ECONOMIC COMMISSION FOR EUROPE

ENVIRONMENTAL MONITORING AND REPORTING

Eastern Europe, the Caucasus and Central Asia

UNITED NATIONS
New York and Geneva, 2003

NOTE

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

*

* *

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or areas, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The publication is based, primarily, on reports prepared for the UNECE Working Group on Environmental Monitoring and environmental performance reviews of countries of Eastern Europe, the Caucasus and Central Asia.

It is published with the financial support of the European Community 

UNECE Information Unit
Palais des Nations
CH-1211 Geneva 10
Switzerland

Phone: +41 (0)22 917 44 44
Fax: +41 (0)22 917 05 05
E-mail: info.ece@unece.org
Website: http://www.unece.org

UNITED NATIONS PUBLICATION
Sales No. E.03-II-E.33
ISBN 92-1-116848-1

Preface

The "Environment for Europe" process, under the aegis of the United Nations Economic Commission for Europe countries of Eastern Europe, the Caucasus and Central Asia, has worked since 1991 to strengthen international cooperation to protect and improve the environment across Europe.

At the fourth "Environment for Europe" Conference, in Aarhus, Denmark, in 1998, Environment Ministers recognized that mechanisms for coordinated monitoring, data collection, processing and management in the pan-European region were often inadequate. The difficulties were particularly acute in countries in transition, including the countries of Eastern Europe, the Caucasus and Central Asia. For the Ministers improving these mechanisms and state-of-the-environment information were top priorities.

To meet this goal, the UNECE Committee on Environmental Policy set up an Ad Hoc Working Group on Environment Monitoring in September 2000. The Working Group was charged with providing recommendations, proposing action plans and strengthening international initiatives within the UNECE region in environmental monitoring and related fields. It supported the preparation of the third pan-European environmental assessment report (*Kiev Assessment*) by the European Environment Agency and discussed problems and prospects of environmental monitoring and state-of-the-environment reporting in individual countries of Eastern Europe, the Caucasus and Central Asia.

This publication provides an overview of the challenges faced by national environmental monitoring and reporting systems in Eastern Europe, the Caucasus and Central Asia. It presents recommendations and guidance to these countries on how to improve the situation. The publication is aimed at officials and experts working for environmental authorities in countries of Eastern Europe, the Caucasus and Central Asia and other countries, environmental citizens' organizations and researchers. It is my sincere hope that it will prove very valuable to them.

Brigita Schmögnerova
Executive Secretary

TABLE OF CONTENTS

Page

List of figures

List of tables

List of boxes

Abbreviations

AMAP	Arctic Monitoring Assessment Programme
CLRTAP	Convention on Long-range Transboundary Air Pollution
EEA	European Environment Agency
EIONET	European Environment Information and Observation Network
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EU	European Union
IUCN	World Conservation Union
MEA	Multilateral environmental agreement
MSC	Meteorological Synthesizing Centre
NEAP	National environmental action plan (or programme)
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
POPs	Persistent organic pollutants
PRTR	Pollutant release and transfer register
SoE	State of the environment
UNCSD	United Nations Commission on Sustainable Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNSD	United Nations Statistical Division

Country groups

East European, Caucasian and Central Asian (EECCA) subregion: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The name of this group of countries and its abbreviation is for the purposes of this document only and does not constitute an internationally recognized term based on either geographical or socio-economic criteria.

Caucasus: Armenia, Azerbaijan and Georgia.

Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

Executive Summary

Environmental monitoring is a tool to assess environmental conditions and trends, support policy development and its implementation, and develop information for reporting to national policy makers, international forums and the public.

Over the past decade, a few countries of Eastern Europe, the Caucasus and Central Asia (EECCA) have been largely able to maintain existing monitoring activities. These countries have sought to improve coordination among the many ministries and agencies involved in monitoring. Significant work remains, however, including the replacement of ageing equipment for sampling and measurement, and the further development of unified national networks.

In many other EECCA countries, environmental monitoring has been reduced to a minimum in the face of severe economic conditions. In some areas, monitoring has essentially collapsed. Several of these countries have prepared programmes to rebuild and modernize their monitoring systems, but these await funding.

Specific monitoring activities need attention across the EECCA subregion. The monitoring of urban air pollution, an important human health risk, is poor in many cities. Solid and hazardous waste monitoring is weak. Industrial emissions are not well monitored, reducing the effectiveness of policy instruments such as emissions charges and fines. Monitoring of transboundary issues such as air pollution needs strengthening. Moreover, many countries lack uniform national methodologies across different monitoring areas, and their classification systems are often incompatible with international standards.

Environmental reporting encompasses the various "outputs" of monitoring and information systems. This is a key area that requires attention in EECCA countries. Better information is needed to support national policy. Environmental statistics submitted for international databases are in cases late or incomplete. And public access to environmental information, including data and information based on monitoring, is often limited.

About half the EECCA countries produce and publish regular, national state-of-the-environment (SoE) reports. Only a few reports, however, provide extensive time series, discuss emerging trends and provide conclusions that can be used by policy makers.

