area *(thousand ha)*
Reserves with strict protection regime	I	15	114
National Park	II	11	583
Natural Monument	III	131	5.5
Natural reserve	IV	287	360
Protected landscape	V	26 *	400
Resources reserves	VI	277	-
Multifunctional areas	VII	130	-
Protected areas *(as % of the total territory)*			**3.9**

* 5 biosphere reserves covering 285 000 ha and 21 regional landscape parks.

Source: The Ministry of Environmental Protection and Nuclear Safety, Central Board of National Nature Park and Reserve Management, 1999.

Figure 11.7: Location of protected territories and ecological corridors



collection of 9 000 species and cultivars representative of dry subtropical Mediterranean flora. Genetic resources of cultivated plants are also preserved (e.g. 42 000 specimens of field crops, 500 of medicinal plants, 7 000 in the pomology collection and 485 in the ampelographic collection). Local breeds of cattle (Grey Ukrainian, Ukrainian Whitehead, Brown Carpathian, etc.) are conserved and used in cattle breeding. The Askana-Nova Zoo is famous for acclimatizing and re-acclimatizing ruminant mammals native to steppes, savannahs, deserts and mountains, as well as waterfowl and rare steppe birds. The zoo hosts 15 species listed in the Red Data Book, including the steppe eagle, the common crane, the demoiselle crane and the ruddy shelduck. However, the lack of funds makes it difficult to artificially breed and save rare animals. The conservation measures are currently limited to restricting the use of protected species (permit necessary), better controlling their illegal collection or destruction, and strictly limiting access to the territories and reserves of special importance for these animals.

Another valuable element of the flora heritage is the wealth of medicinal plants Ukraine possesses, although they are declining. To ensure their preservation, 100 000 ha were protected. The idea is to further preserve zones of medicinal plants. This is important to save some taxa listed in the Red Data Book that are important for the pharmaceutical industry, e.g. *Adonis vernalis L.*, *Astragalus dasyanthus Pall.*, *Galanthus nivalis L.* and some species of the *Pulsatilla* genus.

All these measures at the national level are consistent and fully coordinated with Ukraine's international commitments, though it still needs to ratify some important international conventions regarding nature protection (see Chapter 3). In 1996, Ukraine helped to prepare materials and international consultations on the conservation of rare animals such as pygmy cormorants, bats, cetaceans, birds of prey, sturgeons and some other fish species. For instance, following the provisions of the Bern Convention, it participates in the implementation of European action plans to protect 12 endangered species of birds.

Habitats outside protected areas. In more than 96 per cent of (unprotected) territory, various measures are developed to preserve nature. Pressure from agriculture is being eased by the introduction of sustainable agricultural practices and land-use modifications. Since 1993, when Ukraine signed the Helsinki Ministerial Declaration on Sustainable Management of Forests, forestry practices have been modified. In 1998, a contract with Sweden was concluded to jointly draw up a strategic development plan (master plan) for forestry in Ukraine. It will take into account biodiversity protection. Also, regional environmental protection programmes include elements to protect specific ecosystems and other features of nature, even if they are not under a protection regime. For instance, the Polissya project is a "Green Lungs of Europe" initiative. With a view to reducing the degradation of the ecosystems of that region after the Chernobyl accident, an integrated management plan was adopted both to restore the ecosystem and to ensure an environment-friendly use of its resources. Measures have been introduced to restore the fertility of soils; a technical plan has been drawn up to restore the drainage system; and land regeneration and reforestation plans are being prepared for the long term.

Box 11.3: The southern ecological corridor along the Black and Azov Sea coast

This project is the most advanced. It already includes an important number of core zones: 7 nature reserves, 1 national park, 1 biosphere reserve, 35 *zakazniks* (hunting and scenic nature reserves), 32 memorial parks and 102 natural monuments, totalling about 15 per cent of the coastal area. In the future, this protected surface will double with the creation of 3 more national parks and a series of reserves. The coastal zone is particularly rich in wetlands (19 of international importance), steppes and bogs, forests and sands, and brackish and saline reservoirs. For instance, the Black Sea Biosphere Reserve (about 87 000 ha, more than half are water areas) shelters many rare, relict and endemic species. It is also a place where nearly 300 bird species nest and hibernate. 620 plant, 45 mammal, 9 reptile, 5 amphibian, 40 fish species as well as thousands of water and ground invertebrate species are found there. Outside core areas, in the buffer zones, human activities will be re-oriented to lessen their impact on nature. Agricultural practices will be modified, and new economic opportunities, such as ecotourism, promoted. An important effort to inform and train farmers and other stakeholders will be undertaken as part of the programme. The south corridor project, « Conservation of Biodiversity in Azov-Black Sea Ecological Corridor », will benefit from GEF funds and will start in early 1999. Numerous international NGOs, including Wetlands International and Birdlife International, are also participating. The local population will be a key player.

Ecological corridors aim at ensuring a more efficient preservation of biodiversity and continuity of ecosystems both within the protected core areas and their adjacent territories. Their primary purpose is to preserve free migration of animals that require more territory than the existing protected zones provide, and allow for the

spreading of vegetal species. Fully in line with the European Ecological Corridor Network (EECONET) launched by the Netherlands in Maastricht (1993), the network developed by Ukraine consists of 10 first range -- 5 east-west, and 5 north-south -- corridors (Figure 11.7). The latter are along the banks of the Danube, Dniester, Bug, Dnieper and Sivers'kyi Dinets rivers in particular, while the others are (1) along the frontiers in the north, where international protected areas are organized with neighbouring countries, (2 and 3) crossing the country in the middle through steppe zones, where ecosystem continuity has suffered from intensive agriculture, and (4) along the Black and Azov Sea coast (inland) and (5) a sub-marine corridor along the coast. (Box 11.3). In all, corridors will cover more than 10 per cent of the territory.

Financing and economic instruments

Except for hunting and fishing licence fees, compliance with nature protection legislation or biological resource exploitation generates very little income (only 7 per cent of the taxes on natural resources in 1997) (see Chapter 2, in particular Table 2.1). The 1992 Law on the Nature Reserve Fund provides for economic incentives. For instance, those engaged in nature conservation benefit from tax exemptions. Also, private owners whose land is subject to a protection regime are compensated for its restricted use. However, there is as yet no implementing regulation for compensation measures.

Most expenditure for nature and biodiversity protection comes from the State budget. In 1997, national parks and reserves received 1.4 per cent of all environmental expenditures, 98.6 per cent of which were for current expenditures (Table 2.2). In 1998, the expenditure forecast was about 7 780 000 hryvnias, which would represent 11 per cent of the State budget for the environment. Nature protection measures are also financed by local budgets, though at the rayon level the resources are firstly devoted to water supply and to the management of waste water and solid waste.

The shortage of funds is the most serious impediment to the implementation of the provisions of the Convention on Biodiversity in spite of the important international contributions. Ukraine has received financial assistance from GEF, the World Bank, UNEP, the Council of Europe and from foreign countries (mainly the Netherlands and also Austria, Canada, Denmark, France, Germany, Switzerland, the United Kingdom and the United States). Many programmes are short of funds. This is the case of the Natural Reserve Programme, of which only 40-50 per cent is carried out each year. A list of projects undertaken with foreign funds is included in Chapter 3.

Research and information

Ukraine has highly qualified scientific personnel and expertise in conservation, restoration and sustainable use of bioresources. Scientific research into biodiversity conservation is carried out by scientific institutes and centres of the National Academy of Sciences, by research institutions of the Ukrainian Academy of Agricultural Sciences and by departments and chairs at universities or colleges. Ukrainian experts are very knowledgeable about species. They are less experienced in population/ecosystem management and genetics.

The process of decision-making in nature protection and biodiversity conservation involves numerous experts from academies, research and educational institutions, universities and the Ministry for Science and Technology. Bodies of qualified experts exist also at almost all administrative levels. More than 20 universities and educational institutes have departments and chairs with ecological and environmental programmes.

NGOs play a critical and active role in nature conservation, in particular the National Ecological Centre of Ukraine, the Ukrainian Society for Nature Conservation, the Ukrainian Association of Hunters and Fishermen, the Green World Association, the Ukrainian Society for the Protection of Birds, the Ukrainian Botanical Society, etc. Some of them are linked to international NGOs, which contribute to their functioning. They publish journals devoted to nature protection and strive to develop training, to inform and to raise awareness. To coordinate NGO activities with those of State agencies, the Ministry has established the Public Ecological Council.

11.4 Conclusions and recommendations

For about the past 10 years, anthropogenic pressure on nature has eased in Ukraine. Agriculture and industry have reduced their activity levels as a result of the economic crisis and sectoral restructuring. Moreover, policies and measures have been applied which also go in the same direction. Improvement programmes have been put

in place since the mid-1980s to better protect water bodies and eroded soils against intensive agriculture. The banks of water bodies have been planted with trees to restore protective green belts. Trees have also been planted to fragment the huge cultivated fields and consolidate unsteady soils, thus combating erosion and landslides. Although interrupted for shortage of financing, about 40 per cent of the green belt afforestation programme has been implemented. Better agricultural practices are also being worked out (see Chapter 12). As this pressure eases, nature and biodiversity are both recovering. A more decisive introduction of cleaner technology in industry would be a step forward in consolidating these trends (see Chapter 5).

The exploitation of natural bioresources is also becoming more sustainable. The forest area, which is still small (15.6 per cent today with a target of 20 per cent), has grown substantially through afforestation. Currently, more than a third of forests are excluded from any timber production. Principles and practices of sustainable forest exploitation are being introduced stepwise, as planned in the Programme for the Development of Forests and Forestry adopted in 1997. In spite of the shortage of financing, the State Committee for Forestry should be further encouraged to pursue this approach. It should also strengthen its control over game populations, as some are dwindling dangerously (European deer). The wolf population needs better monitoring, and measures to preserve bison bonasus, brown bear, lynx and wild cat need strengthening. The scientific survey and scientific research on forests should also be improved. The fish stock is certainly in a critical situation. The population decrease is due to several factors: illegal fishing, drop in the reintroduction of fish in freshwater and reduction of the spawning areas due to hydrological modifications (drainage, management of river water level, destruction of river-bank vegetation, etc). Among its mandated tasks, the Committee for Fishery should devote more attention to fish stock restoration.

Even if the original wealth of biota has been quite well protected till now, anthropogenic pressures are affecting nature and biodiversity. As shown in the Red Data Book, valuable species are threatened. It is also likely that for commercial interests other species will be increasingly threatened in the future (medicinal plants and traffic in endangered species). Therefore, measures to protect them should be envisaged soon.

Recommendation 11.1:
It is necessary to set up national, regional and sectoral programmes for the restoration of rare plants and animal species as well as for the management of introduced alien species especially where they adversely affect local biodiversity

Tribute should also be paid to the country's very proactive approach to nature protection. Ukraine has for a long time applied policies and strategies that are today fully in line with the European view of applying the Convention on Biodiversity. Its national biodiversity strategy follows the Pan-European Biodiversity and Landscape Strategy, taking over the systematic protection of species and ecosystems. The main objectives of the Strategy are broadly followed. However, knowing the Strategy's implementing programme and financial implications would certainly shed light on the efforts that Ukraine can realistically sustain. It would help establish clear priorities among programme elements.

Recommendation 11.2:
The draft national action programme for biological diversity protection and sustainable use should be adopted urgently.

Ukraine is a lead country in the development of ecological networks. The ambition of the EECONET- ecological network project is to connect the core protected areas by buffer zones, where human activities will be regulated. The project, which is a component of the Pan-European Strategy, appeared early in the Ukrainian environmental policy (pursuant to the 1992 Law of Ukraine on the Nature Reserve Fund). Since then, this goal has been systematically pursued. The corridor network has been mapped, and funding has been actively sought. Not only have agreements been made with IFIs and donor countries, but opportunities for NGO participation have grown. Moreover, the project also has an international cooperation dimension, as it provides for the connection of corridors and protected zones with neighbouring countries. The Carpathian biosphere reserve is the first trilateral (Slovakia, Poland, Ukraine) transfrontier project financed by GEF. Overall, the project is a remarkable example of international cooperation, successful funding initiatives, vertical cooperation between national, regional and local levels, and horizontal coordination between a number of local actors (various sectors of activity, NGOs, scientists, education).

Such a broad project has important financial implications. The first practical implementation will be the southern corridor, which stretches along the Black Sea and the Sea of Azov. There, problems remain. The most valuable sites are in principle protected, although there is no information on the international recognition of the status of many protected areas. In the unprotected zones, considerable management problems subsist with pollution. The corridor project will be entirely financed by international grants. Nevertheless, the project includes the creation of some new protected areas along the corridor, a requirement which will be even more demanding in other regions (in particular the central horizontal corridor across the steppe).

These new protected areas will necessitate management boards, hence operating finance. The Ministry of Environmental Protection and Nuclear Safety submitted 10 proposals for new protected objects in the period 1997-1998. Some have been accepted, such as the new Biosphere Reserve in the Danube Delta and a national park for protecting wetlands in the Black Sea region. The Ministry's budget for operating nature reserves under its responsibility is extremely tight. In 1998, 40 per cent of the requested budget was actually attributed. Salaries represented almost the totality of the allotted sum, a situation which is likely to continue in 1999.

The EECONET project can raise Ukraine's environmental profile on the international stage. At the local level, it can be useful as well, in particular if it involves local people. Ukrainian scientists are highly qualified and knowledgeable about species and ecosystems. However, more national expertise would be needed in the management of projects and programmes for nature protection. Then national nature management experts could take over more responsibilities in the development and implementation of programmes financed with foreign funds. Ultimately, they should participate fully in these projects' decision-making processes. International NGOs, which have many projects in Ukraine, could contribute to nature management and encourage a participatory approach in management as well. International projects (in particular those currently being worked out with neighbouring countries, such as Belarus, Republic of Moldova, Romania, Hungary, Russian Federation) should be seen as opportunities for building the capacity of local people.

Recommendation 11.3:
Training and capacity building should be introduced as a regular component of any EECONET project to make Ukrainian specialists acquire the skills necessary for managing biodiversity and nature protection projects. To this end, the creation of an international centre in Ukraine to give training in nature conservation and EECONET development would be an excellent opportunity for meeting the needs of Ukraine and of its neighbours in eastern Europe and the newly independent States. The centre could benefit from western partner experience.

Protected areas are the cornerstone of Ukraine's nature protection policy. It is true that their percentage is still rather low (3.9 per cent of the territory). However, existing protected areas (2.0 per cent inherited from the previous regime) have long benefited from an excellent, in most cases strict, protection regime. They cover almost all the typical Ukrainian ecosystems (forest, forest-steppe, steppe, wetland, mountain, coast) and threatened species. Recently, efforts have focused on enlarging protected wetlands in the Black Sea coastal zone. Probably more steppe zones and inland wetland zones along the Sea of Azov's coast also deserve protection. This objective, as well as a further enlargement of protected territories to 5 per cent, is feasible thanks to the Presidential Decision of 1994 which designated 0.7 million ha of scientifically and ecologically precious territory as State property for future protection. It should also be pointed out that creating new protected areas is easier and cheaper at a time when the lands are still not privatized, as it is not necessary to expropriate or compensate the owners. But even in the present favourable situation, shortage of funding will be the most severe obstacle to reaching the targets.

According to the Law on the Nature Reserve Fund, any new protected area is put under the responsibility of the Ministry of Environmental Protection and Nuclear Safety, potentially adding to its budgetary needs. Additional funding would therefore be welcome. It might therefore be wise to shift the responsibility for the management of protected zones to other levels of administration. In protected areas and buffer zones, a nature protection regime leaving some room for limited use might be preferable to the traditional, strict protection. The development of, for instance, ecotourism could bring an economic benefit not only to the protected areas, but also to the local

population. Grazing, mushroom picking, hunting, haymaking, etc. could also fall into this category, if these activities require authorization subject to the payment of a fee. Pilot projects could be launched in selected zones, where foreign financing can be attracted and the potential for ecotourism seems promising. Based on existing examples, ecotourism could be introduced step by step, and preferably developed from regional or local initiatives. The funds obtained, together with contributions from regional and local administrations, could help cover the cost of operations.

Recommendation 11.4:
The creation of new protected areas preferably as regional landscape parks under the responsibility of regions (oblasts or groups of rayons) should be considered. A limited but controlled use of these zones and their assets could be authorized subject to the payment of a fee. Local people and communities should be better involved in this process of nature conservation, and their specific interests and needs better taken into account.

Shifting more responsibilities for nature and biodiversity protection to the regional and local level would also have a number of other advantages. At the local level, it will be easier to raise awareness among citizens and encourage their participation (introducing sustainable agricultural practices, clean technologies, good housekeeping, etc.). As a result, actions could be more easily undertaken at regional level. For instance, more attention could be paid to nature and biodiversity protection in the special regional management programmes. In the Dnieper Basin Management Programme, biodiversity is only a sub-component of other specific issues. The result is that economic decisions unduly and unnecessarily neglect sustainability. It is true that a certain effort has been made to improve intersectoral coordination between the stakeholders of the Dnieper river management. An inter-departmental commission for the management of the Dnieper river water resources has been created including the Ministry of Energy, the Committee for Fishery, the Ministry of Environmental Protection and Nuclear Safety, and scientists under the chairmanship of the State Committee of Water Resources. The experience shows that the regulation of the Dnieper water level suits economic interests (energy production), but neglects all questions concerning the maintenance of spawning areas and aquatic ecosystems. It is to be expected that the development of ecological corridors will mitigate this trend, as is starting to be the case with the southern corridor. Also, local management plans at a pilot scale should be developed in corridor areas not covered by a protection regime in order to demonstrate how nature and biodiversity are preserved when implementing sustainable development principles (for instance in agricultural and industrial practices) and using natural resources in a more traditional way. One such pilot project is going on with TACIS support in the Carpathians (Bukovina).

Recommendation 11.5:
Biodiversity conservation and nature protection components should be included into all decision-making processes of regional and sectoral development programmes (e.g. the Dnieper programme).

Putting protected areas under the responsibility of different authorities, including regional and local ones, means that their protection regimes and financing need to be harmonized. This is already a problem today and would become more difficult in the future. The decision of the Cabinet of Ministers to put all these entities under a single unit - the Central Board for National Natural Park and Reserve Management - is certainly a step in the right direction. Such a unit should also be entrusted with further developing the protection strategies and all related aspects.

Recommendation 11.6:
The existing special unit (i.e. Central Board for National Natural Parks and Reserve Management) may be improved to ensure the harmonized implementation of protection regimes and rules for different protected areas, including the balancing of funding in the different protected areas. All institutions of the Nature Reserve Fund of national importance should be subordinated to the Central Board. See also Recommendation 1.5.

Species populations and ecosystems cannot be managed without monitoring. The legislation provides for the monitoring/surveying of all species. There has long been a project to establish an inventory of all species. A long-term objective is to introduce an internationally compatible geographical information system.

For the time being, owing to budgetary constraints, only those populations that have an economic interest (forest, fish, game) are monitored. Surveys and inventories of other flora and fauna species and their habitats have been interrupted. It seems that even for species included in the Ukrainian green

and red data books, most of the information is missing. This situation cannot continue, as there is no benchmark to implement efficient protection strategies anymore.

All potential sources of information should be exploited. In addition, a regulation should make clear what official information should be collected, by whom and how, as there is no provision regarding monitoring in Regulation 391. Advice on how to organize an information system at minimal expense should be sought from all possible partners (national institutions, NGOs, foreign institutions involved in conservation of flora and fauna). Alternative solutions to close the gaps in monitoring need to be worked out. In this connection, the NGO community could be extremely helpful. The information required could probably best be developed by progressively extending surveys of the species that the partners in the scheme are the most interested in. Furthermore, disclosing this information on the Internet would also be useful to international partners and organizations.

Recommendation 11.7:
The monitoring of species and ecosystems, the compiling of a species cadastre and the mapping of habitats should be seen as prerequisites for any management policy, and should therefore be pursued in spite of the economic difficulties. National surveys on threatened or rare species and habitats (in particular those which fall under international agreements) should be carried out or updated.

Recommendation 11.8:
The biological monitoring strategy should be pursued and completed. It should be well-funded, result-oriented and cost-effective. The legal framework should be adjusted accordingly, making it clear what information should be collected, by whom and how.

The legal framework for nature protection is almost complete. Draft laws on hunting and on fishing are now before Parliament. Some laws of the 90s would need to be amended (Laws on the Animal World and the Nature Conservation Fund, Forest Code). It is possible that a gap still remains about the protection and sustainable exploitation of the genetic fund and valuable fauna and flora species (e.g. medicinal plants), and that sub-laws are needed to specify the framework and modalities of acceptable ecotourism activities in and around protected areas. This is a question that deserves more attention, as there is an underlying strong economic interest. In its 1998 Principal Directions, the Government reaffirmed its intention to work out a nature utilization plan. Meanwhile, a better enforcement of the permitting system and a more efficient collection of payments for the use of bioresources would help regulating it.

The enforcement of laws seems more problematic. At the local level, the different inspectorates (for forest protection and hunting, for fishing, for land use, for nature protection, etc.) collaborate, but it seems that their decisions regarding violations are not always backed by the judicial authorities, and that local court decisions are rarely implemented. An effort to fully enforce the provisions of the 1995 Code on Administrative Law Violations seems necessary (see Recommendation 1.1).

PART III: ECONOMIC AND SECTORAL INTEGRATION

Chapter 12

ENVIRONMENTAL CONCERNS IN AGRICULTURE

12.1 Overview of agricultural activities

Climate and natural conditions

Ukrainian agricultural land represents approximately 41 million hectares, or about 71 per cent of the country's surface. In the European Union, agricultural land represents 41 per cent of the total surface, the highest proportion being in the United Kingdom, with 65 per cent. Almost 80 per cent of the agricultural area is arable land (55 per cent on average in the European Union, see Table 12.1). Nevertheless, the total arable land suffered a 4 per cent reduction between 1985 and 1997 (2.6 million hectares).

Table 12.1: Agricultural land use, 1997

	Million ha	*As % of agricultural land*
Agricultural land	**41.84**	**100.0**
Arable land	33.19	79.3
of which: - cultivated land	*30.00*	
- fallow land	*2.30*	
Permanent cropland	1.02	2.4
Meadows and pastures	7.63	18.3

Source: Statistical Yearbook of Ukraine for 1996, State Statistics Committee of Ukraine.

Most of the farmland (46 per cent of arable land) is very fertile, composed of chernozem with 3 per cent to 5 per cent of humus. 95 per cent of Ukraine's territory is flat, since most of the country is situated in the European plains. The climate is continental, with average highs of 20 to 25^{0}C in the summer and average lows of -3 to -10^{0}C in the winter. Although this land is good for large-scale farming, one of its main drawbacks is the high degree of erosion due to winds. Forests represent 15.6 per cent of the territory. Ukraine can be divided into three natural regions (see Figure 11.1), from north to south: the Polissya, the forest steppe, and the steppe (40 per cent of the territory). These regions are in turn divided into subregions with specific characteristics: more or less humid areas, forest or prairie.