Indicators are key tools for SoE reporting, for policy evaluation and for public information. The development and use of environmental indicators are important areas for attention in EECCA. Harmonization with international indicator approaches has to be strengthened. International indicator sets – such as the indicators used for the *Kiev Assessment* – can provide an important reference point for this work.

At the "Environment for Europe" Conference held in Kiev on 21-23 May 2003, the Ministers endorsed the Recommendations for strengthening environmental monitoring and information systems in EECCA countries, prepared by the UNECE Working Group on Environmental Monitoring. The Ministers also endorsed the UNECE Guidelines for the preparation of national SoE reports. These documents provide a road map for strengthening monitoring and reporting in the EECCA subregion.

INTRODUCTION

Environmental monitoring is generally defined as gathering, assessing and reporting environmental information obtained through continuous or periodic sampling, observation and analysis of both natural variation or changes and anthropogenic pressures and their effects on humans and the environment. Today the difference between environmental monitoring and the production of other types of environmental information is less distinct than it once was.

A. Environmental monitoring systems: key elements

Environmental monitoring systems are crucial for environmental policy: they are the "eyes and ears" for policy makers, researchers, and the public seeking to understand and improve the environment. National environmental policies, institutions and funding mechanisms provide the context for monitoring systems. National policies can also specify goals for their development. Moreover, providing information to support national policies is a key objective of monitoring systems.

The framework for monitoring systems themselves includes: legislation and regulations establishing monitoring goals and requirements including technical monitoring standards; institutions mandated to carry out monitoring and information activities; the mechanisms of cooperation and coordination among these institutions; national information strategies; and, funding mechanisms.

Environmental monitoring covers various areas. Some of these – for example, ambient air quality, air pollution emissions, water resources and quality – are indispensable for nearly all countries. The importance of other areas – such as those related to specific natural resources, for example forestry and fisheries – can depend on the geographic context.

Monitoring starts with data collection – observations and measurements – and it depends on sampling equipment, monitoring stations, laboratories, and skilled personnel. Monitoring work follows specific methodologies, protocols and classifications. These are in turn influenced by information systems, including reporting approaches and indicators used. Harmonizing data availability, parameters and quality is important, both at national and international levels, so that, for example, national decision makers can compare conditions in different parts of the country, and international forums can review information (such as water quality or air emissions indicators) across countries.

In addition to direct in situ measurements, aerial and satellite remote sensing promises to be of growing value. Non-governmental organizations (NGOs) and volunteers may contribute to data collection, in particular for themes such as species inventories. Modelling can substitute where data collection is difficult and less cost-effective.

To ensure that monitoring systems keep pace with the demand for information and developments in environmental policies and strategies, it is important to regularly review their organisation and outputs to detect possible gaps, weaknesses or imbalances.

Environmental information systems analyse and synthesize monitoring data, developing "information" for reporting to end-users, such as policy makers and the public. Effective information flows are needed to transmit and share data between polluters and environmental authorities, among monitoring agencies and between local, subnational and national levels of government. Raw data need to be transmitted, stored, processed, interpreted and analysed: computer networks, databases and software are vital tools. The integration of environmental, economic, health and other data is important for policy objectives, including sustainable development goals.

Chapter I of this report discusses environmental monitoring systems in EECCA countries over the past decade, as well as common gaps and key recommendations for progress.

B. Environmental reporting

Environmental reporting, through tools such as state-of-the-environment (SoE) reports, communicates data and information from monitoring systems to end users such as policy makers and the public.

Reporting typically has four closely linked objectives:

- *Assessing environmental conditions and trends.* This is necessary for all subsequent objectives. Conditions and trends change over time, and assessment is a continuous task. Scientific understanding of natural cycles and human interaction with the environment also continues to evolve: assessment requires a dialogue with scientific research, in particular for emerging issues;
- *Supporting environmental policy*. Environmental data and information are vital throughout the policy cycle;
- *Reporting to international forums.* As Parties to various multilateral environmental agreements (MEAs), EECCA countries have undertaken obligations that can include data reporting on relevant environmental trends. In addition, several international organizations request their member countries to provide environmental data regularly;
- *Providing information to the public.* The public's right to environmental information is affirmed in national laws and principle 10 of the Rio Declaration on Environment and Development. Moreover, public awareness of and concern for the environment can be a key force promoting environmental protection.

Chapter II discusses environmental reporting, in particular SoE reporting, a key mechanism for providing information on environmental conditions, trends and policy progress to officials and the public. The chapter also reviews indicators, which are an essential tool for environmental reporting.

Chapter III presents overall conclusions derived from the analysis of the current situation within EECCA. Annexes provide guidance to EECCA countries in improving their environmental monitoring and reporting systems.