Agricultural activities

Farmland is not evenly distributed throughout the country. Several oblasts have large areas of farmland, especially Cherkaska oblast in the centre, where 74 per cent of the land is used for agriculture, Kirovogradska oblast (86 per cent), Zaporozhska oblast (88 per cent) or, in the south-east, Khersonska oblast (81 per cent).

Due to its soil's natural fertility, Ukraine was one of the Soviet Union's main suppliers of grain (25 per cent of the Soviet Union's total production), meat and milk (20 per cent of the Union's production) and sugar beet (50 per cent). Most of the land is ploughed (70 per cent of agricultural land), and since it is naturally exposed to wind and water erosion, it is subject to a great deal of pressure.

The principal crops are grain (44.1 per cent of the planted area), technical crops (12.1 per cent), potatoes (7.1 per cent) and fodder (6.7 per cent). This distribution has not changed much in the past 10 years. The yield is quite low (see Table 12.2) and has been decreasing over the past ten years due to the economic difficulties encountered by agricultural enterprises. The low crops of recent years can be ascribed to the insufficient number of tractors and combine harvesters in working order (lack of maintenance or fuel), and to the lack of fertilizers and pesticides. Between 1986 and 1996, the number of tractors decreased by 15 per cent and the number of combine harvesters by 24 per cent. Between 1990 and 1997, the consumption of pesticides and fertilizers per hectare dropped 78 per cent.

Productivity is not very high in the livestock breeding sector either. On average, in 1996, Ukrainian cows produced 1.7 tonnes of milk per year. Average EU production exceeds 5 tonnes per year. In addition, the livestock breeding sector is declining, mainly due to the lack of finance and

Table 12.2: Main crops, 1996

	Area	Production	Yield		
	(Million ha)	*(Million t)*	1990 *(t/ha)*	1996 *(t/ha)*	Average EU *(t/ha)*
Wheat (winter and spring)	5.9	13.6	4.0	2.3	5.8
Maize	0.7	1.8	3.8	2.7	..
Potatoes	1.5	18.4	11.7	11.9	33.9
Sugar beet	1.3	23.0	27.6	18.3	51.2

Source: State Comittee of Statistics of the Ukraine and Eurostat.

fodder. The bovine count was 12.7 million in 1997, or 17 per cent less than in 1996 and 37 per cent less than in 1991. The number of pigs has also dropped, from 17.8 million to 11.2 million in 1996, and the fowl stock has halved. In 1990, livestock breeding represented 55 per cent of agricultural production, 49 per cent in 1996 and 38 per cent in 1997.

Due to the crop and livestock decline, the share of the agricultural sector in the country's GNP decreased from 20 per cent in 1992 to 15 per cent in 1995 and down to 8 per cent in 1997. Thus, between 1991 and 1997, agricultural production suffered a 43 per cent decrease in constant prices.

Types of farms

In 1996, 21 per cent of the labour force was employed in the agricultural sector (5 million people). This figure has remained constant since, despite the decline in agricultural production, which led to a 50 per cent decrease in the productivity of farm work between 1990 and 1996. The rural population in Ukraine is relatively old: the population of working age represents only 49 per cent of the total rural population.

The types of farms were typical of those of the former Soviet Union. There were two types of collective farms: the sovkhozes or State farms and the kolkhozes. The sovkhozes were run like industrial enterprises, with salaried staff and a director appointed by the Ministry of Agriculture. The kolkhozes, or collective farms, were enterprises in which employees' salaries were based on the number of working hours.

Today, there are four types of farms (see Table 12.3):

- *State farms*: they correspond to the former sovkhozes. With the implementation of the 1992 Land Code and the 1992 and 1993 Laws on Collective Farms, this type of farm is now gradually disappearing.
- *Collective farms*: these correspond to the former kolkhozes. The members of the farm own shares in it. These represent a given number of hectares. The farms are cultivated on a collective basis.
- *Private farms*: the land distribution process has led to the creation of independent farm units, usually family enterprises, which are similar to western-type farms. According to the statistical yearbook, a private farm is a form of free enterprise involved in agricultural production as well as in the processing and distribution of agricultural produce.
- *Allotments*: in addition to the farms, there are about 11.4 million plots cultivated by families and representing 14 per cent of the agricultural land. These plots are small holdings, collective gardens or kitchen gardens. They are usually managed on a part-time basis by employees of large collective farms.

In 1997, there were 15 739 public farming enterprises (State farms and collective farms), cultivating 2 200 hectares each on average and representing 84 per cent of the agricultural land. Private farms and allotments represent only 16 per cent of the territory devoted to farming. In addition, private farms employ an average of 5 to 10 workers, whereas State and collective farms employ 200 to 300 workers on average.

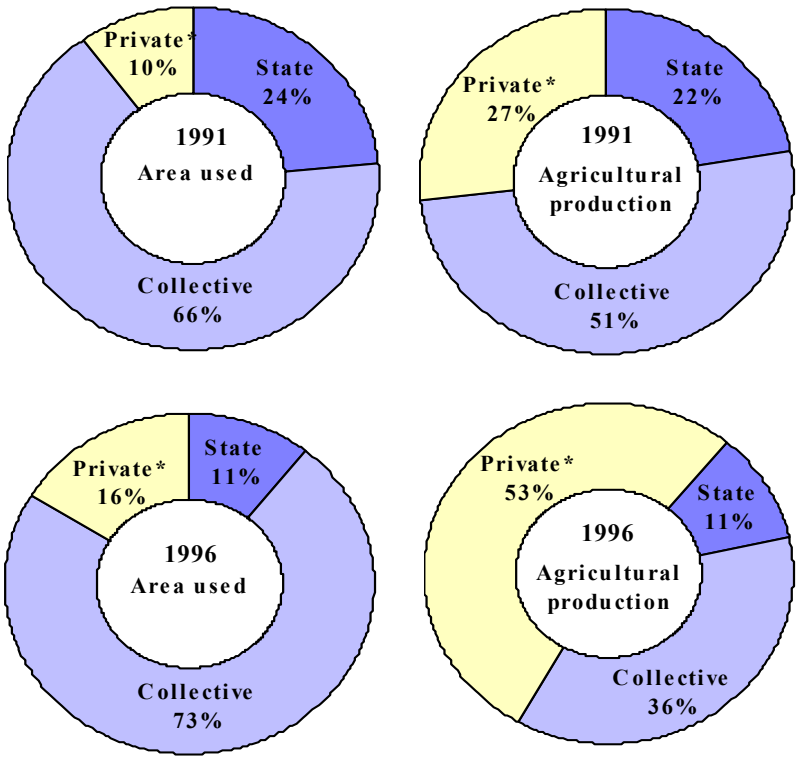
Although the ownership status of farms has changed since Soviet times, their management has remained practically the same. Productivity levels vary, depending on the status (Figure 12.1). More than half the agricultural production in monetary terms is produced by the independent farmers

Table 12.3: Farm types and their evolution over time, 1992 and 1996

	Number of farms		Total area *(1 000 ha)*		Average area per farm *(ha)*		Share of farm types *as % of total area*	
	1992*	1996	1992*	1996	1992*	1996	1992*	1996
State farm	4 659.0	4 440.0	9 312.7	5 156.3	1 998.9	1 161.3	23.2	11.6
Collective farm enterprise	9 351.0	11 299.0	26 921.9	32 491.5	2 879.0	2 875.6	67.1	73.4
Private farms	2 687.0	38 988.0	48.9	928.8	18.2	23.8	0.1	2.1
Allotments	9763 079.0	11433 123.0	3 864.0	5 693.6	0.4	0.5	9.6	12.9

Source: State Committee of Statistics of Ukraine.

Figure 12.1: Development of land use and production levels per type of farm, 1991 and 1996



Source: State Committee of Statistics of Ukraine.

Note:
* Including family plots.

This difference is explained not only by the fact that livestock is raised mainly on individual farms, but also by the fact that independent farmers use their land more efficiently.

Aspects of agricultural production processes

Irrigation and drainage are relatively widespread:

- 3.3 million hectares, or almost 10 per cent of arable land, are drained. The drained areas are situated mainly in the north, in the polissya zone (Volynsky oblast: 416 000 ha; Zhytomir: 425 000 ha, Chernihiv: 300 000 ha, L'viv: 500 000 ha);
- Irrigated areas (2.5 million hectares) are located mainly in the south. The regions where irrigation is most frequent are Kherson (471 700 ha), Zaporozh'yea (263 000 ha) and the Crimean peninsula (397 000 ha).

The consumption of fertilizers and pesticides has considerably decreased in recent years, due to the

lack of funds. The quantity of pesticides used per hectare has dropped from 3.5 kg/ha in 1990 to 0.6 in 1998. In 1996, 35 000 tonnes of pesticides were considered necessary, but only 27 300 tonnes were actually spread. In 1997 only 24 100 tonnes were available, against the 32 000 tonnes actually needed. Only 10 per cent of the pesticides used are produced in Ukraine. The rest is imported mostly from the Russian Federation and eastern Europe.

Table 12.4: Fertilizer consumption, 1990 and 1997

	1990		1997	
	(1 000 t)	*(kg/ha)*	*(1 000 t)*	*(kg/ha)*
Total	**4 242**	**141**	**562**	**22**
Nitrogen	1 784	59	413	16
Phosphate	1 280	43	104	4
Potassium	1 178	39	45	2

Source: State Committee for Agriculture.

The consumption of fertilizers has also plummeted (Table 12.4).

Not only is the amount of fertilizer applied per hectare decreasing, but the number of hectares fertilized is too: in 1997, the fertilized surface represented only 36 per cent of fertilizable land. Nitrogen fertilizers are entirely produced in Ukraine. The domestic production of phosphate is low (327 000 tonnes in 1996) and that of potassium practically nil (39 000 tonnes in 1996).

During the past three years, pesticides and fertilizers have been distributed by "agrobusiness" companies, which have taken over the former State monopoly. Some of these companies remain State-controlled. Nevertheless, due to the farms' lack of funds and the debts contracted for the purchase of farm inputs, an input/crop barter system has developed, at rates which are not in the farmers' interest.

The main problems of the agricultural sector

Generally speaking, the agricultural sector is experiencing serious internal difficulties, and numerous farms are bankrupt or on the verge of bankruptcy. These are due to the transitional nature of the economy and to the fact that this transition is happening at a particularly slow pace in the agricultural sector, as the following facts prove:

- *Agricultural markets are poorly organized*: products are to a large extent sold to the State, at low prices. Indeed, privatization has not really reached the food and agricultural sector. Most of the 7 600 production and food-processing enterprises (among which over 2 000 food-processing enterprises) are State-owned or are leased to their employees.
- *Credits are difficult to obtain*: the interest rates offered to farmers are too high and, as a result, they are unable to invest in machinery or new technology. For this reason, they are highly dependent on the opportunities for barter provided by the public sector (inputs in exchange for produce).
- *Lack of technical assistance*: agricultural education is poorly developed. Apparently, there is no extension service able to provide comprehensive information to farmers. However, several services of the agricultural department at the level of oblast administrations periodically provide information to the specialists of collective and State farms or to private farmers. Each service provides information on a specific aspect: pesticide use, fertilizer use, tilling techniques, health rules, etc. All of them deal with environmental matters, as farmers are not at all sensitized to the environmental consequences of their practices. So a comprehensive extension service is needed, including environmental perspectives. There have been attempts to organize or reorganize specialized technical assistance thanks to international programmes (especially TACIS and USAID). For instance, special programmes to improve farming support services for sunflower production were set up in 1995 under TACIS to improve its technical and economic efficiency. Others are currently running in several oblasts (Kirovograd, Lugansk and Chernivtsy) in order to set up pilot structures, able to manage advice centres and training seminars. Within these programmes, some experiments in organic agriculture are taking place.

12.2 Environmental issues in agricultural activities

Soil erosion

Today, 35 per cent of Ukraine's arable land is considered to be threatened by wind or water

erosion. This situation has been aggravated by inappropriate farming practices. Anti-erosion measures had been taken since 1967, but they were stopped three years ago due to a lack of financial resources.

The specific role played by Ukraine as a major agricultural supplier of the Soviet Union led to the intensive use of land for agriculture. As a result, farming was developed in areas not really suitable for that purpose, such as slopes, natural pastures, peatland, wetlands (drained) or dry land. This has aggravated the soil erosion problem: each year, 330 million tonnes of fertile matter are lost due to erosion. On slopes, the average annual loss of fertile elements is estimated at 15 tonnes/ha.

Another important factor for erosion is intensive ploughing. It is now estimated that more than 4 million ha should be used for pasture to protect the land against erosion. In addition, little account is taken of the nature of the soil. All regions have wheat and maize fields; pigs and cattle are raised everywhere. No effort is made to adapt the type of culture to the area's actual potential. Lastly, there is not enough crop rotation.

14 per cent of the irrigated areas are threatened by erosion, 5 per cent have been over-irrigated, between 11 per cent and 25 per cent have become pre-saline. At the same time, 43.2 per cent of drained land has become more acid, 10.7 per cent are too moist, nearly 13 per cent are waterlogged. This situation resulted in the deterioration of soil quality and a decrease in its productivity. An important reason for the decrease in crops was the impoverishment of soil humus due to the drop in mineral and organic fertilizer use. In 1990, 8.6 t/ha of organic and 141 kg/ha of mineral fertilizers were applied; in 1997 respectively 2.5 t/ha and 22 kg/ha. Moreover, lime use dropped as well, from 0.5 million ha treated in 1990 to 35 000 ha in 1997. Similarly 300 000 ha were treated with gypsum in 1990 and only 7 000 in 1997. The lack of financial resources has also made it impossible to implement anti-erosion measures. In 1996, less than 10 per cent of the budget devoted to financing anti-erosion measures was allotted. The area threatened by erosion is thus increasing at an estimated rate of 80 000 hectares per year and 19.4 million hectares are considered to be deteriorating.

Soil pollution

The first main concern regarding soil pollution relates to heavy metal and pesticide residues. The Ministry of Agriculture (Department of Plant Protection) monitors the quality of soils. Surveys show the presence of lead (especially in Lugansk and Khmelnytsk oblasts), copper (Zaporozh'ye, Kherson, and Khmelnytsk oblasts), and cadmium (Kyiv and Donetsk oblasts). In 1994, 2.6 per cent of the surveyed territory of Ukraine was considered contaminated with heavy metals. This pollution is due mainly to industrial atmospheric fallout.

Concerning pesticide pollution, the results of a soil-quality survey conducted in 1996 in 32 rayons situated in 17 different oblasts showed that during the past three years the quantity of pesticide residue had decreased. Of the analysed samples, only one contained a DDT concentration above the permissible limit. However, there is still a serious risk of soil and water pollution from the 13 500 tonnes of unused and stockpiled obsolete pesticides stored in inadequate conditions. A first significant step forward is the ongoing completion of a Danish assistance programme which includes a full inventory, the chemical classification and safe provisional disposal (i.e. maintaining the sites where pesticides are still stored). (For details, see Chapter 6)

The second type of pollution concerns radioisotopes in the soil, and is a much greater cause for concern. More than 8 million hectares of agricultural land are contaminated with Cs 137, with a density exceeding 0.1 Ci per square kilometre (among which 6 million hectares of ploughed land, see Chapter 4). They are mainly located in Zhytomir (70 per cent) and Kyiv (15 per cent) oblasts.

Water pollution

The problem of bacterial pollution of water resources in rural areas is very serious (see Chapters 8 and 14). This type of pollution is primarily caused by the fact that household waste water is not purified. The situation is further aggravated by inappropriate manure storage, and by leaks from livestock farms and direct discharges of contaminating substances. The authorities consider the run-off from farmland to be the second cause of surface water pollution in Ukraine.

Owing to the decline in the consumption of agro-chemicals and pesticides over the last few years, the pollution of water due to chemicals used in agriculture (nitrates, phosphates and pesticides) is also decreasing. However, the level of water pollution by nitrates remains high: in 1997, the

concentration of nitrates in 19 per cent of the 2 388 samples taken from the water used for agriculture exceeded the acceptable level. Overall, the discharge of agricultural pollutants into surface water is decreasing. In 1996, it was estimated at 2.2 million tonnes of contaminating substances, or 4.6 per cent of total contaminating discharges, as opposed to 2.9 million tonnes (6 per cent of total contaminating discharges) in 1994.

The waste of water resources

Agricultural water use was estimated at 2.0 billion m^3 in 1997. The estimated use in 1990 was more than twice as high. This decrease may be linked to the reduction in livestock and the decline in agricultural production in recent years. Losses due to irrigation remain high. They are due to the poor design and maintenance of irrigation systems – corresponding losses are estimated at 60 per cent. This is a serious problem in the south, where water resources are scarce.

12.3 Environmental policy in agriculture

Actors

Administrative responsibilities for environmental policy in agriculture are scattered among many administrative units. The State Committee for Land Resources is responsible for land issues. Its department for land organization is the main promoter of the land protection programme, which deals mainly with agricultural issues (see below). Several units of the Ministry of Agriculture deal with aspects of the environmental impact of agricultural practices. There is a special unit (2-3 persons) for nature protection. It is responsible for the implications of agriculture for nature and the environment, whereas the department for agricultural protection is responsible for the control and the use of agrochemical products, and for soil contamination. The Ministry of Environmental Protection and Nuclear Safety also deals with agricultural issues, as one of the main objectives of the Strategy of Conservation of Ukraine's Biological Diversity is to integrate environmental considerations into sectoral activities and in particular into agricultural activities. The Strategy includes a special chapter on the conservation of biodiversity of agricultural landscapes and territories of intensive agricultural activities. The Ministry has also taken steps to improve agricultural landscapes by integrating some territories into the national ecological network (see Chapter 11). However, the subject of agricultural pollution is integrated into the pollution control division, together with other pollution matters and not dealt with as such. So at the Ministry of Environmental Protection there is no one to tackle the environmental issue of agriculture comprehensively.

Besides these administrative units, the Agrarian Academy of Sciences also plays a role. Especially the Institute of Agro-ecology and Biotechnology is involved in evaluating the environmental impact of agriculture in Ukraine, but it suffers from a lack of resources. NGOs do not often deal with agricultural issues, because most of them are based and organize their activities in cities. However, scientific NGOs like the Geographic Society are involved in the implementation of some programmes, for instance in the "contour melioration" programme (see below). Farmers' representatives do not play any role in this.

International cooperation is important. A large project of USAID (see Chapter 3), called Environmental Policy and Technology Project, includes a working group dealing with sustainable agriculture. Some TACIS projects in agriculture have an environmental dimension, since they promote a better knowledge by popularizing modern agricultural production techniques. Also, some bilateral international cooperation projects (e.g. with France) try to promote organic agriculture for some crops (for instance in Kirovograd oblast). However, these efforts suffer from a lack of coordination.

Nevertheless, there is little environmental awareness, in particular in the rural areas. Farmers as well as bureaucrats at the rayon and oblast levels are not really aware of the problem of agricultural pollution and especially of diffuse sources of pollution.

Policy objectives and instruments

Several measures have been taken to reduce the impact of agriculture on the environment or to offset the negative consequences of certain agricultural practices. These are mainly measures to curb erosion, control soil quality and the agricultural equipment that causes pollution and to protect vulnerable areas.

Curbing soil erosion and controlling soil quality is undoubtedly the most important policy objective. The problem of soil erosion was first addressed after the Second World War. Farm plots were

separated by strips of forest. According to estimates of the Ministry of Agriculture, almost 40 000 hectares of forest were planted, thus ensuring the protection of 13 million hectares of arable land. However, this type of protection is only moderately effective, due to the sparseness of the rows of trees planted on these strips. Moreover, this type of measure is not always implemented. Indeed, farmers often consider these strips to be an obstacle to farming and do not easily accept them. In addition, insufficient financial means have prevented this programme from being implemented during the past three years.

A programme was launched in 1986 to fight water erosion and protect streams. The aim is to consolidate eroded river banks by forbidding the ploughing of slopes situated near rivers and by ensuring that these areas are covered with vegetation. In the most critical cases, land improvement measures (the "contour-melioration system") have been enforced. This programme will be reinforced and developed in the framework of the 1997-2005 Plan for Soil Protection (2 500 million hryvnias budgeted from 1999 to 2010, see below).

The struggle against erosion also entails the use of fertilizers, but only 20 to 25 per cent of losses are offset at present, owing to enterprises' lack of financial resources. At the same time, every year, the agrochemical departments of the Ministry of Agriculture conduct soil analyses (with the help of 30 to 70 persons per oblast). The level of pesticide residues, heavy metals and radionuclides in soil are measured regularly, to control soil quality and check the way farmers are using the land.

An agrochemical “passport” programme for agricultural land was launched in 1996, aiming to assess the agrochemical quality of the soils: 97 300 "passports" were delivered in 1996, corresponding to 5.6 million hectares, and 116 400 passports were delivered in 1997, corresponding to 5.9 million hectares. This passport programme is used in the land privatization programme: land distribution as well as land use must be based on the soil's agrochemical quality. However, this programme is also impaired by a lack of funds, as are all public programmes. It is part of the national programme for soil protection to be implemented before 2010 (34 millions ha to be issued “passports” by 2010, see below).

The Land Code classifies land into seven categories according to the purpose for which it is used: agricultural land; land for human settlements; land for industry, transport network, defence; land for protected areas, health restoration/ recreation and historical/cultural purposes; forest (protected forests and production forests) land; water management (reservoirs) land; and reserved land. These areas, regardless of their ownership status, must be used in compliance with their designation and the type of development associated with it. The State Committee for Land Resources, which has decentralized branches in each rayon, is in charge of ensuring that the use of the land corresponds to its designation. In the case of agricultural land, the Land Code specifies that the users of this type of land must maintain or even increase the fertility of the soil and implement the protection measures provided for by law. Land that is contaminated with radioactive or chemical substances must not be used for agricultural purposes.

Agricultural facilities, in particular those devoted to livestock breeding, are subject to the same constraints as industrial facilities as concerns their environmental impact, according to the Law on Environmental Protection (see Chapter 1). The use of water, the discharge of waste water and the production of waste are subject to special authorizations. In addition to this legislation, there is a tax on the use of natural resources, which includes the use of land (see Chapter 2).

The amount of waste water generated from livestock raising is not too high, because the stables usually do not use much water. There are also strict rules concerning the watertightness of the stables and manure storage facilities. On the other hand, there are no laws concerning the duration of manure storage (6 months is nevertheless recommended). Generally speaking, the buildings used to keep livestock are quite old. Most of them were built at a time when pollution problems were not publicized (especially diffuse pollution). Dunghills are frequently seen near stables; no special precautions are taken to prevent contaminated water running off. Given their age, the facilities often leak, and since very little money is spent on improvements, there is much concern about the consequences for water quality. The high concentration of nitrates in the water used for agriculture partly confirms that there is a problem.

The sale and use of pesticides are subject to the usual forms of control: a list of authorized pesticides (about 200), import licences delivered by the Ministry of Agriculture and approved by the

Chemicals Committee, rules concerning safety, storage, transport and use. In this respect, there are two different versions of these rules; the first was published by the Ministry of Agriculture in 1985, and the second by the Ministry of Health Protection in 1998. Both of them have to be implemented at the same time. In addition, in each oblast, there is an office for the control of pesticide use, which advises farming enterprises (2 000 employees spread over the entire country).

According to the National Programme for soil protection, the agricultural use of 5 million hectares of land (i.e. 1.4 million hectares of agricultural land and 3.7 of arable land) is forbidden for environmental reasons. These areas are buffer zones surrounding water collection areas, zones alongside river banks and lakes, slopes, and the coasts of the Sea of Azov and the Black Sea. However, this ban is difficult to enforce, due to the insufficient staffing of environmental inspection services at the rayon and oblast levels. The plan is to revise this target to restrict the use of 2.4 million hectares only. They will be devoted to afforestation (0.6 million hectares) and pastures (1.8 million hectares).

Prospects

The document "Principal Directions of State policy of Ukraine for environmental protection" of 1998 devotes a chapter to the objectives that should be met to reconcile agricultural activities and environmental concerns. The Ukrainian authorities believe that current agricultural practices are too intensive and lead to the deterioration of the country's natural resources, in particular soil, water, and natural areas. In addition, the present reform of rural and land property is an opportunity for considering ecological concerns. A programme for an agricultural environmental management system is now being prepared. Its main objectives are to:

- form highly productive and ecologically stable agricultural landscapes (optimal ratios between crop land, forests, hay meadows, pastures, lakes, rivers);
- incorporate ecological and landscape factors into relevant legislation, as criteria for determining the type of agricultural land use;
- promote environmentally friendly agricultural practices (especially as concerns the use of agrochemicals);
- revitalize soil fertility by appropriate protection measures;
- withdraw the less productive plots of land from agricultural use, especially in highly cultivated areas; and
- encourage organic farming.

To reach these objectives, the following measures are envisaged:

- an overall economic and ecological evaluation of the Ukrainian territory, which would include the identification of natural areas (already protected or needing protection), of agricultural production zones, of industrial production zones and of the areas suffering the most from pollution;
- implementation of a national programme for soil protection before the year 2010;
- formulation and implementation of sectoral programmes for the preservation and renewal of natural resources such as soil, water, biological elements (especially fish and forests), raw materials and minerals;
- setting-up of a procedure for land distribution which would take into account the environmental state of the area and exclude zones that are either contaminated, highly eroded, humid or saline, or very vulnerable from an environmental point of view;
- implementation of anti-erosion measures (strips of forest, planting vegetation on slopes); and
- creation of water protection zones.

Some of these measures are gradually being implemented. Measures to promote environmentally friendly agricultural practices are now being defined. A working group made up of representatives from the Ministries of Agriculture and of Environmental Protection and of the Committee on Water Resources have been meeting on a regular basis during the past two years, in the framework of a USAID project on sustainable agriculture. The working group has produced a code (guide) of good agricultural practices to prevent pollution of natural waters. This code contains information concerning the impact of certain practices – fertilizer use, manure spreading, pesticide use -- on the quality of water, as well as on how to prevent erosion.

The guide's main recommendations concern the minimization of surface run-off by covering soil in the winter and withdrawing seriously eroded slopes from cultivation, the type of cultures and rotation according to the degree of the slope, tilling practices, and the use of slurry and manure (quality,

quantity and periods for applying them). In addition, the guide explains the mechanisms causing agriculture-induced water pollution.

The authorities are planning to circulate this guide via the specialized agricultural press. Its recommendations could also serve as a basis for the definition of new environmental protection laws. The guide should, moreover, serve as a basis for the definition of "good agricultural practice corridors" in the framework of a policy for the protection of biodiversity (see Chapter 11), as the guide could be used to train farmers in the buffer zones surrounding protected areas to implement farming practices that are more compatible with environmental protection. Experiments with pilot farms are being considered.

A large-scale programme for land protection was drawn up by the State Committee for Land Resources, with the participation of the Ministries of Agriculture, of Environmental Protection, of Industrial Policy and the Academy of Agrarian Sciences. The budget necessary for its implementation has been evaluated at 85 billion hryvnias, 10.8 billion from the State budget and 74.8 billion from land users and landowners. The programme, now awaiting adoption, provides for a protection programme covering a period of 13 years (1997-2010). The first stage (1997-2000) is devoted to measures preventing the deterioration of soils and the loss of fertility, the second stage (2001-2005) to the concrete implementation of protection measures, and the last stage (2005-2010) to the overall implementation of the plan. The following general measures are planned:

- the redistribution of land use, with a reduction in agricultural land of 3.8 million hectares. More than 2 million hectares of degraded, eroded and radioactively contaminated land will be excluded from agricultural use and conserved by sowing meadows (1.5 million hectares) or planting forests (600 000 ha). Overall, forest areas will be increased by 2 per cent, natural environmental protection areas by 6 per cent and 6 million hectares will be put into the land reserve. According to the plan, the actual designation of each piece of land will have to take into account its agronomical and ecological value. This task is currently being carried out by the Administration of the State Committee for Land Resources in each oblast
- protection measures against soil erosion: the "contour-melioration system" will be developed for sloping land: remedial protection measures will also be reinforced
- measures for improving soil quality thanks to organic fertilizers, adding lime to acid soils, or gypsum to salty soils.

The proposed programme is ambitious, and will require a large budget, which might be difficult to fund. The main focus on erosion is justified by the importance of soil degradation but must be accompanied by an intense campaign to raise the awareness of farmers and agricultural land users. Attention should also be paid to regional conditions: it is important to adapt the national programme at least to the three natural units.

12.4 Conclusions and recommendations

Agriculture is one of Ukraine's most important activities, be it in terms of employment, land use or contribution to the national economy. However, its size is declining, and given the present low level of productivity, this decline will continue.

Past agricultural practices have had a serious impact on the environment, especially on the soil, but the relative decrease in the intensity of agricultural production over the past four or five years should ease this pressure. The benefits of this relative decline should be seized. More specifically, the modernization of Ukraine's agriculture, made necessary by the market economy, should go hand in hand with an increased awareness of its environmental impact. Agricultural development should not exclusively aim at a massive and rapid intensification of agricultural production – rather, the modernization of farms should be carried out in such a way as to avoid the ecological problems that are currently encountered in the traditional market economies.

So far, mitigation efforts regarding the impact of agriculture on the environment have focused on setting up an adequate and coherent legal framework. Existing land protection programmes are exemplary in this respect, although their provisions could be complemented. For example, the principle of land designation means that land use is subjected to a strict framework, defined at a specific moment in time. But economic or natural conditions change, which is not necessarily compatible with a rigid definition of land use. It seems necessary therefore to set up a periodical re-evaluation process, in order to adapt land use to any changes that may occur over time.

At the same time, a monitoring system should be created. It must be harmonized with the definition of designated land use. The actual control system regarding compliance with land-use designations seems inefficient (due to the weak means made available) and counterproductive: in a country where regulations abound, any additional regulation may just be lost in the mass of existing rules. It might be more useful to set up a monitoring system, based on the mutual commitment of the partners. For similar reasons, the European Union has developed the concept of "farming contracts", in which the obligations of administrations and farmers are specified together with the nature of the agricultural practices. The contracts are limited in time and therefore, in principle, make it possible to assess periodically how effectively the mutual obligations have been met and to adjust the practices.

Recommendation 12.1:
Designated land uses should be monitored and periodically re-evaluated, in order to adapt them to changing socio-economic conditions. The existing command-and-control system of land use should in the long run be replaced by partnership arrangements between the public administrations and the farmers.

While the legal framework to prevent agriculture-induced environmental damage is as yet incomplete, special emphasis should be laid on the implementation of existing regulations. The decision to deal with this problem via the Land Code and the designation of land use is a positive step; a complement to this approach should be the enforcement of environmentally friendly agricultural practices. Both private farmers and farmers working in collective farms need to be informed about the environmental consequences of their practices. Given that the farm system is changing very slowly and that the privatization process has been slowed down, it is important that not only private farmers, but also collective farm workers should be trained in this respect.

Training could be based on the existing national guide of good agricultural practice, which was drawn up in collaboration with most of the actors concerned. Its recommendations should be put into practice now and the guide should be widely circulated among farmers. This guide could also be improved to take into account all the environmental aspects of agricultural practices (and especially nature degradation concerns, environmental rehabilitation of contaminated land, use of pesticides and fertilizers, irrigation, etc.) and not only water pollution. In any improvement of the existing guide, it would be worthwhile to explore the idea of extensifying agricultural practices. Such extensification is currently occurring anyhow, and could therefore easily become part of a new production strategy. This strategy should also focus on the quality of food and agricultural products. It could emphasize the importance of local conditions for crop selection and the need to reconstruct irrigation systems so as to reduce water losses.

Recommendation 12.2:
It should be recognized that more environmentally friendly and ultimately sustainable agricultural practices must be promoted and developed urgently. To this end, adequate training programmes for both private and collective farmers should be set up. The training should be undertaken by a suitably equipped extension service. Any revision of the existing national guide for good agricultural practice should include a realistic agricultural production strategy.

The Ministry of Environmental Protection apparently does not have sufficient manpower to monitor all the environmental issues linked to agriculture. Its approach is based on the environmental media (water, air, soil, both at the national and regional levels), which makes it difficult to deal with issues from a sectoral angle. The creation of an ad hoc unit to monitor the impact of agriculture on the environment is necessary. The task of this unit would be to establish and coordinate relations between all those concerned: the State Committee for Land Resources, the Ministry of Agriculture, the agrochemical departments, as well as the Ministry of Health Protection. In its work, the unit should be able to benefit from an information system that permits the monitoring of agriculture/environment issues and agricultural practices.

Recommendation 12.3:
An inter-ministerial/inter-agency unit should be created to monitor, analyse and control the environmental impacts of agriculture, and of genetically modified organisms. A system of indicators to analyse these impacts would be useful.

The past intensive cultivation of land has in many cases resulted in erosion, particularly of slopes, landslides and, in general, exhaustion of soils. The resulting soil erosion was particularly intense in the centre of the country, subject to frequent winds, and

in the south, where violent storms also provoke water erosion. In times of drought, the overcultivation of the steppes and mediterranean climate zones could lead to desertification. Various programmes have been implemented over time to slow down erosion processes, including afforestation of river banks, modification of agricultural practices in vulnerable zones and taking land out of cultivation (see Chapter 10 on nature protection). However, comprehensive and systematic measures should now be defined, and a land protection programme and specific laws be implemented. The existing draft laws and the programme on land protection contain provisions combatting erosion. They should be adopted as a matter of great urgency. As erosion problems are eligible for funding under GEF, international financial assistance could be sought to facilitate the implementation of at least part of the programme.

Recommendation 12.4:
The improvement of the Land Code and the adoption of the Law on Land Protection should be accelerated, as should the adoption of the National Programme for Land Protection till 2010. International financial assistance for the implementation of the Programme should be sought, possibly in particular in the framework of the GEF.

Soils are often heavily polluted by heavy metals and radionuclides from industry. Only sporadic measurements have been made for heavy metals (lead, copper, cadmium), but no exhaustive study has been carried out so far, mapping of the nature and extent of contamination does not exist, nor does intercalibration of methodology, etc. The few results obtained in monitoring are not reliable. However, such monitoring is a necessary step towards the implementation of remedial measures. It is likely that phytoremediation could be envisaged in many cases, using cultures adapted to both the specific regions at stake and the elements that should be eliminated. Innovative scientific and technological projects should be worked out in this direction at the local (oblast) levels.

Recommendation 12.5:
Environmental rehabilitation programmes of contaminated agricultural land at oblast level should be initiated, based on satisfactory monitoring information as well as innovative methodologies, which could even attract international assistance.

Chapter 13

ENVIRONMENTAL CONCERNS IN ENERGY

13.1 The energy sector of the Ukrainian economy

Development of main aggregates

The abundant availability of cheap Russian crude oil and natural gas in the past gave rise to the development of heavy, energy-intensive industries (metallurgical, chemical, shipbuilding, coal, machine tools and weaponry). This situation created strong energy supply links between Ukraine and Russia, as the priorities of the Soviet authorities were to develop hydrocarbon fields in Siberia and Central Asia rather than to exploit the oil and gas reserves located in the Black Sea and the Sea of Azov.

During the nineties, Ukraine has experienced one of the deepest recessions among the countries of the former Soviet Union. Between 1990 and 1995, as the price of fuel imports moved towards world market levels, Ukraine's imports declined, and the shortage of energy worsened its economic crisis, as imports of energy products are essential to the Ukrainian economy. In 1996, domestic production met only 22 per cent of the country's oil requirements, 21 per cent of its natural gas needs and 87 per cent of its coal needs. Currently, Ukraine imports gas from the Russian Federation and Turkmenistan, crude oil from the Russian Federation, and petroleum products from the Russian Federation, the Baltic States, Kazakhstan and western Europe. The Russian Federation and Poland sell coal to Ukraine. Data on the supply of total primary energy are included in Table 13.1. Import data are the subject of Table 13.2. Table 13.3 is devoted to final energy consumption by sector.

Table 13.1: Evolution of primary energy supply, 1990-1997

Mtoe

	1990	1991	1992	1993	1994	1995	1996	1997*
Total	**252.6**	**251.0**	**219.9**	**194.3**	**165.2**	**161.9**	**153.9**	**136.0**
Oil and oil products	60.9	67.7	41.9	29.2	23.8	25.3	18.7	15.0
Coal	81.6	69.0	70.6	64.6	50.8	51.9	43.9	36.0
Gas	91.8	95.0	88.5	79.7	71.7	65.4	69.7	62.0
Others	18.3	19.3	18.9	20.8	18.9	19.3	21.6	23.0

Source: IEA.

Note:
* Provisional data.

Table 13.2: Imports of energy, 1990-1997

Mtoe

	1990	1991	1992	1993	1994	1995	1996	1997*
Total	**161.2**	**149.0**	**121.2**	**94.0**	**80.5**	**84.7**	**77.3**	**59.0**
Crude oil	53.4	49.5	34.5	19.8	15.9	13.4	9.3	6.9
Petroleum products	22.4	15.3	8.9	5.5	5.4	9.3	5.6	5.1
Coal	10.6	7.8	7.1	5.3	4.6	9.8	6.7	0.0
Gas	73.5	74.8	69.4	62.0	53.6	51.4	54.8	47.0
Electricity	1.3	1.6	1.3	1.4	1.0	0.8	0.9	0.0

Source: IEA.

Note:
* Provisional data.

Table 13.3: Final energy consumption by sector, 1990-1996

	1990	1991	1992	1993	1994	1995	1996
Total (Mtoe)	**183.7**	**183.1**	**152.3**	**133.1**	**110.6**	**105.3**	**98.5**
Industrial energy use (%)	53.6	53.2	55.9	56.2	48.3	47.6	47.6
Non-energy use (%)	2.0	3.5	2.2	1.2	1.3	1.0	0.8
Transport (%)	9.1	7.4	7.8	7.4	7.8	8.2	6.7
Residential/commercial (%)	28.5	29.2	28.6	30.2	34.6	35.4	37.5
Others (%)	6.8	6.7	5.5	5.0	8.0	7.9	7.4

Source: IEA.

The share of coal remained in the range of 28 - 33 per cent of the total primary energy supply between 1990 and 1996, i.e. it more or less paralleled the overall decrease in energy needs during this period. Coal production decreased from 86.8 Mtoe in 1990 to 38.3 Mtoe in 1996 (-56 per cent), and over the same period the share of domestically produced coal dropped from 76 to 67 per cent.

The primary energy supply of oil fell drastically, from 24 per cent in 1990 to 12 per cent in 1996. The largest single decrease occurred in 1992 (from 68 Mtoe in 1991 to 42 Mtoe). The domestic production mainly by national companies (VAT Ukrnafta, VAT Ukrgazprom for condensate and DVP Chornomornaftogaz) and a recent joint venture (Poltava) remains at about 4 Mtoe per year. Exploration and drilling campaigns have come to a virtual standstill. The sharp fall in the imports of crude oil and petroleum products from 75 Mtoe in 1990 to 15 Mtoe in 1996 is mainly due to the fact that Ukraine finds it hard to pay for imports, so that considerable debts have accumulated.

The share of natural gas in energy consumption increased from 36 per cent in 1990 to 45 per cent in 1996, which is about twice the share of western countries. In absolute terms, however, the supply decreased by 22 Mtoe between 1990 and 1996. Indigenous production of natural gas totalled 18.1 billion m^3 in 1997 (18.4 billion m^3 in 1996), and provided 22 per cent of the country's gas demand. VAT Ukrgazprom produced 13.8 billion m^3 of gas and 682 000 tonnes of condensate in 1997. Ukraine imported 63.2 billion m^3 of natural gas in 1997. The country is the biggest importer of Russian gas (50.2 billion m^3 in 1997, representing 62 per cent of Ukraine's gas demand). In addition, 13 billion m^3 were imported from Turkmenistan in 1997, compared to 19 billion m^3 in 1996.

Electricity generation

Ukraine's electrical power industry is affected by the country's overall macroeconomic situation, ageing power generation facilities, financial difficulties (non-payment of electricity bills and low revenues) and general inefficiency. Most equipment installed in Ukrainian power plants was manufactured in Russia and lags at least one generation behind modern equipment. The electric power system has a total installed capacity of 53 900 MW (for details, see Table 13.4). In 1997, Ukraine produced 178 TWh, of which 49.8 per cent came from fossil-fuelled plants (TPP), 44.6 per cent was generated by five nuclear plants (NPP), and 5.6 per cent by hydroelectric plants (HPP).

There are 16 major thermal power plants using conventional steam cycles, the largest ones (Vuglegirska and Zaporozh'ye) designed for a capacity of 3 600 MW. Three plants (Kyiv 5, Kyiv 6 and Kharkiv 5) are combined heat and power (CHP) plants. There are 104 electric generators at thermal power stations (TPS) of the Ministry of Energy and Electrification (90.3 per cent of the TPS installed capacity): 8 units with a capacity of 720-800 MW, 42 units of 282-300 MW, 5 units of 250 MW, 43 units of 175-210 MW and 6 units of 150 MW. In 1997, the corresponding installed capacity utilization ratio was 30 per cent due to difficulties in fuel supply, and also because of the load schedule planned for NPP. The most efficient fuel-oil-fired 800 MW units were practically idle with a capacity use of 8 per cent.

Heat supply

Supplying heat and hot water to commercial and residential customers as well as steam to industrial consumers using district heating systems is a very

Table 13.4: Installed capacity and production of electric power plants, 1995-1997

	1995	1996	1997
Total			
Installed capacity *(GW)*	55.1	54.0	53.9
Power production *(TWh)*	193.9	181.7	178.0
Power consumption *(TWh)*	151.3	139.8	126.9
Own consumption and losses *(TWh)*	42.6	41.9	51.1
TPP			
Installed capacity *(GW)*	36.6	36.5	36.4
as % of the total installed capacity	*66.4*	*67.6*	*67.5*
Power production *(TWh)*	113.3	93.3	88.6
as % of the total electricity produced	*58.4*	*51.3*	*49.8*
NPP			
Installed capacity *(GW)*	13.8	12.8	12.8
as % of the total installed capacity	*25.1*	*23.7*	*23.8*
Power production *(TWh)*	70.5	79.6	79.4
as % of the total electricity produced	*36.4*	*43.5*	*44.6*
HPP			
Installed capacity *(GW)*	4.7	4.7	4.7
as % of the total installed capacity	*8.5*	*8.7*	*8.7*
Power production *(TWh)*	10.1	8.8	10.0
as % of the total electricity produced	*5.2*	*4.8*	*5.6*

Source: Minergo.

common practice throughout Ukraine. Currently two thirds of the population are served by district heating. Heat production is operated by thermal conglomerates, industrial and public combined heat and power plants (CHP) and heat-only boilers (HOB). The maximum installed heat capacity at Ukraine's CHP account for about 11.5 per cent of the TPP installed capacity and represents 4 200 MW. Approximately 25 per cent of the total heat is produced by these CHP.

Between 1995 and 1997 the supply of heat by power companies of the Ministry of Energy and Electrification decreased from 46.5 million Gcal to 41.8 million Gcal. One specificity of Ukraine's district heating (DH) system is that it uses natural gas and fuel oil instead of low-grade sources of energy to feed primarily heat-only boilers. As the cost of these fuels has moved towards world levels while incomes have not kept pace, there is an imbalance between production costs and sales revenues.

Oil and gas supply

Ukraine has proven oil reserves of 147 million tonnes, 52 per cent of which are difficult to extract. The Dnieper-Donets region in eastern Ukraine accounts for 85 per cent of crude oil extraction. Insufficient investment in Ukraine's oil sector since 1991 has led to a regular decline in production (more than 60 per cent over the past 20 years). In 1997, Ukraine produced 93 000 bbl/day and consumed 439 000 bbl/day.

Ukraine has six oil-processing plants (joint-stock companies) producing basic petroleum products:

- KremenchukNaftoOrgSyntez in central Ukraine;
- LysychanskNaftoOrgSyntez, or Linos in eastern Ukraine;
- KersonNaftoPererobka in southern Ukraine;
- Odessa processing plant in southern Ukraine;
- Halychyna (Drahobych) Oil processing plant; and

- NaftoKhimik Prykarpattia (Nadvirna) in the west.

The total primary processing capacity is about 51 million tonnes per year and the refineries can produce about 50 by-products. The oil refining intensity averages 54.5 per cent. The volume of refined crude oil has decreased sharply in recent years. In 1996 only 13 million tonnes of crude oil were refined, compared to 16.3 million tonnes in 1995. Currently the Ukrainian refineries are working at about 20 per cent of nominal capacity. High prices for crude oil deliveries, old technology (steam and electric power use are excessive), and the lack of funds for development explain the present situation.

Proven gas reserves were estimated at 992 billion m^3 in January 1997 and the potential resources are quite large, especially offshore (Black Sea and Sea of Azov). The Committee on Geology and Mineral Resources estimates total resources at 6 800 billion m^3, of which about 2 900 billion m^3 of conventional gas, 850 billion m^3 of coal-bed methane in the Donets basin and 2 100 billion m^3 of Black Sea gas hydrates.

Domestic natural gas production has been declining since its peak in 1975 (68.7 billion m^3), due to the depletion of existing reserves and the lack of new significant discoveries. This drop is also linked to poor technology and extraction methods, and reserves that turned out to be smaller than expected.

In 1997, five new gas fields were put into operation, as well as new wells on the acting fields, including the offshore Shtormove field in the Black Sea. According to the National Energy Programme of Ukraine through the year 2010, adopted in 1996, the Government plans to increase domestic production to 35 billion m^3 by 2010. A considerable part of the increased production should come from new gas fields. A first offshore international tender was held in 1996, at which Shell-Pecten won the right to explore four blocks on the Black Sea shelf together with DVP Chornomornaftogaz. In addition, BP began prospecting for gas in the Dnieper-Donets basin in 1997. However, attracting foreign investors on a large scale to develop the oil and gas complex is complicated as there is no legal framework.

The Ukrainian gas transport system, controlled by VAT Ukrgazprom, is regionally connected and constitutes the main hub for the transport of gas between Russia and Central Asia and consumers located in eastern, central, and western Europe. Approximately 93 per cent of all Russian gas exported to central and western Europe as well as Turkey transit through Ukraine. In 1999, Ukraine will receive 40 billion m^3 of gas as payment for the transit of Russian gas through its territory to western Europe.

Coal supply

Coal is used for around 50 per cent of electricity generation, 27 GW of total installed capacity being based on coal. The exploitable reserves of 46 billion tonnes could, at the 1990 production level, guarantee the normal operation of the conventional thermal power sector during the next 300 years. Coal and, in second position, nuclear energy are the major energy sources of electric power generation in Ukraine and future increases are projected on that basis, with some natural gas mainly for CHP utilities.

Owing to the importance of coal for the national energy economy, the introduction of market mechanisms into the coal economy started in 1994, when the Government decided to re-establish the Ministry for the Coal Industry and transform the State enterprises into joint-stock companies. Since then, however, the companies have remained under State ownership. Lack of budget funds and clear political vision about the future role of domestic coal in the energy mix has delayed further reform. In August 1995, the Government and the National Bank jointly signed Decision No 620, providing financial support for the coal sector (13 billion karbovanets) to ensure coal production during autumn and winter 1995/1996. However, the sector remained inefficient and unprofitable and its debts rose substantially. Presidential Decision No 116 of February 1996 on Structural Reforms in the Coal Sector and its Adaptation to Market Operation was confirmed a few months later (May 1996) by Government Resolution No 521. It acknowledged that no progress had been made but that, on the contrary, production costs had continued to rise, productivity rates had decreased, output had declined and loss-making enterprises still survived. Some indicators of actual restructuring are shown in Table 13.5.

13.2 Sectoral policies and strategies

Future energy requirements

In the framework of the TACIS programme, a scenario approach was used to determine energy prospects in the context of the general economic

Table 13.5: Indicators of restructuring of the coal industry, 1990-1998

	1990	1993	1995	1997	1998
Coal production *(Mt)*	164.8	115.7	83.6	75.9	80.0
Number of mines / pits *(Units)*	268 / 6	259 / 7	259 / 6	260 / 6	271 / 5
Number of employees *(1 000)*	609	621	527	429	400
State subsidies *(% of price)*	75.4	82.2	0.0	43.7	37.8
Productivity growth *(%)*	100.0	67.7	59.1	65.9	68.5

Source: UN ECE, Committee on Sustainable Energy, Energy/1998/15.

situation. The study identified two sets of assumptions about the growth of the economy, with two alternative scenarios for the evolution of the reforms. The scenarios integrate hypotheses that are commonly accepted by researchers, such as the dependence of economic recovery on the speed and extent of reforms. The assumed growth rates correspond to a gradual recovery of the economy in the short to medium term, gaining momentum later. It is widely believed that even the low-growth scenario might turn out to be optimistic.

For the energy sector, it is assumed that cross-subsidies for energy prices will be maintained, assigning to industrial customers part of the costs linked to gas and electricity consumption in the residential sector. In this way, the individual user is given no incentive to save energy. Household energy consumption is assumed to remain constant due to the low standard of living. Energy efficiency is assumed to stagnate in the industrial sector, due to a lack of finance available for plant modernization. The low-growth scenario also implies no improvements in energy efficiency in services, agriculture or transport. In this situation, the problem of energy production is worth mentioning. The poor availability of capital and fuels will force the power sector to strongly exploit already existing nuclear plants and perhaps defer the closure of the Chernobyl plant. Table 13.6 summarizes the benchmarks of the energy demand forecast that corresponds to the low-growth scenario. The most favourable hypothesis (high-growth scenario) is based on reforms which are quickly approved and uniformly applied to promote the privatization of State companies, remove controls on the prices of both raw materials and final products and reorganize services. The liberalization of energy prices and the elimination of cross-subsidies should promote investments in energy saving. The political implications of energy bills and the burden on the State budget should also be reduced.

In this context, the following main effects can be noticed (see Table 13.6): the increased role of electricity end-uses, a reduction in specific consumption and an improvement in energy efficiency (in residential and commercial sectors), an increase in consumption in the transport sector. In this scenario the power production system will have to be largely expanded. Most likely this growth will take place in the thermoelectric plants.

In the same scenario, energy-saving measures are not very efficient and the reduction in energy intensity will be slow. Electricity demand in final uses should expand by slightly more than 2 per cent a year between 2000 and 2010. Consumption and losses in the energy sector will significantly increase in this scenario, due to the lack of infrastructure modernization and a reduced management awareness of waste and inefficiencies. Energy demand from industry is expected to remain stagnant around or slightly above the 1995 level (50 Mtoe), in line with a slow recovery of activity. On the other hand, the residential-commercial sector will require an increasing amount of energy, especially for heating, due to the absence of targeted conservation measures and increased losses in energy transformation and distribution.

General energy policy

At the end of 1993, the Government prepared a "Concept for the Development of the Energy Sector of Ukraine for the period up to 2010", which was approved by Parliament. It intended to achieve harmony between the development of the economy and the state of the environment. It mentioned energy savings, restructuring of the production potential, diversification of energy sources and rational use of domestic energy sources as the main long-term objectives.

In July 1994, the Law on Energy Conservation was adopted by Parliament. The Law contains six

Table 13.6: Energy demand forecast up to 2010

Mtoe

		2000	2005	2010
Total final use		**111.1**	**119.1**	**127.1**
of which:	Fuels	98.7	105.3	111.5
	Electricity	12.4	13.8	15.6
	" " *(GWh equivalent)*	*(144 186)*	*(160 465)*	*(181 395)*
Residential and commercial		**44.5**	**49.1**	**52.6**
of which:	Fuels	40.0	44.0	46.4
	Electricity	4.5	5.1	6.2
Industrial use		**50.7**	**52.5**	**54.5**
of which:	Fuels	44.9	46.1	47.7
	Electricity	5.8	6.4	6.8
Transport		**9.4**	**10.3**	**11.9**
of which:	Fuels	8.5	9.4	10.9
	Electricity	0.9	0.9	1.0
Agriculture		**5.3**	**5.9**	**6.6**
of which:	Fuels	4.1	4.5	5.0
	Electricity	1.2	1.4	1.6
Other uses (incl. Non-energy)		**1.2**	**1.3**	**1.5**
Fuel input to thermal power plants		**28.3**	**31.9**	**35.9**
Nuclear and hydro power		**20.2**	**19.4**	**18.9**
Energy sector own cons. & losses		**7.3**	**6.8**	**6.6**
Total primary energy demand		**154.5**	**163.4**	**172.9**
of which:	Fuels	134.3	144.0	154.0

Source: TACIS.

sections: general provisions, economic mechanisms, standards and norms, expertise, State control, and international relations in energy conservation. The Law provides economic incentives for investments in energy conservation, introducing also regulatory mechanisms for efficient energy use by industrial enterprises. The payments form the basis of the National Energy Efficiency Fund as well as extrabudgetary funds at local and oblast levels (see Chapter 2 for details about the funds). The Government approved the regulations for the operation of the National Energy Efficiency Fund in February 1996.

The National Energy Programme of Ukraine through the year 2010 was approved by Parliament in May 1996. The exploration of indigenous Ukrainian energy resources and the introduction of energy-efficient technologies are being strengthened in an attempt to decrease import dependency by about 30 per cent compared to 1990. The Programme foresees the further development of the hydrocarbon sector, especially the offshore fields of the Black Sea and the Sea of Azov. The plan is to increase crude oil production from 4.1 Mt in 1997 to 7.5 Mt by the year 2010, and that of natural gas from 18 to 35.5 billion m^3. Economic coal mines should be improved, and new ones created, allowing for an increase in production to 170 million tonnes by 2010, meeting all national solid fuel needs. The development of the electric power sector is foreseen through the modernization (see below) and construction of nuclear and thermal power plants. It is forecast that by 2010 their respective shares in production will be 40 per cent and 50 per cent, the remaining 10 per cent coming from other sources. The development of non-conventional and renewable energy sources would make it possible to save 11.2 Mtoe in the annual energy balance. According to the National Energy Programme, the total installed capacity of new cogeneration plants will be 4.2 GW by 2010.

On the basis of the National Energy Programme, a comprehensive State Energy Conservation Programme was prepared by the State Committee for Energy Conservation in 1996, endorsed by the Cabinet of Ministers, and approved by Parliament in 1997. It aims at drawing up guidelines for the State energy conservation policy, taking into account the current state of the economy and development forecasts. This three-step policy is expected to save about 135-145 Mtoe by 2010 by eliminating energy wastage, improving the energy efficiency of processes, introducing energy-efficient equipment and increasing the share of high-tech and low energy consuming production in the economy.

Strategies for the electricity sector

The Council for Studying the Productive Forces of Ukraine has forecast the demand for electricity up to the year 2015. The results of the investigation are included in Table 13.7. The power sector will have to adapt to demand. The Union of Ukrainian Researchers and Engineers Societies sees the modernization of the power sector in three stages. The first step would lead to the replacement of secondary equipment so as to increase operating time and efficiency. The cost of this work is US$ 200 per kW. The second stage is dedicated to the modernization of boilers and turbines, as well as to the conversion of low-grade coal heaters, leading to a sharp reduction in supplementary natural gas and fuel oil consumption. The estimated cost of this step is US$ 400 to 600 per kW. The last stage consists of a complete replacement of conventional boilers by new clean fluidized bed combustion technology (cost estimate US$ 600 to 800 per kW).

Various transformations have been taken in the electric power sector. Currently the generating sector consists of four thermal conglomerates (Dniproenergo, Donbasenergo, Tsenterenergo and Zakhidenergo), two hydroelectric companies (Dniprohydroenergo, Dnistrohydroenergo), five nuclear plants (grouped into a nuclear utility: Energoatom), combined heat and power plants, industrial auto-producers, and a power pool operated by Energomarket State Enterprise. The structural reorganization allowed the creation of a wholesale electricity market in March 1997, covering 86 per cent of electric power transmission. There are 27 regional power companies providing distribution and services in oblasts and the cities of Kyiv and Sevastopol, and about 106 independent entities active on the wholesale market.

In the coming years, thermal power generation from solid fuels will be developed on a large scale. To minimize negative environmental impacts, the "Principal Directions of State policy of Ukraine in environmental protection, use of natural resources and ensuring ecological safety" propose to:

- introduce new technologies for burning low-grade coal in boilers with fluidized bed combustion
- increase the use of highly efficient steam-gas plants
- improve the quality of fuel by reducing ash content to 10 per cent and sulphur to 1-1.5 per cent
- introduce control systems that minimize emissions of dust, sulphur, and nitrogen compounds
- take measures to use solid wastes (ash, sludge and dust)

Table 13.7: Forecast of electricity demand up to 2015

TWh

	1990	1997	2000	2005	2010	2015
Total	**270**	**176.9**	**175 - 180**	**200 - 210**	**225 - 240**	**245 - 265**
Industry	147.6	73.4	70.3 - 74.5	88.3 - 93	97.1 - 102	103 - 114
Agriculture	19	10	11.5 - 12.1	16.5 - 18	19.4 - 22	22.2 - 25
Building industry	4	1	1 - 1.1	2.2 - 2.3	2.7 - 3.2	3.2 - 4
Transport	14.5	10	10 - 10.1	11 - 12	12.6 - 13.8	14 - 17
Public services, population	44.6	41	44 - 45.2	47 – 50	56.3 - 61	63.5 - 65
Own consumption, losses	40.3	41.5	38.2 - 39	35 – 36	37 - 38	39.1 - 40

Source: Council for Studying the Productive Forces of Ukraine.

- increase water re-circulation to 75-80 per cent of its total volume
- review environmental standards and requirements in keeping with their economic viability and environmental conditions.

The unified power system of Ukraine is in parallel operation with that of the Russian Federation as well as that of the northern Caucasus. However, it seems that exchanges of electricity between the systems are fraught with difficulties. At the same time, "Lvov island" in the west of the country has a power system that operates independently from the rest of the network.

Strategies for the oil and gas sector

Ukraine's strategic goal is to reduce its import dependency on oil and gas. New avenues, including the re-establishment of old relationships with Kazakhstan, Azerbaijan and the Middle East for oil, and with Turkmenistan and Uzbekistan for gas, are under consideration. Also, import needs are being reduced by stimulating domestic production and implementing energy-saving policies and technologies.

In 1996, the Government approved a plan to overhaul the oil industry. The plan was designed to encourage competitiveness and to increase domestic oil output by 2010 to 7.5 million tonnes a year by improving the existing exploitation and developing new reserves. Further plans envisage importing crude oil from the Middle East via the Turkish Black Sea port of Samsun.

Foreign investment in Ukraine's oil and gas sector has been made through joint ventures rather than privatization. In 1998, Odessa Petroleum, which recently completed a deal with Tintex Capital, drilled three wells in south-western Ukraine (Belolessky block) and plans to carry out additional drilling and seismic surveys. Joint ventures have been established between Ukrnafta and American (EuroGas) and Canadian (LVR) companies to develop oil fields in western Ukraine (Dolina) and in the north-east (Bugruvativske). Today foreign investors still complain about such difficulties as the lack of a clear legal framework, a complex tax system or heavy administrative rules, which discourage investments in the oil sector. In December 1998, Parliament had not yet approved the law on production sharing agreements.

Ukraine is modernizing the oil terminal of Odessa and plans to build a 600 km crude oil pipeline (551 000 bbl/day capacity) between the Ukrainian Black Sea port and the Druzhba pipeline via Brody (near Lviv). The new terminal is designed for a throughput capacity of 800 000bbl/day and will receive shipped crude oil from the Caspian Sea, in transit to eastern Europe and Germany via the Brody pipeline.

The Presidential Decree of 25 February 1998 lays down special conditions for the national company Naftogaz Ukrainy. The company had been founded in May of the same year, by decision of the Cabinet of Ministers. It resulted from the merger of the following State joint-stock companies: Chornomornonaftogaz (Black Sea oil-gas), Prydnipros'ki magistral'ni naftoprovody (By-Dnieper river's main pipelines), Magistral'ni naftoprovody Druzhba (Main pipelines Friendship), Ukrspetstransgaz and the open joint-stock companies Ukrgazprom, Ukrnafta as well as the State joint-stock company Ukragaz.

The National Joint-stock Company "Naftogaz Ukrainy" (Oil and Gas of Ukraine) reports to the Cabinet of Ministers and organizes the restructuring and privatization of the oil and gas sector with a view to adapting it to market conditions. Restructuring has given rise to the following daughter companies of Naftogaz Ukrainy:

- State company Ukrgazvydobyvannia (Ukrgasproduction) responsible for production of natural gas
- State company Ukrtransgaz for transport and storage of gas
- Trading house Gaz Ukrainy (Gas of Ukraine) for direct purchase and marketing of gas.

At the beginning of May 1998, the Government and the World Bank agreed on an action plan that foresees four main areas of reforms to be implemented during 1998-2001:

- Restructuring of the gas industry
- Establishment of the appropriate legal framework and a licence-based, regulatory system (e.g. oil and gas law)
- Development of a competitive gas market (customer registration, metering, etc.)
- Improvement of gas pricing.

Strategies for the coal sector

The recently approved Government programme advocates commercialization and full economic independence of enterprises, new measures to reduce production costs and subsidies, increasing

competition in the energy market, rendering the industry efficient and, finally, providing conditions for attracting foreign investments. The basic programme mechanisms are liberalization of coal prices, adaptation of production to coal demand, gradual change in ownership and production structures, and market development.

In compliance with the restructuring programme, and taking into account viability criteria of individual mines, their total number (271 at end-1997) have been classified into four groups:

- Group 1 (71 mines): profitable without any State support; medium-term privatization by auction.
- Group 2 (200 mines): loss-making, therefore in danger of closure. This group was subdivided into three sub-groups:
  - Group 2.1 (105 mines): potentially profitable, to which opportunities are given by the State, possibly enabling them to join Group 1
  - Group 2.2 (75 mines): to be closed in the medium term; programme of closure to be coordinated and supervised by Ministry for the Coal Industry
  - Group 2.3 (20 mines): to be closed immediately.

Thus, all uneconomic mines will have to be closed in the short or medium term, on the sole condition that the budget funds required for alleviating the social and economic consequences of the closure are available. The Government will also provide funds for the environmental site clean-up programme, including safety. In this respect, a pilot project is running at three deep mines, in order to gain experience in particular aspects, such as control of methane emissions, fires, control of mine water quality, liquidation of mine shafts, erosion and behaviour of mine tips (see also Chapter 10).

Solution of debt issues

Debts are a major issue in the Ukrainian energy economy. Gas, electricity and heat suppliers have seen their financial position seriously weakened since 1994-1995. The Government issued a resolution, in September 1995, allowing them to disconnect all non-payers. Two similar resolutions, regarding power supply to the business sector and gas deliveries to State-run organizations and institutions, were passed in August 1996 and June 1997, respectively. The implementation of these resolutions, which also call for a ban on the barter of energy supplies, was difficult to get off the ground but is currently gaining momentum, although payment discipline in the household and public sectors remains poor.

The Government increased electricity tariffs to cover the operating costs of the least efficient producers, but privileged residential consumers (e.g. military, Chernobyl victims, etc.) still benefit from special conditions. A financial recovery plan was developed pursuant to Presidential Decree N° 21 of 21 January 1998 and related instructions to the Cabinet of Ministers to address the financial crisis in the Ukrainian electricity sector. The plan identifies actions in five areas: cost reduction, retail tariffs, payment of current invoices, payment of arrears and privatization.

In the gas sector, non-payment occurs at all stages. According to the State Oil and Gas Committee, during the first quarter of 1998, 15.3 billion m^3 of gas worth 1.96 billion hryvnias were delivered to consumers. Only 13.5 per cent of deliveries were paid for. The debt of consumers amounted to 1.7 billion hryvnias at the end of the first quarter of 1998. Total debts have accumulated to 7.49 billion hryvnias (US$ 3.75 billion). To raise the share of cash payments for gas, VAT Ukrgazprom has recently begun selling gas to be used for domestic consumption via tenders.

Non-payment by consumers has also led to a large outstanding debt to external gas suppliers. Thus the debt to Gazprom was estimated at US$ 1.2 billion by June 1998. To solve the problem, the Ukrainian authorities proposed a scheduled repayment, half in cash and half with manufactured goods, while Gazprom intended to acquire shares in the Ukrainian energy infrastructure (refineries, underground gas storage facilities and transit pipelines) to reduce the debt. In January 1998, a protocol was signed for the annual delivery of 20 billion m^3 of Turkmen gas to Ukraine until the year 2005. However, Turkmen gas exports to Ukraine have not yet resumed after being suspended in spring 1997, partly owing to non-payment (as well as a dispute with the Russian Federation over transit fees and pipelines access).

Oil refineries are also in a delicate financial situation. Electricity supplies from the Russian Federation are sometimes curtailed because Ukrainian importers only pay for up to 10 per cent of supplies. It is difficult to predict how the restructuring of the energy sector through

privatization, and the plan to overhaul and expand the natural gas infrastructure in Ukraine will be carried out. Attempts by the State Privatization Fund to sell refineries were either unsuccessful or raised less revenue than projected. Moreover, it postponed the sale of 14 power distributors when a tender for three of them failed to attract even one bid. The gas sector restructuring has so far proved ineffective in preventing the accumulation of gas supply debts, and no real solution has yet been found to manage non-payment.

13.3 Energy conservation and pollution problems and their management

Energy intensity

Total primary supply of energy per unit of GDP is about 9 times higher than in western Europe and about 20 per cent higher than in the Czech Republic and Poland. The supply per capita is about ten per cent lower than in western Europe. Although the extent of the hidden economy is unknown, it seems clear that the Ukrainian energy intensity per unit of output is substantially above west European levels. The uncommonly high share of heavy and energy-intensive industries, obsolete equipment and processes, and a very high use of electricity in production (see Table 13.8) contribute to this. The increase in energy intensity over recent years can be explained by the economic depression.

Industry. Energy intensity in the Ukrainian industrial sector is higher than in western Europe, although it is difficult to define the difference precisely because of differences in computation methods. Since 1990, the industrial sector's energy demand has fallen in overall terms by 46 per cent, and by 50 per cent for electricity. The value of production has dropped 67 per cent during the same period. The chemical industry has traditionally been one of the basic sectors of the economy and has long had a stable share of 6-7 per cent of Ukraine's total industrial production. Over the past seven years the sector has suffered a considerable decrease in output and a corresponding decrease in the rate of capacity utilization. A strategic plan for the recovery of the chemical industry up to the year 2010 attaches priority to reducing energy and raw material consumption by reducing waste, by using newer catalytic technologies and by improving pollution control. Energy consumption in the production of chemicals and cement has decreased since 1990, amounting to 5.1 million t in 1997 compared to 15 million t in 1993. Cement production consumes 0.15 toe per tonne of cement (i.e. about 50 per cent more than in a number of OECD countries). In steel production, open-hearth or arc furnaces are used, consuming 21 per cent more electric power than the European average. In the production of ferro-alloys, this consumption is 38 per cent higher.

According to a study by USAID (1995), substantial (35 per cent) energy savings could be realized in the industrial sector over 10 years by implementing low-cost conservation measures such as efficient maintenance, insulation and energy metering. Major energy savings can also be achieved by changing industrial motors, which drive a lot of secondary equipment. The Government intends to introduce advanced technologies and processes to optimize the energy use in the industrial sector. Several industrial projects have been identified. They relate to the recovery of industrial waste and other non-traditional energy sources, the recovery

Table 13.8: Evolution of energy intensity, 1992-1996

	1992	1993	1994	1995	1996	1996 OECD Europe
TPES/GDP *(Toe / US$ 1 000 (1990))*	1.83	1.87	1.63	1.81	1.91	0.21
TFC/GDP *(Toe / US$ 1 000 (1990))*	..	1.28	1.09	1.18	1.22	..
TPES/Pop. *(Toe / capita)*	4.23	3.72	3.19	3.14	3.04	3.39
Oil supply/GDP *(Toe / US$ 1 000 (1990))*	0.35	0.28	0.23	0.28	0.23	0.09
Oil supply/Pop. *(Toe / capita)*	0.80	0.56	0.46	0.49	0.37	1.35
Elect. Cons./GDP *(kWh / US$ (1990))*	1.86	1.99	1.77	1.92	2.01	0.34
Elect. Cons./capita *(kWh / capita)*	4,308	3,948	3,470	3,342	3,194	5,349

Source: IEA.

of coal-bed methane, etc. In June 1998, an American company (EuroGas) signed two agreements to develop coal-bed methane production in Ukraine. Under the first agreement, a joint venture with a private Ukrainian company (MGT) was founded to drill three exploratory wells in the Donetsk coal basin. The second agreement aims at a similar venture with a State-owned geological company (Zahidukrgeologica) for a licence area in the Lviv-Volyn coal basin.

Households and commerce. Today, the residential sector consumes at least 33 per cent of total fuel used. Current specific consumption for heating one square metre of space is 1.5 times that of the United States or Germany, and 2.5-3 times that of Italy or Denmark. The State Committee on Energy Savings (in charge of the energy conservation programme with other ministries and agencies) studied measures to improve energy efficiency in construction, residential buildings and the communal sector. There are 20 programmes under way. The most important are: "Residential and civil construction energy efficiency programme", "Energy saving programme in housing and communal services" and "State Programme on implementation of different stages of installation of metering and control equipment for water and heat in the existing buildings stock, 1996-2000".

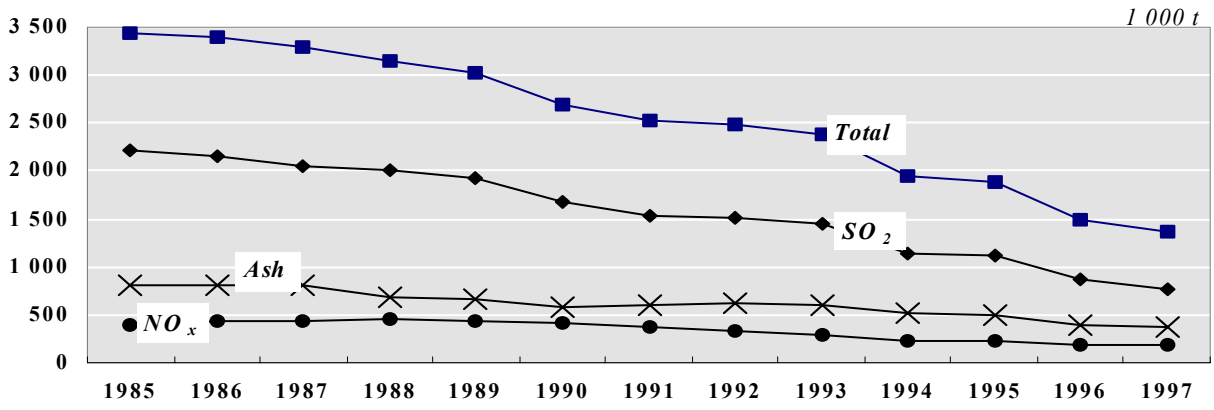
Measures are being implemented in a difficult economic context. For instance, only few apartments have water and heat meters and temperature controls, and progress is slow in their installation in residential buildings. All existing financial means (local budgets, debt financing, available cash) have been used up, while the funds introduced by the new law on the taxation system do not operate, as tax collection is a general problem.

New heat engineering requirements have been introduced since 1995, and sizeable energy savings (about one third of energy used for the heating of buildings) are expected from their implementation. Parallel to this, numerous technical solutions for heat insulation in both new and old buildings were developed. These solutions have been tested in several demonstration projects, mostly based on internationally assisted programmes (e.g. through TACIS). Finally, newly created specialized centres on energy conservation and building renovation train professionals of the building sector.

Sectoral environmental issues

Coal and power sectors. Being the most important source of estimated gross air emissions, electricity generation is a significant contributor to air pollution through the use of low-quality fuels and poor pollution prevention and monitoring equipment. Most of the thermal power plants are old and use obsolete technology and low-quality fuel. The control of excess air is carried out manually, following indication by old, slow oxygen analysers. Consequently, excess air causes inefficient combustion and fuel waste. Some of the older coal-fired power stations (e.g. Lugansk and Starobesheve) face problems of leaks in boiler casing. Air leaks and overloads the induced draught fans and reduces unit capacities, so that the plants lose about 15 per cent of their nominal capacity.

Figure 13.1: Emissions of major pollutants by the thermal power plants, 1985-1997



Source: M inergo.

Table 13.9: CO_2 emissions from fuel combustion by sector in 1996

Million t CO_2

	Total	of which:		
		Coal	Oil	Gas
Total	**387.91**	**168.79**	**56.28**	**162.83**
Public electricity and heat production	134.14	68.95	9.08	56.10
Autoproducers	4.58	3.19	0.33	1.06
Other energy industries	4.77	0.41	1.26	3.10
Manufacturing industries	112.32	57.43	15.45	39.43
Transport	16.92	-	16.92	-
Other sectors	93.42	21.39	12.16	59.87
of which: Residential	*65.75*	*21.39*	*5.03*	*39.34*
Losses and/or transformation	17.72	13.39	1.07	3.26
Statistical differences	4.03	4.03	-	-

Source: IEA.

The bulk of the installed thermal power capacity (138 blocks) has been in operation for more than 25 years (only 10 per cent built after 1980) and requires huge investments in clean combustion and gas-emission control technologies. Most plants have high stacks, which limit local air pollution, but none is equipped for continuous emission monitoring. Generally, coal and fuel oil quality is low, hampering emission control. Only particulate control equipment performing at acceptable level is installed at thermal plants. The principal air emissions are set out in Figure 13.1 and 13.9.

Almost 60 per cent of conventional thermal power stations burn domestic coal. The average ash content of coal delivered to power plants is more than 33 per cent and sulphur content 1.5-2 per cent. Very often the solid fuel delivered includes wash waste, the calorific value of coals ranging from 3 000 to 4 500 kcal/kg. Coal-fired thermal power stations are designed to burn coals with a calorific content over 5 000 kcal/kg, so all plants use gas and fuel oil (average sulphur content 3 per cent) as additional fuels. This practice leads to more emissions and additional solid waste accumulating in the boiler and at the particulate control equipment.

The Intergovernmental Analytical and Advising Council developed a market-based approach to supplying fuels for power plants, considering calorific properties, purchase and transport costs of the different fuels. Its study considers an initial condition of consumption of 25 million tonnes of coal of 5 000 kcal/kg without any additional fuel, the electric power block being fully loaded. The consumption of 25 million tonnes of coal of 4 000 kcal/kg with the addition of gas in one case and fuel oil in the other is then considered. The comparison of the results shows that consuming low-grade coal with additional gas leads to losses of US$ 74 million, and consuming low-grade coal with additional fuel oil leads to losses of US$ 11 million. In both cases, an additional cost of US$ 26 million for the transport of rock has to be added.

The study illustrates the necessity to create a real coal market. Institutional reforms and flexible implementing mechanisms will make it possible to focus on the most economic reserves and improve product variety and quality. Each power plant has to choose its solid fuels according to its boiler specifications, pollution control equipment performance and costs of purchase. The availability of low-cost, high-quality steam coal is likely to be a prerequisite for new coal-fired plants in the medium term.

The quality of the coal that is supplied to power plants, in terms of its ash and sulphur, remains a problem also for coal industries. The low quality of the solid fuel provided reflects various factors: the thinness and the quality of the vertical seams now being exploited, the high sulphur content of coal, the type of equipment employed and the lack of blending practices. There are about 35 coal washing plants, which wash steam coal using common technologies, such as jigging, to meet boiler specifications. Today, the washing capacity does not appear to be adjusted either to users' needs or to environmental requirements.

In 1992, the Ministry of Environmental Protection implemented a pollution fee system for air

emissions, water effluents and waste disposal. The system was intended to reduce pollution to meet standard levels (for details, see Chapter 2).

Heat supply. According to IEA estimates, Ukrainian heat consumption is above 1.7 GJ/m^2/year. This figure compares to 0.7-0.75 GJ/m^2/year in Denmark, indicating a considerable savings potential. Data on emissions from heating plants are not available. A project is under way to make district heating plants use fuels more efficiently, thereby reducing air pollution and waste-water generation.

A joint project between KyivEnergo and the World Bank to improve district heating in Kyiv illustrates the problems to be solved when attempting to improve the related efficiencies. The Kyiv district heating system has a capacity of about 15 000 Gcal/h and consists of 10 major networks. 2 CHP and 9 large HOB plants and several small isolated networks, served by 112 small HOB plants. The system uses primarily gas, although large boilers and CHP units can be fired with fuel oil. Half the budget of KyivEnergo is dedicated to buying fuels. The project envisages:

- Reconditioning and replacement of pumping capacity and boilers (50 years old), improvement of control equipment
- Upgrading of transmission and distribution pipelines. Lack of maintenance and deteriorating water quality has led to corrosion of the network and equipment. Consequently, heat losses are uncommonly high, and the make-up water volume does not meet norms
- Improvement of water treatment and heat sub-stations. The distribution system will be converted from constant to variable flow regime, using automated heat sub-stations with metered consumption. This will make it possible to reduce heat energy consumption by as much as 25 per cent.

Oil and gas industries. The technology used in refineries is frequently old, and leakages of oil, oil products and gas occur during the various processes. The facilities for treating waste water are insufficient, and the technology for removing oil and chemical pollutants obsolete. Sludge and solid wastes impregnated with oil and chemicals are stocked in open areas, without adapted confining structures. Finally, most of the processes implemented in the refineries need equipment to reduce sulphur emissions. The discharge of ballast water from oil tankers in and around Odessa harbour is also an environmental problem.

During the seismic oil and gas exploration campaigns, soils, river systems or groundwaters may be polluted. Drilling oil or gas wells may cause the same damage, but the quantities and the quality of the potential pollutants (such as hydrocarbons, specific mud or brine and CO_2 or SO_2 emanations) may worsen the consequences of an accident. Poor cementation may also provoke cross-water circulation between aquifers, leading to a contamination of drinking-water resources on a regional scale. Crude oil assisted production requires large amounts of water and solvents.

Regarding the oil and gas industry, the "Principal Directions" state that it is necessary to carry out a comprehensive certification of oil and gas facilities, develop environmentally efficient hydrocarbon extraction technologies, modify the current environmental protection standards and develop technologies to prevent, evaluate and manage pollution caused by hydrocarbons.

Institutional arrangements

The Ministry for the Coal Industry is responsible for coal mining and distribution, including links with the power sector. It supervises the coal industry's environmental performance. The holding company Ukruglerestrukturizatsiya is responsible for closing down inefficient mines.

The Ministry of Energy and Electrification supervises the power sector. Day-to-day operations are carried out by six privatized companies (four thermal and two hydro). The State company Ukrelektroperedacha is responsible for interregional electricity transmission. 27 regional distribution companies (oblenergos) transmit power through low-voltage grids. They distribute power to end-users at regulated retail tariffs. The National Energy Regulatory Commission has regulated electricity tariffs since 1996.

The State Committee for Oil, Gas and Oil Processing was until recently (replaced by Naftogaz Ukrainy) responsible for the production, import, refining, transport and distribution of crude oil, petroleum products and natural gas. It contained over 230 enterprises, including 66 State-owned firms.

The Committee on Geology and Mineral Resources

is responsible for issuing licences that allow private or State-owned enterprises to explore and exploit deposits in return for royalties and taxes. These revenues are shared equally between the Ministry of Finance and the Committee. The Government intends to reduce the Committee's share to 20 per cent. In the course of licensing, the Committee verifies that the relevant environmental legislation is respected. Moreover, it has its own control procedures and performs its own impact studies.

Naftogaz Ukrainy (Oil and Gas of Ukraine) was established in May 1998. The company manages extraction, processing and transport activities. Naftogaz Ukrainy reports to the Cabinet of Ministers and will organize the restructuring and privatization of the industry.

The Ministry of Environmental Protection and Nuclear Safety formulates environmental policy and regulations. It drafted basic payment standards for the use of mineral resources, in coordination with the other ministries and departments concerned. The Ministry also drew up the draft ecological requirements for privatization (see also Chapters 1 and 2).

The State Committee for Energy Conservation (established in 1995) is responsible for the energy efficiency policy (EU TACIS programmes, energy flows, etc.). It has the right to represent Ukraine in international organizations and sign agreements. The following other governmental ministries, entities and private institutions play an important role in the energy sector:

- The Parliamentary Committee on the Energy Sector and Nuclear Safety
- The National Security Council of the Presidential Administration
- The Ministry of Foreign Trade (imports), the Ministry of the Economy (State financial support for restructuring and privatization), the Ministry of Finance (budget allocations), the Ministry of Statistics
- The Committee on Geology and Mineral Resources issues licences and concessions for oil and gas exploration and production
- The Committee on Hydrometeorology operates the most extensive environmental monitoring network
- The State Committee on Building, Architecture and Housing Policy
- Different private research institutions provide analytical studies.

The National Electricity Regulatory Commission of Ukraine was among the first bodies to develop economic regulations in Ukraine. It is responsible for the implementation of national price policies in the electricity sector. Environmental protection regulations are its responsibility, too. The Commission's responsibilities are being extended to regulations for the oil and gas sectors as well.

Energy prices

The authorities are developing economic incentives to promote energy conservation. These incentives include grants, subsidized loans and tax rebates. Although these incentives are used, they are unlikely to have much impact on energy consumption until energy prices reach market levels. Parliament did not approve a reduction in subsidies or an increase in energy prices.

The Government sets the prices of electricity, natural gas and coal, other energy fuel prices such as liquefied petroleum gas (LPG) and heating fuel oil. Local authorities determine district heating and wood prices. The Government also sets the average price of heat for non-household consumers and prices for domestically produced crude oil, natural gas and steam coal. Energy prices have increased substantially since 1991, especially the prices of natural gas and crude oil, used primarily in heat and electricity production. These price increases have affected the prices of services such as electricity and heat prices. Energy prices have reached OECD price levels, as have electricity and heat prices, while industrial consumers are paying above-world-market prices for coal, fuel oil and natural gas. By contrast, households pay energy prices that cover only 50-80 per cent of production costs. The difference is financed from the State budget (central and local).

The *prices of oil and oil products* were liberalized in 1995. Paying customers are sure of being supplied and competition between private filling stations is developing. The *coal and electricity* price policy depends on various factors. One aim is to adapt domestic prices to world market levels, as the population's purchasing power grows. In 1994, the Government issued Resolution No 733 on 'Price and Tariff Formation in a Period of Transition'. Government Resolution No 109 (February 1995) determined the pricing rights and responsibilities of different State institutions. The Ministry for the Coal Industry proposes wholesale coal prices, and the National Energy Regulatory Commission wholesale electricity prices, both for

approval by the Ministry of the Economy. Wholesale electricity prices should be aligned on the current power generating costs, while coal prices should be negotiated between the coal companies and consumers. Negotiating *coal prices* is extremely difficult, particularly with power generators. In many cases, the price of domestic coal exceeds that of imported coal. In 1998, the Ministry of Energy and Electrification's thermal power plants paid HRV 128 per tonne of average fuel. By 1998, *electricity pricing* had not yet been reformed for social reasons, such as the population's low purchasing power.

The Government has taken measures to raise the levels of *heat tariffs,* e.g. in Kyiv. According to World Bank data, the production costs in the main district heating system in Kyiv rose from US$ 1.86 /Gcal in 1994 to US$ 17.77 /Gcal in 1998. The new methodology used to establish heat tariffs takes into account all costs, i.e. maintenance costs, depreciation and interest, as well as a reasonable profit margin.

Gas used to be the most under-priced of all energy sources in Ukraine. *Gas prices* are regulated by the Ministry of the Economy. Pursuant to Cabinet of Ministers Decree No 1027 of 19 September 1997, entitled "Procedure for supplying the national economy and the population with natural gas in 1998", the industrial sector is supplied free with gas. The wholesale companies are free to sell imported gas to industrial consumers at the conditions agreed with their customers. Generally, the price is based on the import price (around US$ 80/1 000 m^3), plus a gas transport tariff paid to Ukrgazprom (US$ 8.722) and a distribution tariff (US$ 5.34). Much of the gas supplies are actually bartered. For the population, the communal sector and State institutions, the price of domestic gas (sold entirely to those categories of customers) went from US$ 83 to US$ 66 per 1 000 m^3. Payments (taxes, royalties, VAT) to the State budget dropped from 68 to 42 per cent and the cost of gas production increased by 16 per cent.

End-user prices had increased considerably by the end of 1994 (by US$ 4-5 for small consumers and US$ 30-40 for industrial consumers) and continued upward until 1998, although inflation has occasionally whittled down the increases in real terms. There have been different successive decrees since 1995 fixing new tariffs in hryvnias for private individuals and in US$ for industrial clients. There are two household tariffs:

- A: no meter, i.e. use determined by applying consumption standards: HRV 154 per 1 000 m^3
- B: metered uses: HRV 136 per 1 000 m^3.

From 1999 to 2001, the Ministry of the Economy wants to phase in a cost-covering price (including costs of transport and storage) for the gas supplied to the population, the communal and budget-supported sector. As a first step, the retail price of gas distributed to the population has been increased by 18 per cent from June 1998, following the devaluation of the hryvnia.

13.4 Conclusions and recommendations

Energy and the energy industry are of paramount importance for any country in transition. For Ukraine, the success of the restructuring exercise in the energy sector will affect the whole economy. The energy industry will continue to be a major source of hard currency earnings and tax revenue, even when the tax system is finally overhauled. It should be mentioned that barter practices should be abandoned as rapidly as possible so that a normal financial circuit may be established. The adaptation and restructuring of the energy sector are part of a package of reforms that the Government will have to carry out. Both require considerable investments. The stable financing of fixed investment hinges on the existence of a legal, regulatory and institutional framework that supports long-term finance. An effective mechanism for corporate governance is necessary so that investors can be sure that they will have a voice in corporate affairs.

Steps have been taken to prepare a production sharing agreement (PSA) law that would define the regulatory framework in which foreign investors can do business in the production and commercialization of hydrocarbons. The Ukrainian Government may approve the law before the end of 1999. Likewise, a general law regarding concessions is currently being discussed in the Ukrainian Parliament and, if accepted, would also be applicable to the energy sector, where it would open opportunities for both Ukrainian and foreign investments. The implementation of a clear framework, together with its transparent application, is a key issue for any country wishing to attract foreign investments.

Recommendation 13.1:
A stable legal, regulatory and institutional framework for investments in the energy sector

should be created and implemented, in order to strengthen further the efforts undertaken so far for a long-term market-oriented energy policy. It should recognize the particular features of investment projects in this sector together with the obvious need for large-scale investment. Investments favouring the development of renewable forms of energy should be given priority.

A firm and lasting commitment of the authorities to sound and predictable economic policies is only one precondition for economic stability and sustained growth. Another is the creation or strengthening of credible and transparent institutions through which such policies can be implemented. At present, several State institutions are involved in supervising, regulating and managing the energy economy, from the extraction of energy resources to their distribution to the final consumers. The Government continues to make the budget decisions of companies and to control the revenues generated from their operations. In fact, the State regulates all markets of the energy sector, except that for oil and oil products. The tasks of the State administration are numerous, ownership and supervisory responsibilities are interwoven. As a result, the efficiency of the system as a whole is limited.

Recommendation 13.2:
The Government's role in the energy sector is to be redefined. The large number of government ministries, agencies, bodies and State enterprises currently involved in controlling energy production, distribution and prices should be streamlined as a result.

One of the most serious issues that the country had to tackle in its first years of transition was the sharp price increase for energy imports. Arrears in payments at all levels were both a result and a cause of additional problems, like the reintroduction of barter into the economy – a practice that should be eradicated at the earliest possible time. Methods of central planning (price controls, cross-subsidization, supply rationing or cut-offs) were applied rather than market mechanisms to regulate and balance energy supply and demand. However, for the energy sector as a whole to recover and Ukraine's import dependency to drop, an overall policy is needed. It should include such measures as: creating tariff structures for coal, gas and thermal energy as well as for electricity, finding a viable solution to the debt problem at all levels of the economy and create incentives to conserve energy.

If such a policy is to succeed, it will have to lead to the liberalization of markets, enabling users of energy to make their choices in accordance with their requirements. The gas industry faces many challenges, such as the establishment of a clear policy and legal framework for the oil and gas industry and its operating environment, especially dispute settlement procedures, non-payment of bills by customers, inappropriate tariffs, etc. Natural gas use as fuel should be reserved for combined heat and power plants, and measures to discourage barter should be taken. Furthermore, metering and other conservation equipment need to be installed for individual users of various forms of energy. In the case of electricity consumption, the meters should contribute to the equalization of use patterns. Fiscal measures will be necessary, for instance to mitigate negative social effects from the transition to a market economy in energy.

Recommendation 13.3:
A sustainable, market-oriented and coherent policy aiming at energy savings so as to reduce import dependency and promote energy conservation should be developed as a matter of urgency. It should specify the need to liberalize markets and take fiscal measures and technical measures like the introduction of modern metering equipment for individual users. Social concerns should increasingly be transferred to well-targeted social security programmes and not remain part of energy policies.

The absence of transparent, rational, market-based tariffs is the most significant obstacle to energy efficiency in Ukraine. Energy prices should cover all costs, including reasonable profit rates. Market-based electricity and gas tariffs, reflecting all costs (direct and associated) of energy generation and transmission, are also crucial to establishing sustainability and economic viability in Ukraine's restructured power and gas sectors. The Ukrainian electricity market has undergone a transformation during the past years, gradually moving toward market pricing and increasing cost-cutting incentives. Nevertheless, the wholesale power market is still far from its final stage where electricity is bought at the market price without governmental control or compensation mechanisms. A modern tariff structure should be introduced, including a shift in load from peak to non-peak hours. Finally, the cost of the environmental impact of electricity generation and transmission has to be included in tariffs as an equitable and transparent surcharge.

Recommendation 13.4:
The establishment and publication of a time schedule for the introduction of market prices for all forms of energy should be seen as an urgent requirement for the success of the energy sector's restructuring and modernization.

Thermal plants should continue to become more efficient. The introduction of new technologies that allow low-quality coal to be burnt in boiler units should be facilitated. Consequently, coal desulphurization units and control systems that minimize atmospheric emissions of dust, sulphur, nitrogen and carbon compounds should be installed when existing thermal power stations are refurbished or new generating units built. To improve the efficiency of the dust collection equipment, newer technology fabric filters need to be installed. Investment priority should be given to reconditioning existing thermal power plants, focusing on installing flexible capacity to meet peak loads.

On the other hand, Ukraine should continue to upgrade its electricity grid to meet European standards. Ukraine should develop a truly integrated national system, which would be interconnected with that of neighbouring countries, rather than be part of an integrated system whose centre of gravity and control lies outside its own borders. Because of its strategic location, the country could someday become an important transit country for electricity in the same way as it is for gas.

Recommendation 13.5:
The transition of the electricity supply system should, first, concentrate on reducing air emissions from existing thermal power stations, and on organizing an integrated and interconnected grid system inside the country and with its neighbours. See also Recommendation 4.3.

The determination of priorities, as well as the allocation of financial means in the modernization of thermal power plants, could be decided on the basis of environmental audits – complementing the study carried out by the Council for Studying Productive Forces. Such audits could become instrumental also in the improvement of communication between actors in the energy sectors, including environmental managers.

Recommendation 13.6:
Environmental audits in thermal power plants should be considered. See also Recommendations 1.4 and 7.5.

Chapter 14

HUMAN HEALTH AND THE ENVIRONMENT

14.1 Health status and environmental conditions

General health status

In 1997 Ukraine had a population of about 51 424 000. Demographic data from 1987 to 1997 reveal a negative trend in natural population increase (see Table 14.1). The proportion of people over 65 is growing continuously (from 11.4 per cent in 1987 to 13.97 per cent in 1997), while the proportion of people under 14 is declining (from 21.68 per cent in 1987 to 19.44 per cent in 1997). The birth rate decreased from 14.8 per thousand in 1987 to 8.77 per thousand in 1997.

The total fertility rate in 1996 was 1.31 children per woman, which is below the replacement level. 70 per cent of Ukrainians live in towns.

Several indicators show that the health status of the Ukrainian population has deteriorated over the past six years. Life expectancy at birth has decreased from 70 years to 67.7 years, with a greater fall in males (it reached 61.6 years in 1996 and increased to 62.3 years in 1997) than in females (74 years in 1970, 72.8 years in 1996 and 73.2 years in 1997). Life expectancy is 10 years shorter than for the population of the European Union. Infant mortality has increased since 1986 and in 1996 was 15.2 per thousand live births. This value is well above the EU value of 6.01 (1995). Yet it cannot explain fully the decrease in life expectancy. The post-neonatal mortality rate (6.9 in 1996), determined to a large extent by sanitary conditions, is around the average for central and eastern Europe and well below the average in the newly independent States (11.4 in 1992).

The most important causes of death are diseases of the circulatory system (61 per cent, see Table 14.2). Since 1986 the death rate has increased. This is in contrast with the countries of the European Union and central Europe, where deaths due to circulatory diseases are declining. Malignant neoplasm is the second cause of death (12.08 per cent of the total) with rates 10 per cent below the EU average but the same as the average in newly independent States. (In 1996, the standardized death rate for malignant neoplasm was 176.80 per 100 000 population, against 208.9 in central and eastern Europe and 195.1 in EU countries).

The incidence of cancer has increased from 292 /100 000 in 1987 to 310 /100 000 in 1996, which is above the average in the newly independent States and central and eastern Europe but below the EU average rate. The incidence of throat and lung cancer increased till 1992 (35/100 000 in 1980, 51/100 000 in 1992, 45/100 000 in 1996) but has decreased since then. The incidence of breast cancer has increased since 1980, but that of cancer of the cervix and the uterus has fallen.

The greatest increase in the past few years has been in deaths from external causes, representing 10.98 per cent of the total. 8 per cent of them are due to traffic accidents. The standardized mortality rates for traffic accidents peaked in 1990 (22.96/100 000) but has decreased since then (11.96/100 000 in 1997). The suicide rate has risen during the past ten years by about 37 per cent.

Table 14.1: Demographic data 1986-1997

Rate per mille

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Birth rate	15.5	14.8	14.5	13.3	12.7	12.1	11.4	10.7	10.0	9.6	9.1	8.7
Infant mortality	11.1	11.4	11.7	11.6	12.1	12.9	13.4	14.2	14.7	15.4	15.2	14.9
Natural population increase	4.4	3.4	2.8	1.7	0.6	-0.8	-2.0	-3.5	-4.7	-5.8	-6.1	-6.2

Source: Ukrainian statistical yearbook, Ministry of Health Protection.

Table 14.2: Death rates for the four most important causes, 1987-1997

	1987		1997		% change 1987-1997
	per 100 000	*%*	*per 100 000*	*%*	
All causes	**1,109.4**	**100.0**	**1,353.8**	**100.0**	**22.0**
of which:					
Diseases of the circulatory system	681.0	61.4	771.5	57.0	13.3
Malignant neoplasm	174.7	15.7	174.3	12.9	-0.2
External injury	84.8	7.6	147.3	10.9	73.7
Respiratory diseases	77.0	6.9	73.9	5.5	-4.0

Source: Health for All database, WHO 1998.

The fourth cause of death is respiratory disease (5.54 per cent of the total), with a death rate of 73.89 per 100 000 population. The disease declined till 1992 (67.7/100 000), but has increased since. Most of the deaths are in the age bracket over 65.

Mortality due to infectious diseases is very low (21.74/100 000 in 1996), but has risen since 1980. Also mortality due to chronic liver diseases (22.83/100 000 in 1997) and diseases of the digestive system (40.57/100 000 in 1997) have increased since 1980.

Of the diseases that could be prevented by immunization, diphtheria deserves special attention. A rapid increase in the number of cases of diphtheria was observed in 1991, when it rose tenfold compared to 1990 (from 0.2 to 2.1 per 100 000 of population). The situation was worst in 1995, when 5 277 cases were registered (10.25 per 100 000 of population), including 1,036 children. TBC morbidity is also increasing, from 5.6 per 100 000 of population in 1993 to 8.6 in 1997.

Drinking water and waste water

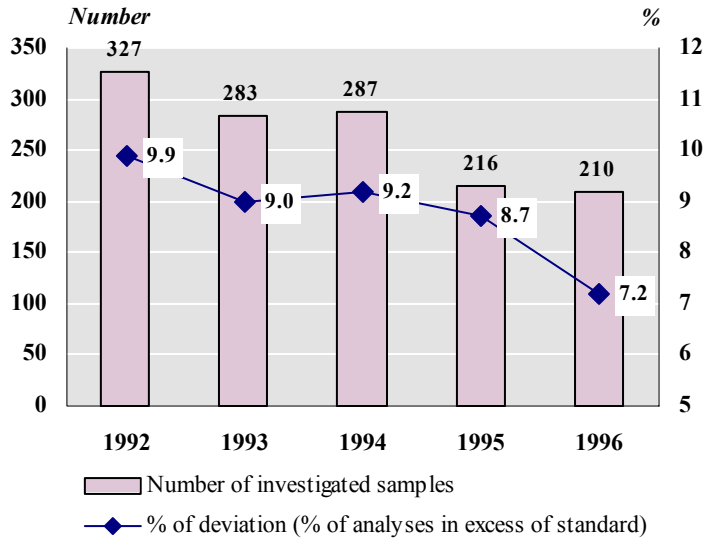
82 per cent of the drinking and industrial waters derive from surface water bodies, 14 per cent from underground sources and 4 per cent from the sea. More than 60 per cent of the surface water comes from the Dnieper basin. The water supply is frequently interrupted, e.g. water is not supplied at night. As drinking-water pipes often leak and are laid next to waste-water pipes, any interruption in the supply causes seepage from waste water into clean water, causing additional contamination. This is also confirmed by a study carried out by the Canadian development agency, which compared water quality, costs and services between Zaporizhzhia and Edmonton. The study shows that the annual number of water-supply system breaks in Zaporizhzhia is three times higher than in Edmonton (2 500/year against 700/year). Their average repair time in Zaporizhzhia is around 6-7 days, in Edmonton around 1-3 days.

Due to the decline in production, the volume of waste water discharged into water bodies has reduced by 978 million m^3 to 13 197 million m^3. Of this total, 4 108 million m^3 of contaminated water were discharged into water bodies, including 980 million m^3 untreated. The volume has increased by 7 per cent since 1995. Most of the discharge goes into the river Dnieper. Groundwater pollution is especially marked in the regions of Dnepropetrovsk-Dneprodzerzhinsk (waste water from metallurgical and chemical industry), Novomoskovsk-Pavlograd (from mines and cattle-breeding), Kryviy Rig (mine water and water from metallurgical plants), and Zhytomir - Rivne (waste water from chemical and light industries).

The situation is particular bad in the Black Sea area. Many illnesses are due to discharges of untreated sewage water. The city of Balaklaya suffers a high occurrence of disease, with its daily generation of 10 000 m^3 of sewage water. In Sevastopol, the repeated breakdowns of sewage collectors cause additional disruptions. The most important contaminants are petroleum products.

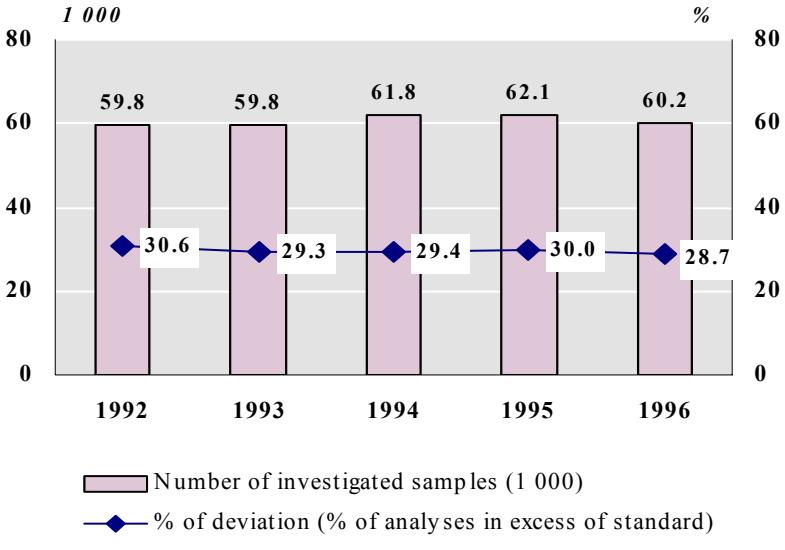
There is a difference in quality between water from centralized and decentralized supply systems. Water quality in decentralized systems is the worst (some 30 per cent of samples fail to meet standards, compared to 5.7 per cent in the centralized supply). The major reason for this is that 55.2-64 per cent of

Figure 14.1: Microbial quality of water from centralized supply, 1992-1996



Source: NEHAPs.

Figure 14.2: Microbial quality of water from decentralized supply, 1992-1996



Source: NEHAPs.

these systems have no protected sanitary zones around their sources and 27 per cent no disinfecting facilities. Around 9 per cent of the centralized water-supply systems and 29 per cent of the decentralized supply systems do not meet microbial standards (see Figures 14.1 and 14.2). Although there is a new resolution of the Cabinet of Ministers (CM 2024 of 18 December 98) regulating the local regime of sanitary zones for the protection of water sources, this is apparently not respected.

The regions with the biggest problems are Crimea, Luganska oblast and Sevastopol. In 1997, 6.9 per cent of the samples of the centralized water pipes did not meet the coli standard. Water pipes in Ternopilska oblast (11.9 per cent), Mykolaivska oblast (11.5 per cent), Khmelnitska oblast (11 per cent), Luganska oblast (9.8 per cent), Zakarpatska oblast (9.3 per cent), Vinnitska oblast (8.7 per cent) and Kirovogradska oblast (7.7 per cent) were particularly hazardous.

Every year between 1992 and 1996 *V. cholerae* was found in Donetska and Zaporizka oblasts and in Crimea and, in 4 years out of 5, in Mykolaivska, Kharkivska and Odeska oblasts. In 1994-1996 the virus hepatitis A antigen test was positive in 7.9 per cent of all samples from water-supply systems. In Kyiv, some sources did not meet the microbiological requirements (two stable samples were taken from deep wells in Kyiv, and four samples from centralized supply systems in different locations).

Very little information is available about chemical pollution. The smaller sanitary epidemiological services from the rayons do not have the necessary equipment. Therefore, samples have to be sent to the oblast level and this is done only upon specific request. A comparative study carried out in Odessa, Tartarbunary, Kyiv and Artemivs'k by the Institute of Toxicology from 1995 to 1997 revealed very different levels of pollution. Organoleptic characteristics, inorganic compounds, heavy metals and pesticides were analysed.

In Odessa, higher concentrations of cadmium and lead were consistently found, and an excess of phenol, halogen-containing compounds, iron and oil products were found in some samples. Hexachlorocyclohexane, DDT metabolites and Simazin (representative of a stable class of herbicides, used in irrigation agriculture) were also present in some samples. The concentration of iron in Kyiv was above the average of 0.2 mg/l. The iron content in Artemivs'k and Tartarbunary was 2.5 times above the norm. Tartarbunary did not meet the organoleptic standards.

In total, 29 outbreaks of acute intestinal infections were registered in Ukraine in 1992-1996 (Table 14.3). Twelve outbreaks were caused by *Shigella flexneri*, 10 outbreaks by *Salmonella typhi,* 5 by hepatitis A and 1 by *Shigella sonnei* and *Escherichia coli*.

Hepatitis A is a prevalent infection. Large outbreaks as well as sporadic cases are common. Data analyses of the hepatitis A incidence (1975-1996) have illustrated that this infection is widespread and seasonally concentrated in winter and spring. A positive trend with morbidity increases of 1.9 per one hundred thousand of population per year has been typical of the theoretical development of the hepatitis A epidemic process over the past six years. Most outbreaks were due to poor river water quality, especially the Dnieper river water.

Table 14.3: Outbreaks and cases of acute intestinal infections, 1992-1996

Number

	1992	1993	1994	1995	1996	1992-96
Total						
- outbreaks	**2**	**3**	**11**	**8**	**5**	**29**
- cases	**188**	**863**	**2 394**	**1 357**	**2 599**	**7 401**
of which:						
S. typhi						
- outbreaks	1	2	2	2	3	10
- cases	47	103	9	77	11	247
Sh. flexneri						
- outbreaks	1	-	7	4	-	12
- cases	141	-	1 026	564	-	1 731
V. hepatitis A						
- outbreaks	-	1	1	2	1	5
- cases	-	760	1 300	716	2 530	5 306
Sh. sonnei						
- outbreaks	-	-	1	-	-	1
- cases	-	-	59	-	-	59
Pathogenic E. coli						
- outbreaks	-	-	-	-	1	1
- cases	-	-	-	-	58	58

Source: NEHAPs.

From 1992 to 1996, the average hepatitis A morbidity rate was 255.5 per 100 000 persons. The highest morbidity rate was observed in Mykolaivska oblast (360.9 per $cent_{000}$) and in Crimea (1 061.5 per $cent_{000}$). The morbidity rate for children (up to 14 years) was significantly higher. The country's average was 465.9 per $cent_{000}$. 17 oblasts registered such a level between 1992 and 1996. Extremely high morbidity rates were registered in Crimea (1 562.8 per $cent_{ooo}$), Mykolaivska oblast (681.9 per $cent_{ooo}$), Kirovogradska oblast (627.6 per $cent_{ooo}$) and Donetska oblast (619 per $cent_{ooo}$). The highest incidences are still in Crimea and Sevastopol, with 1 045.5 and 1 150.2 per 100 000 people.

Cholera broke out in 1994 and 1995 in Mykolaivska oblast and in Crimea. An assessment of the outbreaks by the World Health Organization (WHO) indicated that foodstuffs could not be excluded as possible causes. Inadequately dried fish could well have caused the 1995 outbreak, but only water-related factors had been explored as a possible cause. A recommendation was made to implement standard (case-control) methods to investigate outbreaks, which consider both food and water risks, and to base action on the results of these studies. Training in those methods and a sample questionnaire to be used as a basis for the assessment of future outbreaks were provided in Odessa in 1995. At that time there was also the wish to increase the monitoring of *Vibrio cholerae* in natural reservoirs (which was already taking up a large part of the budget for cholera prevention), but this was discouraged by WHO.

The overall morbidity rate for Flexner's dysentery increased from 12.64 per 100 000 persons in 1992 to 15.4 in 1996.

Waste

No data are available concerning either exposure, or waste-related health effects. There are 2 754 storage sites for industrial waste. It can be assumed that many pose serious health risks. 63 per cent of the sites do not meet hygiene and sanitary standards. The main reasons are insufficient insulation and lack of sanitary protection in areas that require it. In addition to disposal at (inadequate) dumping sites, large amounts of hazardous waste are stored on industrial premises.

Enterprises in Kharkov have accumulated 146 million tonnes of class 1 and 2 toxic waste, while enterprises in Kremenchuk have accumulated 95 per cent of the hazardous waste of Poltavska oblast. The site in Velyki Dymytrovychi is overloaded by a factor of 2 and there is a danger of the dam breaking. Another major problem will be the treatment and disposal of an estimated 8.9 million tonnes of very toxic stockpiled or dumped waste (Class 1 and 2 wastes, see Chapter 6).

In the agricultural regions of Ukraine (Vinnitska, Zhytomyrska, Poltavska and others), considerable amounts of obsolete pesticides are inadequately stored on farms (for details, see Chapter 6). A large quantity of liquid manure has accumulated in the 700 large cattle-breeding complexes.

Apparently about half the 656 municipal waste disposal sites do not meet the hygiene standards. The reasons are poor design of the disposal facilities, overfilled open dumps and co-disposal with hazardous wastes. Poorly dewatered heavy metal sludges have also caused notable disposal problems in several places.

Food

The Ukrainian Institute of Hygiene has carried out several studies on food contamination. A study on the daily load of heavy metals and nitrates in food products in industrial towns (Kyiv, Shostka, Cherkassy, Dnipropetrovsk, Dniprodzerzhynsk, Kryviy Rig and Nikopol) was carried out by random sampling. The study showed that the average lead content in food did not exceed the daily maximum allowable concentration (0.45 mg daily) in any of the towns, while the cadmium concentration did. Mercury also exceeded the MAC (0.014 - 0.029 mg daily) by about 30 per cent. Nitrate exceeded the maximum allowable concentrations in some cases, while average levels of nitrates in the food rations did not. The study on nitrates also revealed that infants aged 6 to 12 months received a higher concentration of nitrates than adults. High nitrate concentrations are associated with metahaemoglobinaemia, a condition that may even cause the death of young children (the most vulnerable group are babies under 3 months). It has also been suggested that nitrates are implicated in stomach cancer, but this association has not been demonstrated.

Investigations of home-produced children's foodstuffs, carried out in 1994-1996, revealed that no sample exceeded allowable levels of heavy metals, nitrates or pesticides. However, the study also revealed that microbial contamination is still a problem. The reasons are the increase in food

markets without laboratory control of food quality, as well as control problems in industrial children's food production. Ukrainian legislation limits the use of synthetic additives in food for children under the age of 3.

The state of nutrition and the composition of the diet have changed over the past ten years. The consumption of corn products has increased, while that of meat and fish products has fallen. The energy content of the average diet has decreased (3 597 kcal in 1990, 2 640 kcal in 1996). About 14.4 million people live in areas where the soil has a low iodine content (Volyn, Rivne, Ternopil, Lviv, Chernihiv, Zhytomir, and Kyiv). In the former Soviet Union, table salt was iodized in such areas. This practice has been reduced. UNICEF and other agencies are promoting a programme for its resumption.

There have been a number of serious outbreaks of food poisoning in recent years (see Table 14.4). Of the 1996 victims, 1 057 were concentrated in only 10 outbreaks. 74.4 per cent of the victims were children. Investigations traced those cases to catering facilities in schools, kindergartens and medical centres.

Table 14.4: Food-borne disease outbreaks, victims and deaths, 1995 and 1996

Number

	1995	1996
Outbreaks	251	239
Victims	1 138	1 498
Deaths	-	15

Source: NEHAPs.

Most of the outbreaks are due to *Salmonella enteritis*, *Shigella sonnei* and *flexneri*. Botulism morbidity is still very high in Ukraine and is a major public health problem in some regions (see Table 14.5). *Clostridium botulinum* was found in 56 per cent of meat products, 26 per cent of fish and fish products, 12 per cent of mushrooms, 3 per cent of vegetables, 1 per cent of other products during investigations into outbreaks. Tinned meat products were the most frequent cause. Most of the cases were of type B with a lower mortality. The largest mortality (up to 30 per cent) was due to type E linked to the intake of fish products. The slow provision of medical care also contributed to the high death toll.

Poisoning by wild mushrooms is the most prevalent form of acute food poisoning of a non-microbial nature in Ukraine, as most able-bodied persons (63.6 per cent) pick mushrooms regularly. Between 1993 and 1995, medical centres treated 961 to 1 011 cases a year. Their caseload peaked in 1996 with 2 861 cases (0.32 per 100 000). Most cases of poisoning were observed among the urban population (60.1 per cent of all reported cases). The unemployed, pensioners, students and pupils make up 67.1 per cent of cases.

Ambient and indoor air pollution

Although total emissions of the five conventional pollutants into the ambient air have decreased since 1990, specific toxic pollutants exceed the WHO standards in almost all big Ukrainian cities (see Chapter 7). In these cities, in addition to the power stations and other stationary sources, air pollution from motor vehicles poses an increasing risk to human health. In some cities, air pollution from mobile sources accounts for 60 to 90% of total emissions. Diesel emissions are not included in these figures. Diesel particles are known to have negative health effects and have recently been classified as toxic by Cal EPA.

Table 14.5: Number of botulism outbreaks, cases and victims, 1991-1996

	1991	1992	1993	1994	1995	1996
Regions *(Number)*	11	21	19	17	16	21
Cases *(Number)*	129	163	355	297	231	225
Victims *(Number)*	175	327	606	425	268	289
Lethal cases						
(Number)	13	22	22	24	13	15
(As % of victims)	*7.4*	*6.7*	*3.6*	*5.6*	*4.9*	*5.2*

Source: NEHAPs.

The current monitoring of ambient air concentrations is inadequate to estimate health effects with any degree of accuracy, due to the limitations of the present monitoring systems. Particulate matter, especially the respirable fraction (PM10), is considered a good indicator of exposure to air pollution. Levels of total suspended particles (of which 50 to 80% are usually found to be respirable in other countries) appear to be high in several large Ukrainian cities, ranging from an annual mean of 100 to 400 micrograms per cubic metre. Much lower levels (i.e. 10 to 50 $\mu g/m^3$) have been associated with both short- and long-term cardiovascular, respiratory and all-cause mortality, as well as with respiratory morbidity and decrease in lung functional capacity in various studies. If the Ukrainian estimates are reliable, health risks from air pollution would be considerable.

Some European studies have shown that some air pollutants like PM10 may enter indoors relatively easily, even with windows closed. Others, like ozone, enter mainly through open windows. One survey found indoor and outdoor pollution levels to be fairly equal, particularly on ground floors and along busy roads. SO_2 and NO_2 concentrations were higher indoors, with SO_2 concentrations exceeding the maximum ambient guideline values in 60% of the cases. Chemicals from cleaning products and building materials, some with carcinogenic potential, were found to exceed outdoor levels two- to fourfold. Indoor smoking is in all likelihood a more important source of indoor air pollution than outdoor traffic in Ukraine, as around 40% of the adult population are smokers, and indoor smoking is largely uninhibited. Gas cookers lead to high levels of indoor air pollution as well and have been associated with respiratory diseases in children. Information on the extent to which gas cookers are used is not available.

Transport, environment and health

Responsibilities for traffic accident prevention are dispersed, and an overall responsibility does not seem to exist:

- Municipalities are responsible with regard to accidents within city boundaries.
- The State Committee on Statistics collects information on accident injuries.
- Injuries on roads outside cities, and accidents involving vehicles transporting dangerous goods are reported to the Ministry of Transport (MoT), while injuries inside cities are reported to the municipalities.
- Vehicle inspections are done by the Ministry of Internal Affairs.
- Long-term health care after accidents is administered by the Ministry of Health Protection.
- The Ministry of Emergency Situations provides emergency help, assesses causes of accidents and makes recommendations for accident prevention.
- MoT develops transport corridors (three road and one river corridors are under development)
- Driving tests are coordinated by the Automobile Road Corporation.
- Land-use planning is a municipal responsibility.

For new roads, EIA is done by MEPNS, while MoT assesses the road conditions. Estimates of potential health impacts of the conditions of roads do not seem to exist. Surveys of traffic would provide essential information to estimate injury rates. Noise levels are not monitored. On the whole, information on traffic accidents and related health risk factors does not seem to be used adequately at any level. The Ukrainian report on environmentally sustainable transport may provide a starting point for a comprehensive assessment of health risks of transport policies.

Health effects of the Chernobyl accident

The direct health impacts of the Chernobyl nuclear power plant accident and subsequent release of radionuclides include the effects of exposure to ionizing radiation, and those resulting from stress and relocation. They occurred largely in three groups of people: clean-up workers, especially those active in the first two years of decontamination; resident populations living in areas of high deposition of radionuclides; and populations who had to move home quickly to avoid radiation exposure. The large costs of clean-up activities may also indirectly have had health consequences.

Two people died in the explosion; 134 people had radiation sickness, 28 of whom died of it in the first three months. The most striking effect is the unprecedented and unexpected increase in the incidence of thyroid cancer in children. Around 700 cases have been reported in Ukraine since the accident -- a massive increase in what is usually a very rare disease. These thyroid cancers were clearly associated with exposure to the radioactive iodine plume which followed the accident. These

cancers are unusually aggressive, presenting early metastasis. This effect may have been intensified by the high prevalence of iodine deficiency in parts of Ukraine and perhaps by the administration of stable iodine after the plume. (The adequate protective measure is to administer it before contact with the radioactive iodine.) Children born after the accident have a much lower prevalence and this cohort effect will wear out. No excess in leukaemia or in other cancers could be found, contrary to what was expected from the experience with exposure to atomic bombs.

A large research programme is under way to estimate individual radiation doses and to look at the effects of long-term exposure to low levels of radiation on human health. This is particularly important as previous knowledge was based on the follow-up of the populations affected by the atomic bombs in Japan (single high doses). Secondly, longer periods of observation (only 13 years have passed since the accident) are required to identify increases in the incidence of many cancers. Databases and international collaboration have been established. Current national efforts to establish and maintain registers of cancer, congenital malformations or genetic indicators for example are essential to respond to these questions and should be supported.

The other major effect is the extensive psychosocial problems suffered by the many people who were relocated. Around 116 000 people were moved from their homes between the end of April and August 1986. The lack of information following the accident, the stress of relocation with the break-up of social ties, the fear of long-term consequences are likely to have contributed to the build-up of stress. The fear was not irrational, as suggested by some. There was real scientific uncertainty and a lack of consensus about what the health effects could be. The unexpected findings on thyroid cancer and the ineffectiveness of bone marrow transplants in the treatment of clean-up workers are a demonstration of that. The lack of information persisted over many years, and there was real reason to mistrust official statements.

A high prevalence of a syndrome called "vegetative or vascular distonia" in Ukraine, which includes fatigue, lassitude, lack of interest and want of vitality, was found among clean-up workers, adults and children in contaminated and non-contaminated areas in 1990 before physical effects were demonstrated. Mental well-being assessed with a standard questionnaire (GHQ) was worse in women living in contaminated areas seven years after the accident than in non-contaminated areas. Symptoms of stress persisted years after the accident, and are the highest in resettled populations, intermediate for people living in restricted areas, and the lowest in non-restricted areas.

Higher morbidity and poor immune status indicators have been reported in liquidators, their children (especially in the first years following the accident), and in resettled populations, including children. A very high proportion of children has hyperplasia of the thyroid, the implications of that are not clear. Research has an important role in trying to disentangle the relative contributions of stress, recurrent infections, nutritional and other problems from those of low doses of radiation in causing these health problems.

With hindsight the relocation may have caused more harm than good. Less than 5% of the people who moved from their homes received more than 100 mSv of radiation from Chernobyl (compared to a lifetime background of 170 mSv, and unlikely to have detectable health impacts).

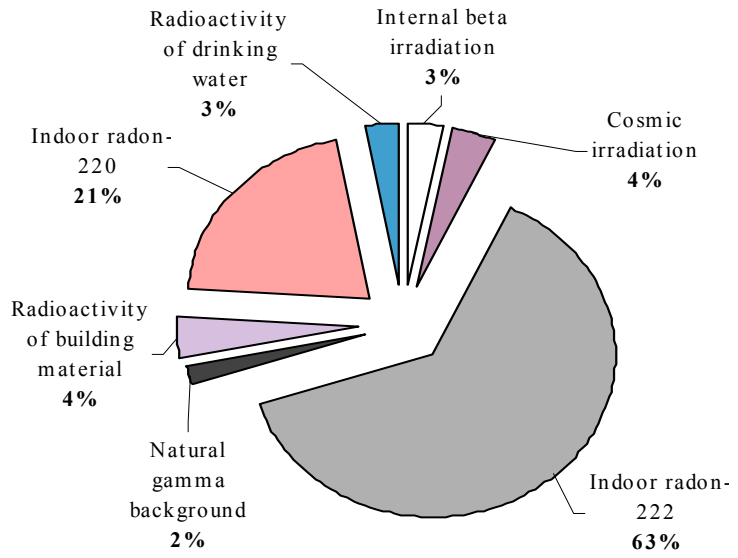
The response to physical health problems has overall been more adequate than that given to the psychosocial consequences. UNESCO for example has created a number of counselling and guidance clinics. However, there is still a need to develop and take action to reduce the psychosocial burden for the million or so people thought to be affected, learning from the work done so far. A medical model alone cannot deliver that type of help and there is a need to think through responses that integrate development and health concerns.

Natural radiation

Radon (^{222}Rn) is on average responsible for about 60 per cent of yearly radiation exposure (dose) in the Ukrainian population -- Chernobyl sources included. Architectural measures and ventilation of homes can reduce radon exposure. It makes up 63 per cent of the total dose from natural radiation.

Indoor radon is by far the most important source of natural radiation in Ukraine (see Figure 14.3). There is very good information about the radon concentration in homes across Ukraine, thanks to the studies being conducted by the Radioecology Laboratory of the Research Centre for Radiation Medicine. These studies investigate indoor ^{222}Rn concentrations and also the radioactivity of building

Figure 14.3: Main sources of natural radiation



Source: NEHAPs.

material and drinking water. About 19 000 homes in over 800 settlements have been examined since 1988. About 23 per cent of homes in Ukraine are estimated to have radon levels above 100 Bq-m^3 and 0.3 per cent of homes above 200 Bq-m^3.

The variation in indoor ^{222}Rn levels according to architectural planning; number of members in the household and their age, behaviour, professional activity; and the seasons was systematically investigated. A large seasonal variation can be observed; measurements are higher in winter and the seasonal difference is higher in southern regions. The highest levels of indoor ^{222}Rn were found (see Table 14.6) in one-storey homes (type I), followed by the first floor of multi-storey homes (type II) and homes above the first floor (type III). Types II and I had ^{222}Rn from underground emissions, while in type III homes the main source was building materials. Oblasts affected by the Chernobyl accident tend to have lower natural levels of radon, so the two sources of radiation are not necessarily cumulative.

House-to-house variation in indoor ^{222}Rn concentrations was considerable. For example, results of 100 measurements in Samchintsy (a village in the Vinnitsa region) showed that equilibrium equivalent indoor ^{222}Rn concentrations (EEC) varied from 25 to 460 Bq·m^{-3} between neighbouring houses. The variation is explained by building characteristics (ventilated spaces underneath the floor, floor construction, building materials).

Water can be a significant source of indoor ^{222}Rn. This was observed in multi-storey buildings in the Cherkassy region, where levels of ^{222}Rn in underground water were found to reach thousands of Bq·l^{-1}.

After the Chernobyl accident, resettlement from contaminated areas was based on levels of caesium and strontium; natural radiation was not considered. In some cases this led to those relocated receiving a greater dose of radiation over a 64-year period than they would have received had they not been relocated. For example, people moved from Narodichsky oblast (contaminated by Chernobyl, but with low radon levels) to Kherson oblast (no Chernobyl contamination, but high radon levels) will receive an extra 343 mSv compared to what they would have received had they stayed put.

Based on these studies, the Radioecology Laboratory of the Research Centre for Radiation Medicine has determined effective dose equivalents (EED) from ^{222}Rn irradiation, equally weighted for the population, to be 3.8 mSv per year. However, in some cases, the individual effective exposure may be above 50 mSv per year.

Occupational health

Acute occupational morbidity is normally registered by the different health posts or centres and then follows the routine information flow. The number of new cases of occupational disease has grown since 1989 (1.2 cases in 10 000 workers), with the highest incidence in 1994 (6.8 cases in 10 000 workers). The rate has decreased since 1994 (see Figure 14.4). The main pathologies are: pneumoconiosis (more than 50 per cent of the total), chronic bronchitis (13 per cent of the total), followed by vibration diseases, cochlear neuritis, and diseases of the locomotive system.

Measurements of harmful factors at the workplace (1995) after cases of occupational morbidity revealed that most of the cases occur in the coal industry (dust with silicon dioxide and carbon and

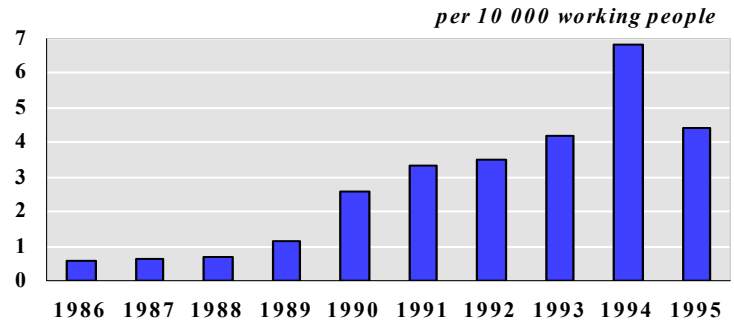
Table 14.6: Radon in types of dwelling

Bqm $^{-3}$

Region	The average ^{222}Rn ECC			Weighted average values of the ^{222}Rn ECC
	I type	II type	III type	
Vinnitsa	79	38	28	65
Volyn	19	13	10	16
Donetsk	102	89	34	65
Zhitomir	70	45	26	55
Zaporozh'e	94	43	24	56
Ivano-Frankovsk	55	38	20	45
Kyiv	54	29	23	34
Odessa	115	78	34	77
Poltava	44	32	23	36
Rivne	65	32	20	51
Sumy	36	18	13	27
Ternopil	132	48	33	104
Cherkassy	89	34	25	68
Chernigiv	38	24	20	32
Cherson	156	106	34	111
Dnepropetrovsk	89	39	25	50
Chernovtsy	55	38	20	45
Chmelnitsk	75	49	30	61

Source: NEHAPs.

Figure 14.4: Occupational diseases in Ukraine, 1986-1995



Source: NEHAPs.

coal dust). 43 per cent of the analysed samples in the coal industry exceeded more than 100 times the maximum allowed concentration of dust with silicon dioxide and more than ten times the MAC of carbon and coal dust.

Most victims work in the coal industry (76.8 per cent), the machine-building industry (6.75 per cent), the metallurgical industry (6.6 per cent) and agriculture (4.3 per cent). No data are available from the uranium industry. One million persons work in the coal industry in Donestska oblast, 400 000 of them underground. 65 per cent of coal in Donbas lies very deep (0.5-1.1 km). The extraction of coal in the deep stratum is characterized by high gas explosiveness. Coal dust concentration can reach 60-1 000 mg/m^3, and free silicon dioxide content is between 2 and 13 per cent of the total dust composition. Total humidity and temperature (mean value 38°C) are very high.

Pneumoconiosis is also found in workers in metallurgy and the machine-building industry, for instance in Dnipropetrovska, Lvivska and Kharkivska oblast. Observations have demonstrated that with few or no protective measures and long working hours, workers developed pneumoconiosis in six years.

The number of cases of cochlear neuritis has increased since 1990 (230 cases in 1990, 959 cases in 1995). Probably, these data are the result of better diagnostic services.

Women account for 5-6 per cent of patients with occupational diseases (700-750 cases per year). In the mining industry the number of women with occupational diseases is around 30-40 per cent. Ukrainian law foresees that, after the diagnosis of pregnancy, women should do easier work. But those "easier" jobs tend to be less well paid, so women very often continue to work in polluted environments (e.g. mines or agriculture). Women are entitled to maternity leave from eight weeks before the date of birth up to 74 days after the birth. Women are also entitled to a leave of absence without pay for up to three years, in order to care for their children.

14.2 Environmental health management

Major laws

Ukraine has made health and environmental commitments. Since independence, it has overhauled its health policies and management structures, with the primary goal of improving the quality and cost-effectiveness of its health care. The Law on Environmental Protection (1991), the Law on Sanitary and Epidemiological Protection of the Population (1994) and the State Building Norms (360-92) related to city planning and the construction standards A.2.2.1.-95: Structure and Content of the environmental impact assessment for the construction of enterprises and buildings lay down the principal provisions.

Table 14.7: Harmful factors at the workplace, 1995

Harmful factors	Number of victims	Levels exceeding MAC				
		1-2 times	3-5 times	6-10 times	more than 10 times	more than 100 times
Dust with silicon dioxide	1 245	28.4	9.0	7.2	12.4	43.0
Carbon and coal dust	784	2.2	3.3	4.2	91.0	0.3
Dust of plant and animal origin	118	15.2	6.8	9.3	16.9	46.6
Welding aerosol	40	35.0	25.0	10.0	12.5	-
Total vibration	298	66.0	17.8	4.7	4.7	0.3
Local vibration	768	47.9	43.3	3.1	2.9	0.3
Noise	1 418	34.1	7.3	15.6	37.0	4.6
Lead and its inorganic compounds	26	61.5	11.5	7.7	3.8	-
Trinitrotoluene	124	50.8	10.5	0.8	33.1	1.6
Electromagnetic fields	40	97.5	-	-	-	-

Source: Selective data from "Registration cards of occupational diseases (occupational poisonings)".

Table 14.8: Drinking-water standards in Ukraine and EU

Mg/l

	BOD5	Ammonia	Nitrates	Copper	Zinc	Mercury	Phenols	HC
Ukraine	3-6	2.0	45	1	1	0.0005	0.001	0.3
EU	5.0	1.5	50	0.005	5	0.001	0.005	0.2

Source: NEHAPs.

Management instruments

The concentration thresholds for pollutants in different media are based on their health effects. The existing system of standards is a legacy of the Soviet Union, and covers a large number of pollutants (for details, see Chapter 2). The Soviet standardization was based on "zero" risk, i.e. allowed levels of potentially hazardous substances should not have any effects on health.

The standards are currently being revised. The drinking-water quality regulation has recently been reviewed (Drinking Water and New State Sanitary Rules and Standards: Drinking Water; Hygiene Requirement for Water Quality from the Centralized Economic-Drinking Water Supply No 136/40 1997). Table 14.8 includes current drinking-water standards and compares them with those of the EU. The regulation contains 29 water-quality parameters that should be regularly monitored. However, in reality only ten of them are randomly sampled by the State sanitary epidemiological service.

The Sanitary epidemiological stations draw random samples from 1 139 municipal, 6 899 departmental and 8 179 rural pipes, and from 158 254 points of decentralized water supply, including 152 440 wells, 996 springs and 4 818 artesian wells. The sanitary regulations differentiate between those of centralized and those of decentralized sources (State sanitary norms and regulations on drinking water hygiene requirements of the quality of centralized water supply systems, No 383 of 23 December 1996 and No 136/1940 of 15 April 1997).

National *air pollution* standards were also developed in Soviet times but have not been updated. Air sampling and monitoring activities are carried out according to the SS 17.2.3.01.86 (Nature protection. Atmosphere, Control rules for the air quality of settlements). Table 7.3 compares the Ukrainian MACs with WHO guiding values. A recent study pointed out that the Ukrainian and European practices differ mainly in their sampling methods (e.g. sample averaging time and sample volumes are very small in Ukraine, collection times are 20 minutes and not 30, 24-hour sampling not always carried out). Moreover, Ukraine uses dated analytical procedures (e.g. bubbles for NO_2, SO_2, NH_3 and HCl); its air monitoring stations are not always properly sited, and it does not have an agency to collect air pollution emission test data.

The regulation on maximum allowable concentrations MACs (SanRS 42-123-4086-86) also includes food standards. The Register of food additives (SanRS N222 - 1997) is a list of those substances (food additives) that are allowed to be used in Ukraine. The content of radionuclides was determined by the Regulation on Temporary Allowable Levels of $^{134,137}Cs$, ^{90}Sr in Food and Drinking Water (TALs-1987), adopted in 1987. In January 1998, the Allowable Levels of Radionuclides $^{134,137}Cs$ and ^{90}Sr in Food and Drinking Water (ALs-97) were drawn up and introduced.

The Law on Sanitary and Epidemiological Protection of the Population of 1994 defines the rights and responsibilities of industrial facilities, agencies, organizations and individuals, and establishes the organization and procedures of the State sanitary epidemiological service and control. The most important change compared to the former Soviet law is that industries, agencies and organizations are responsible for informing the State sanitary epidemiological stations about any hazardous substances or health risk. Another change is that the food certification process is no longer the sole responsibility of the Ministry of Health Protection, but also of the State Committee of Standardization, Metrology and Certification.

Food certification is a two-step process. The Ministry of Health Protection's Chief Medical Officer permits the introduction or development of new products, new manufacturing processes and materials that come into contact with raw foodstuffs or food products during manufacturing,

storage or transport. The permit is based on the results of the State sanitary-hygiene expertise, carried out by different institutions. The State Committee on Standardization, Metrology and Certification carries out additional analyses and issues the certificate.

The institutions performing the analyses required for certification are selected by the Ministry of Health Protection and the State Committee on Standardization, Metrology and Certification. The Ukrainian Institute of Nutrition analyses the nutritional value of food products. The nutritional value of some kinds and groups of raw food is mainly determined by the energetic value and the food substances. The main products analysed are: meat and meat products, poultry, eggs, milk and milk products, fish, fish products and other sea products, cereals and bread, sugar and confectionery, fruit, fresh and processed vegetables, fats, and children's food.

The Ukrainian Institute of Toxicology, the national coordination point for the Codex Alimentarius, analyses the pesticide content, salts of heavy metals, arsenic, nitrates, food additives, hormones, histamine, nitrous compounds, and other additives and contaminants.

The microbial standards are analysed by the local sanitary epidemiological stations. They analyse four groups of micro-organisms: micro-organisms indicating sanitary status, potentially pathogenic organisms, pathogenic organisms, and micro-organisms as indicators of microbial product stability (yeast and microscopic fungi content).

The local sanitary epidemiological stations control food products. They control outbreaks, take up citizens' complaints, and follow up requests from industries or farmers. The law also foresees random sampling. The parameters evaluated are: microbial agents, pesticides, salts of heavy metals, arsenic, nitrates, food additives, hormones, histamine, nitrous compounds. Not all the local sanitary epidemiological stations are able to investigate all the parameters, some can only be determined by specialized laboratories. All local sanitary-epidemiological stations carry out microbiological analysis and analyse nitrate content.

The State Medical Officer is responsible for controlling the $^{137,\ 134}$Cs and ^{90}Sr content in foodstuffs. The concentrations of $^{137,\ 134}$Cs and ^{90}Sr in food and agricultural raw materials of the territories polluted by the Chernobyl accident have decreased.

The medical centres are obliged to inform the closest sanitary epidemiological station within 24 hours of an outbreak of an infectious water- or food-borne disease. The sanitary epidemiological stations are obliged to investigate the outbreak (both laboratory and epidemiological). Usually the results are reported to the local authorities and to the Ministry of Health Protection.

The information system on *occupational morbidity* is based on Cabinet Resolution No 623 of 10 September 1993: the status of investigation and calculation of accidents and occupational diseases at enterprises, institutions and organizations. According to this resolution first-aid posts in companies, their health centres, and all health care facilities have to inform the nearest State sanitary epidemiological station and the enterprise of any work accident, occupational disease or poisoning.

In 1992 a new Law on Labour Protection was introduced. It stipulates that those whose occupational disease can be certified should receive an indemnity and be allowed to retire before the age of 60 or 65.

Four Institutes for Occupational Health, in Kyiv, Kharkov, Donetsk and Kirovagrad, are enabled to certify occupational disease. The administration of nuclear energy is responsible for the certification of occupational disease in uranium miners.

When hired, a new worker must produce a physical health certificate from the local health centre. Workers used to undergo medical check-ups annually or biannually under the Soviet system. Enterprises with more than 2 000 workers still have their own medical service, but the health care service has disappeared nearly everywhere. Also, the sanatorium services of the former Soviet system have disappeared.

The health standard SanRS 3077-84 and SS 12.1.003-83 regulates the *noise* standards. The State Epidemiological Service (SES) takes random acoustic measurements. 73 cities have measuring stations. An analysis of the available data by the Ukrainian Institute of Hygiene has shown that transport is the major producer of noise. Apparently noise levels in buildings along main roads in cities with more than 1 million inhabitants are higher (85 dBA) than the allowable standard (65 dBA).

Institutions

Several agencies, at both national and regional level, carry out inspections and check compliance with hygiene norms, with some overlapping functions. The SES inspects food. The National Institute of Toxicology carries out some very specific inspections upon request.

Different ministries are in charge of environmental and health issues. The Ministry of Health Protection is in the process of restructuring. There is no information on its organizational structure. The Ministry has around 100 employees. The sanitary epidemiological services, which are under the responsibility of the Chief Medical Officer, are part of it. One such service operates in each oblast and in each rayon. The most important institutions for environmental health policy are:

- The Ministry of Environmental Protection and Nuclear Safety
- The State Committee of Construction, Architecture and Housing Policy
- The State Committee of Statistics
- The Committee of Hydrometeorology
- The Ukrainian Institute of Nutrition (National Food Monitoring Programme; policies for healthy nutrition and for food quality and safety; development of technical standards for the quality and safety requirements of foodstuffs, food additives, drinking water and soft drinks)
- The Ukrainian Institute of Hygiene (epidemiological and toxicological research into the implications of environmental contamination (Centre of Ecological Medicine) and in occupational health (Centre of Occupational Medicine); development of hygiene standards for recreational water, air (indoor and outdoor), noise, soil and non-ionizing radiation)
- The Ukrainian Institute of Toxicology

The Ministry of Health Protection currently has around 100 employees, including two First Deputy and three Deputy Ministers. The main departments are those with more than five employees, of which there are ten – but the Ministry was being restructured at the time of writing. There are five minor departments, and two scientific councils report to the Ministry: the Committee of the Medical and Biological Industry and the National Agency on Quality Control of Pharmaceuticals and Foodstuffs (created in April 1999).

Cooperation between the Ministry of Health Protection and the MEPNS is at present limited to informal discussions. The reasons advanced from various sides for this include potential and actual conflicts in the development of the NEHAP by the Ministry of Health Protection and the NEAP by the MEPNS. Furthermore, Ukraine's health care system is going through a deep crisis, and no strategy has yet been approved to solve it.

The Ministry of Health Protection works with different projects of international multilateral organizations. In environmental health these are:

UNDP	Environmental Networking Improved practice of pesticide application Pilot project for Environment Hazard Assessment
UNESCO	Chernobyl programme for social and psychological rehabilitation of the people affected by the disaster
International Federation of Red Cross and Red Crescent Societies (IFRC)	Red Cross Chernobyl Humanitarian Assistance and Rehabilitation project in 1990 for providing screening of food and the environment through radiometric screening
USAID, with the Centres for Disease Control and Prevention (CDC) in Atlanta	Improvement of the health information systems, particularly for sanitary and epidemiological data collection and processing

Monitoring and information systems

The system of mortality registration is well established. The causes of death are recorded according to the International Classification for Diseases (9th revision - from 1999 the 10th revision is expected to be used). The death certificate differs in one aspect from those in EU countries: it indicates whether the cause of death was the main reason, a complication or the direct reason.

Morbidity data are registered in the polyclinics and health centres by the medical doctors. Acute diseases are registered every time a patient goes to a healthcare centre; chronic diseases are registered only once. There are no patient history forms. TBC, dermatological, psychological and oncological diseases are reported only by specialized centres. Communicable diseases are reported to the Ministry of Health Protection every month, while other data are reported every three months to the rayon and from there once a year to the Ministry of Health Protection.

The sanitary epidemiological stations of the Ministry of Health Protection are responsible for carrying out regular random sampling of the quality of drinking water, recreational water, food, air, waste, soils and indoor air pollution, degree of illumination and vibration, noise, and school and kindergarten premises. This information from the local sanitary epidemiological stations is reported every month to the oblast station and from there every three months to the Ministry of Health Protection.

14.3 Conclusions and recommendations

Over the past two decades, Ukraine, like other countries in transition in central and eastern Europe, has experienced a deterioration in some key health indicators, further widening the gap with the health status of populations living in European Union countries. The increase in mortality and morbidity related to environmental conditions (e.g. external injuries, hepatitis A, infectious diseases) calls for measures to revert these negative trends. This requires action within the health system (e.g. more effective procedures and enforcement to control food and water contamination) and more inter-sectoral action to reduce pressure on the environment that has a negative impact on health.

Ensuring a safe water supply, good sanitation and safe food can prevent most hepatitis and cholera cases. A variety of strategies and inter-sectoral cooperation is necessary. Furthermore, there should be an appropriate early response to the threat of outbreaks. In some cases swift adequate patient management can prevent deaths. Over half the decentralized water-supply systems do not have protected sanitary zones around their drinking-water sources and a quarter do not have any disinfecting facilities. These decentralized water-supply systems are the main source of drinking water for the populations in rural areas and in the south of the country.

The high rate of infectious and parasitic diseases, food- and water-borne disease outbreaks is a major public health concern. There is a need to develop a strategy to prevent microbial contamination of water-supply systems. This should be based on: (a) the identification of risk factors for contamination through sanitary inspections and of population groups at risk; (b) identification of special hazardous sources and supply systems and preventive action; (c) cost-effective preventive action directed at the groups who are most at risk; (d) action focused on source protection, and concentrating on the actual implementation of these measures (e.g. economic incentives, technical packages, education, etc); (e) enough monitoring of drinking-water quality to report on progress. Strategies and practical aspects should be based on the WHO Drinking Water Guidelines. At local and interregional level an integrated river basin management approach would ensure collaboration between different sectors, avoid duplication and improve communication. No attention is currently paid to recreational waters.

Recommendation 14.1:
The public health sector should pay more attention to the effects of water pollution and to preventing water-borne diseases. Ukraine should ratify the Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. A system of monitoring bathing waters should be set up, and collected information should be disseminated to the public. *See Recommendation 8.10.*

Systematic measures to ensure food safety are presently limited and handled by different institutions. Food control in different parts of the country is uneven, and access to information on food quality is insufficient. Hazard analysis critical control points (HACCP) are not yet implemented. There is a need to follow the recommendations of the World Declaration and Plan of Action for Nutrition, which called on Governments and other parties to adopt and strengthen comprehensive measures to cover the control of food quality and safety with a view to protecting the health of consumers. A national food safety strategy should be developed accordingly and implemented.

Recommendation 14.2:
The following food protection measures should be considered for urgent implementation:

- *local needs assessments and inter-sectoral collaboration for implementing food safety activities should be included in local food protection programmes*
- *a code of hygienic practices should be distributed to all district food industries and local authorities*
- *the implementation of the Hazard Analysis and Critical Control Point (HACCP) system should be ensured*
- *regular assessment of food technologies that prevent food-borne diseases and reduce post-*

harvest losses should be ensured by the responsible institutions
- *education in the principles of food safety and hygienic handling of food should be organized for all those handling food*
- *the districts should promote food safety in tourism by raising the awareness of the travel industry about possible food-borne hazards*
- *information gathering and dissemination among the public should be strengthened, including surveillance of food-borne diseases*
- *information campaigns to combat mushroom poisoning and botulism deaths should be improved*
- *food quality control on street markets should be ensured.*

Most of the storage sites of industrial waste and municipal waste disposal sites do not meet the hygiene standards. Most hazardous waste disposal is by stockpiling or disposal at inadequate dump sites. There is no need to document the health effects of waste disposal practices before taking action; attention should be focused on adequately disposing of wastes:

- Identify the most hazardous waste disposal sites and implement an integrated strategy to modify them or to close them down.
- Introduce licensing for hazardous waste storage sites
- Standardize regulations regarding the transport of wastes and start a waste-tracking scheme to control and monitor hazardous waste movement
- Make available information on effective waste disposal technologies

Although this review did not address in detail mental health issues, the very high mortality rates due to suicide, alcohol abuse, poisoning and homicide are a cause of concern. These "external" causes of death recorded the greatest increase of all causes between 1987 and 1997. The root cause of this increase in violence, alcohol abuse and poisoning should be investigated, and strategies to address these problems developed.

There is a need to investigate the root causes of the increase in violence, alcohol abuse and poisoning and to develop strategies to address these problems.

Information on traffic accidents and injuries is not adequately brought together. There is a need to involve the various institutions responsible for formulating traffic and land-use policies, collecting information on traffic flows and mixes, injuries and deaths, controlling vehicle and road safety, and enforcing drink-driving legislation, safety belts and helmet use in developing one strategy to prevent traffic injuries and deaths. A common strategy to address traffic-related ill health and deaths should be developed in coordination with the Ministries of Transport, Environment, Land-use Planning and Health. Initially this strategy should focus on traffic accidents, and later it should incorporate air pollution, noise, and walking and cycling as means of transport.

<u>Recommendation 14.3:</u>
The public health sector should take measures to prevent injuries and violence in cooperation with the other institutions involved. Public information campaigns in this respect should be undertaken in cooperation with other involved institutions.

Air pollution and its human health effects appear to be underestimated by the current monitoring methods, which do not enable reasonable exposure estimates to be made. The maximum allowable level for particulate matter of 500 micrograms per cubic metre is far too high and should be reconsidered in line with the recommendations of the WHO air quality guidelines. Mobile sources of air pollution are an important contributing factor to human exposure and most of the cars still use leaded fuel. Diesel vehicle emissions should be inventoried, and the phasing-out of leaded fuel should be envisaged.

Little is currently known about indoor air pollution. It is therefore necessary to collect data in this area and raise public awareness about the most important associated health risks.

<u>Recommendation 14.4:</u>
Data are needed on the most important sources of indoor air pollution, including gas cookers and indoor smoking. Information on the associated health risks, together with recommendations on how to minimize them, should be included in health advice packages given to families as part of health promotion campaigns.

There has been an important increase in occupational disease following independence. Workers' protection and safety have deteriorated. Recent laws have shifted responsibility for protecting the employee to the employer, but these regulations are rarely applied. The economic difficulties have led to a reduction in activities to

ensure employee health and safety. The coal industry poses very high risks to workers, who have the highest number of certified occupational diseases. Little is known about occupational disease in uranium miners. Working conditions should be improved.

Recommendation 14.5:
To reduce occupational morbidity:

- *individual protective measures should be reintroduced and workers should be adequately informed about their health risks*
- *economic instruments should be applied to encourage enterprises to observe health and safety standards, as well as to report all occupational disease*
- *adequate monitoring of occupational disease in all economic sectors, including uranium mines, should be ensured.*

The health effects of the Chernobyl accident are still under evaluation. WHO investigations have shown an increase in thyroid cancer in children. The psychosocial effects of the Chernobyl accident should also be treated on the basis of an adequate strategy. Such a strategy should aim at human development and have a health promotion perspective, rather than follow a disease identification and treatment model. Regarding the health effects of long-term exposure to low-dose radiation, the establishment of a register of indicator diseases (e.g. cancer, congenital malformations or other genetic indicators) would be useful for several purposes, including research on the effects on children.

Recommendation 14.6:
A strategy and programmes to abate the psychosocial effects of the Chernobyl accident should be developed, and programmes to identify the long-term health consequences of long-term exposure to low-dose radiation should be supported. A programme should be planned and implemented to monitor the children of parents affected by the Chernobyl accident.

About 23 per cent of homes in Ukraine are estimated to have radon levels above 100 Bq-m^3 and 0.3 per cent of homes have levels above 200 Bq-m^3, with big differences between the oblasts. Architectural characteristics determine most of the variation in indoor radon. Measures should be taken to decrease the risk to those living in areas/dwellings with high radon levels.

Recommendation 14.7:
Indoor radon should continue to be assessed, in order to investigate areas not yet examined and to monitor trends and results from action to reduce radon in high-risk homes. Information on behavioural measures such as ventilation practices should be made available to households in high-risk areas. Building codes and environmental impact assessments should include sections designed to ensure that radon levels do not exceed 100 Bq/m^3 in new buildings.

There is a need to improve coordination of the various activities carried out by the different ministries and State committees. There is room for better coordination and use of resources both within the Ministry of Health Protection (e.g. central versus decentralized levels) and between different ministries, including those responsible for public health and environmental protection. The inter-sectoral cooperation with the Ministry of Environmental Protection and the other State committees (both at national and regional level) and with the municipal environment and health care services should be further developed.

The municipalities offer great opportunities for inter-sectoral cooperation, but so far the concept of 'healthy cities' has not yet taken off in Ukraine. Further steps should be taken to explore the potential for inter-sectoral action at the local level to promote health and environment. These steps should be taken in parallel to initiatives at national (ministry, State committee) levels, and could be instrumental in bringing about inter-sectoral cooperation. The international work on sustainable and healthy cities, and the experience of decentralized cooperation within WHO are recommended as strategies to pursue that at the local level.

Areas to focus on include: (a) optimizing monitoring carried out by different institutions; (b) strengthening capabilities in environmental health (including the development of human resources); (c) setting common priorities for developments in the area of environmental health (e.g. on air pollution, noise, drinking water, sectors of the economy, drawing-up of the national and local environmental health action plans); (d) defining more clearly the areas of responsibility of the different ministries and committees; (e) making more efficient use of the respective technical competencies, for example in integrated

environmental health impact assessments. The critical review should lead to better coordination also between the sanitary epidemiological services and the regional environmental boards. A National Environmental Health Action Plan should be developed in cooperation. Public awareness and information on environmental health hazards and protection measures are a subject for common campaigns between the MEPNS and the Ministry of Health Protection.

Recommendation 14.8:
More effective cooperation and coordination mechanisms should be established between the Ministry of Health Protection, the Ministry of Environmental Protection and Nuclear Safety and other relevant ministries and State committees, focusing on health promotion and environmental protection around specific issues, such as traffic, agriculture and foodstuffs, mining and industry, water quality and waste. It should particularly aim at the implementation of the National Environmental Health Action Plan, closely coordinated with the National Environmental Action Plan. It should also relate to coordination between national, regional and local levels of public administration.

ANNEXES

Annex I: Recommendations Chapters 1 to 14

Annex II: Selected Environmental and Economic Data

Annex I

SELECTED ECONOMIC AND ENVIRONMENTAL DATA

Selected economic data	
	Ukraine
TOTAL AREA (1 000 km²)	603.5
POPULATION	
Total population, 1997 *(100 000 inh.)*	509.0
- % change (1992-1997)	- 2.3
Population density, 1997 *(inh./km²)*	84.3
GROSS DOMESTIC PRODUCT	
GDP, 1997 *(US$ billion)*	49.7
- % change (1992-1997)	- 58.4
per capita, 1997 *(US$ per capita)*	976.0
INDUSTRY	
Value added in industry, 1997 *(% of GDP)*	33.5
Industrial output	
- % change (1992-1997)	- 51.2
AGRICULTURE	
Value added in agriculture, 1997 *(% of GDP)*	12.6
Agricultural output	
- % change (1993-1997)	*- 32.5*
ENERGY SUPPLY	
Total supply, 1996 *(Mtoe)*	153.9
- % change (1992-1996)	- 30.0
Energy intensity 1996 *(toe/ 1990 US$ 1 000)*	1.9
- % improvement (1992-1996)	4.4
Structure of energy supply, 1996 *(%)*	
- Coal	28.5
- Oil and oil products	12.2
- Gas	45.3
- Others	14.0
ROAD TRANSPORT	
Road traffic volumes, 1996	
- billion veh.-km	..
- % change (1990-1996)	..
- per capita *(1 000 veh.-km/inh.)*	..
Road vehicle stock, 1996	
- 10 000 vehicles	473.6
- % change (1990-1996)	44.8
- private cars per capita *(veh./1 000 inh.)* 1996	9.3

Sources: EIU Country Report and UNECE

Selected environmental data	
	Ukraine
LAND	
Total area *(1 000 km²)*	579.4
Major protected areas *(% of total area)*	3.7
Nitrogenous fertilizer use, 1996 *(tonne/km² arable land)*	..
FOREST	
Forest area *(% of land area)*	15.6
Use of forest resources *(harvest/growth)*	..
Tropical wood imports *(US$/inh.)*	..
THREATENED SPECIES	
Mammals *(% of known species)*	3.8
Birds *(% of known species)*	16.8
Fish *(% of known species)*	17.0
WATER	
Water withdrawal *(% of gross annual availability)*	..
Fish catches *(% of world catches)*	..
Public waste water treatment *(% of population served) 1996*	..
AIR	
Emissions of sulphur oxides, 1996 *(kg/inh.)*	30.0
Emissions of sulphur oxides, 1996 *(kg/US$ 1 000 GDP)*	35.0
Emissions of nitrogen oxides, 1996 *(kg/inh.)*	10.0
Emissions of nitrogen oxides, 1996 *(kg/US$ 1 000 GDP)*	11.7
Emissions of carbon dioxide, 1996 *(tonne/inh.)*	6.0
Emissions of carbon dioxide, 1996 *(tonne/US$ 1 000 GDP)*	7.0
WASTE GENERATED	
Industrial waste* *(kg/US$ 1 000 GDP)*	6 373.6
Municipal waste *(kg/inh.)*	180.0
Nuclear waste *(tonne/Mtoe of TPES)*	..
NOISE	..
Population exposed to leq > 65 dB (A) *(million inh.)*	..

* Excluding mining activity.

Annex II

SELECTED BILATERAL AND MULTILATERAL AGREEMENTS

	Worldwide agreements		Ukraine
	As of 1 July 1999		
1949	(GENEVA) Convention on Road Traffic	**y**	
1957	(BRUSSELS) Int. Conv. Relating to Limitation of Liability of Owners of Sea-going Ships	**y**	
1958	(GENEVA) Conv. Fishing and Conserv. Living Resources of High Seas	**y**	
1969	(BRUSSELS) Intern. Convention on Civil Liability for Oil Pollution Damage	**y**	
	1976 (LONDON) Protocol	**y**	
1969	(BRUSSELS) Conv. Intervention on the High Seas in Case of Oil Pollution Casualties	**y**	**R**
1971	(RAMSAR) Conv. Wetlands of International Importance, especially as waterfowl habitat	**y**	**R**
	1982 (PARIS) Amendment	**y**	
	1987 (REGINA) Amendments	**y**	
1971	(GENEVA) Conv. on Protection against Hazards from Benzene (ILO 136)	**y**	
1971	(BRUSSELS) Conv. Establishment of an International Fund for Compensation of Oil Pollution Damage	**y**	
1972	(PARIS) Conv. Protection of the World Cultural and Natural Heritage	**y**	**R**
1972	(LONDOD) Conv. On the Prevention of Marine Poll. By Dumping of Wastes and Other Matter	**y**	**R**
	1978 Ammendments to Annexes (incineration at see)	**Y**	**R**
	1980 Ammendments to Annexes (list of sustances)	**Y**	**R**
1972	(GENEVA) Conv. Safe Container (CSC)	**Y**	**R**
1973	(WASHINGTON) Conv. International Trade Endangered Species of Wild Fauna and Flora	**y**	**R**
	1983 (GABORONE) Amendment	**y**	
1973	(LONDON) Internat. Conv. for the Prevention of Pollution from Ships (MARPOL)	**y**	**R**
	1978 (LONDON) Protocol (segregated balast)	**y**	**R**
	1978 (LONDON) Annex III on Hazardous Substances	**y**	**R**
	1978 (LONDON) Annex IV on Sewage		**R**
	1978 (LONDON) Annex V on Garbage	**y**	**R**
1974	(GENEVA) Conv. on Prot. against Hazards from Carcinogenic Subst. (ILO 139)	**y**	
1977	(GENEVA) Conv. on Prot. against Hazards from Air Poll., Noise and Vibration (ILO 148)	**y**	
1979	(BONN) Conv. Conservation Migratory Species of Wild Animals	**y**	**R**
	1991(LONDON) Agr. Conservation of Bats in Europe	**y**	**R**
	Agreement on the Consevation of African-Euroasian Migratory Waterbirds (AEWA)	**Y**	**S**
	1992 (NEW YORK) Agreement ASCOBANS	**y**	
1982	(MONTEGO BAY) United Nations Conv. on the Law of the Sea	**y**	**S**

Source: UNECE and Ministry of Environment of Ukraine.
y = in force; **S** = signed; **R** = ratified, acceded, approved

(continued)

	Worldwide agreements		Ukraine
	As of 1 July 1999		
	1994 New York Agreement. Related the Implementation of Part XI of the Convention	**Y**	**R**
	1994 New York Agreem. Implementation of the Provisions the Convention and management of stradding fish stocks and highly migratory fish stock		**S**
1985	(VIENNA) Vienna Conv. for the Protection of the Ozone Layer	**y**	**R**
	1987 (MONTREAL) Montreal Prot. Subst. that Deplete the Ozone Layer	**y**	**R**
	1990 (LONDON) Amendment to Protocol	**y**	**R**
	1992 (COPENHAGEN) Amendment to Protocol	**y**	
1960	(Geneva) Conv. Concerning the Protection of Workers Against Ionizing Radiation	**Y**	**R**
1963	(VIENNA) Conv. Civil Liability for Nuclear Damage	**Y**	**R**
	Protocol on Amendments to the Convention	**Y**	**S**
1963	(Moscow) Treaty banning nuclear Weapons Tests in the Atmosphere, in Outer Space and under Water	**Y**	**R**
1986	(VIENNA) Conv. on Early Notification of Nuclear Accidents	**Y**	**R**
1986	(VIENNA) Conv. on Assistance in the Case of Nuclear Accident or Radiological Emergency	**Y**	**R**
1971	(LONDON, MOSCOW, WASHINGTON) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in Subsoil Thereof	**Y**	**R**
1989	(BASEL) Conv. Control of Transbound. Movts of Hazard. Wastes	**Y**	
1990	(LONDON) Conv. Oil Pollution Preparedness, Response and Cooperation	**Y**	
1992	(RIO) Conv. Biological Diversity	**Y**	**R**
1992	(NEW YORK) United Nations Framework Conv. Climate Change	**Y**	**R**
	1998 KYOTO Protocol to FCCC		**S**
1994	(VIENNA) International Nuclear Safety Convention	**Y**	**R**
1997	(VIENNA) Conv. Management of Radioactive Wastes and spent nuclear fuel		**S**
1997	(VIENNA) Conv. Supplementary Compensation for Nuclear Damage		**S**
1994	(PARIS) Convention to Combat Desertification		

Source: UNECE and Ministry of Environment of Ukraine.
y = in force; **S** = signed; **R** = ratified, acceded, approved

	Regional and subregional agreements		Ukraine
	As of 1 July 1999		
1950	(PARIS) Intern. Conv. for the Protection of Birds	y	
1957	(GENEVA) European Agreement-Intern. Carriage Dangerous Goods by Road (ADR)	y	
1958	(GENEVA) Agreem. Adoption Uniform Cond. of Approval and Recognition for Motor Vehicles Equipment and Parts	y	
1968	(PARIS) European Conv. Protection of Animals during Intern. Transport	y	
	1979 (STRASBOURG) Additional Protocol	y	
1969	(LONDON) European Conv. Protection of Archeological Heritage	y	
1978	(OTTAWA) Convention on Multilateral Cooperation in North-West Atlantic Fisheries	y	
1979	(BERN) Conv. Conservation European Wildlife & Natural Habitats	y	R
1979	(GENEVA) Conv. Long Range Transboundary Air Pollution	y	R
	1984 (GENEVA) Prot. Financing of Co-op Programme (EMEP)	y	R
	1985 (HELSINKI) Prot. Reduction of Sulphur Emissions by 30%	y	R
	1988 (SOFIA) Prot. Control of Emissions of Nitrogen Oxides	y	R
	1991 (GENEVA) Prot. Volatile Organic Compounds	y	S
	1994 (OSLO) Prot. Further Reduction of Sulphur Emissions	y	S
	1998 (Arhus) Protocol on Persistent Organic Pollutants (POP(s))		S
	1998 (Arhus) Protocol on Heavy Metals		S
1992	(Bucharest) Conv. Protection Black Sea Against Pollution	y	R
	1992 (Bucharest) Protocol (combatting pollution by oil and other harmful substances in emergency stuation	Y	R
	1992 (Bucharest) Protocol (protection of the Black Sea marine Environment against pollution from dumping)	Y	
	1992 (Bucharest) Protocol (protection of the Black Sea marine Environment against pollution from land based sources)	Y	R
1991	(ESPOO) Conv. on Env. Impact Ass. in a Transboundary Context	y	R
1992	(HELSINKI) Conv. on the Protection and Use of Transboundary Waters and Intern. Lakes	y	R
1992	(HELSINKI) Conv. Transboundary Effects of Industrial Accidents		
1998	(Arhus) Conv. Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matter		R
1992	(PARIS) Conv. Protection Marine Env. North-East Atlantic		
1993	(LUGANO) Conv. Civil Liability for Damage from Activities Dangerous for the Environment		
1994	(LISBON) Energy Charter Treaty		S
	1994 (LISBON) Prot. on Energy Efficiency and Related Aspects		S

Source: UNECE and Ministry of Environment of Ukraine.

y = in force; S = signed; R = ratified, acceded, approved

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