Chapter I

ENVIRONMENTAL MONITORING SYSTEMS

Under the former Soviet Union, research institutes, hydrometeorological services, public health agencies and other bodies collected large volumes of data related to environmental conditions and trends. Often, however, agencies did not share their data. Moreover, data quality varied, and data series were often not directly compatible (covering, for example, different sampling areas, time series, etc.). The data collected contributed to environmental research and to overview reports on environmental conditions. Nonetheless, difficulties in compiling and comparing data limited a systematic evaluation of the state of the environment. Moreover, little work was done to analyse, integrate and synthesize data for policy development and environmental information was rarely released to the public. (UNECE, 2000d)

A. Monitoring activities

As part of their efforts to establish and strengthen national environmental policy and management, the countries of Eastern Europe, the Caucasus and Central Asia have sought to improve their environmental monitoring systems over the past decade. However, difficult economic conditions, together with other factors (including political instability and conflict), have hampered reform and investment across the EECCA subregion (see fig. I). The subregion has returned to economic growth since the mid-1990s (the solid line presents an average across all EECCA countries). Nonetheless, economic conditions in many countries remain well below levels of a decade ago. For the three Caucasus countries, GDP trends have been worse than the EECCA average. In contrast, the Central Asian countries, many of which have extensive oil and other natural resources, have on average done better.

Economic problems have created severe difficulties for government budgets and public services, including environmental monitoring systems.

The situation concerning environmental monitoring systems varies substantially across EECCA countries. Nonetheless, two main groups can be identified. The first group of countries has maintained the scope of monitoring activities over the past 10 years, or seen only limited decreases. These countries have launched institutional reforms and introduced new programmes for specific geographic areas and environmental issues. Ukraine provides one example (see box 1). Belarus and the Russian Federation are also in this category.

Figure I. GDP trends in EECCA (1990 = 100)

Source: UNECE

Box 1. Environmental monitoring in Ukraine

In Ukraine, environmental monitoring systems have continued to operate over the past decade. Networks of monitoring stations have remained fairly stable with, for example, about 150 fixed ambient air monitoring stations in about 50 cities. Wastewater monitoring stations have increased slightly, from almost 850 in 1991 to over 1,100 in 2001. Across monitoring networks, however, equipment is ageing and needs replacement.

For biodiversity, although Ukraine has greatly increased its protected areas over the past 10 years, the monitoring of species and ecosystems has been reduced to a minimum.

Ukraine's Government has strengthened the legal basis for and the overall coordination of monitoring work, and current programmes seek to improve environmental monitoring (see box 3).

Sources: Ukraine, 2002; UNECE, 1999.

The second group includes countries, in particular in the Caucasus as well as in Central Asia, that have faced severe economic conditions and in some cases political uncertainty and conflict. As a result, these countries have had difficulty maintaining existing monitoring systems: the number of monitoring stations, the volume of data collected and the range of environmental media covered have declined drastically. Georgia provides an example of this group of countries (see box 2).

Box 2. Environmental monitoring in Georgia

Georgia's difficult economic situation brought severe cutbacks in funding for environmental monitoring. Over the past decade, monitoring stations and equipment have deteriorated and many have become unusable. In general, budget allocations cover only salary costs and minimum services at monitoring institutions, leaving little money for essential maintenance or new equipment.

The Ministry of Environment's 12 subnational departments oversee the self-monitoring by companies: this is based mainly on energy and mass balance calculations with little actual emission measurements, as equipment is either obsolete or non-existent. Similar resource problems affect State agencies involved in direct monitoring, such as the State Department of Hydrometeorology (Hydromet), which is responsible for collecting, storing and analysing data on surface water quality, air quality and soil. Hydromet currently monitors ambient air pollution in only four cities, tracking but five pollutants. At the State Department of Geology, responsible for mineral resources, only 30 of its 500 stations to monitor groundwater levels are operating. Moreover, there has been little work to update operating methods, guidelines and protocols over the past 10 years. Quality control for monitoring data is uncertain. Overall, Georgia at present does not have systematic environmental monitoring.

Georgia's Ministry of Environment, in cooperation with other agencies, has drafted a strategy to strengthen environmental monitoring to be implemented in stages through 2010 – however, funding for this initiative remains uncertain.

Sources: UNECE, 2003a; Georgia, 2002.

Policy context

All EECCA countries have developed new environmental policies over the past decade, including environmental strategies and NEAPs. They have also established new environmental laws, typically starting with framework laws. In this process of reform, governments and environmental authorities have sought to improve the policy relevance of their monitoring systems.

The linkage between policy and monitoring priorities remains an important area for work across the EECCA subregion. Existing environmental monitoring systems do not meet all policy needs. In some countries, a contrast remains between the large volume of data produced on certain topics and the difficulty in using these data to support decision-making (UNECE, 2000d). In many EECCA countries, however, the decline in monitoring work means that data are incomplete or simply not available in key environmental policy areas.

Institutions

The new national framework laws in EECCA countries typically refer to environmental monitoring, as well as to public access to environmental information. In addition, many countries have developed specific legislation and regulations that define monitoring responsibilities and tasks among public authorities. For example, table 1 lists the various agencies involved in monitoring in Belarus. Subnational and local offices, as well as research institutions, are often involved.

A few countries have sought to consolidate the agencies involved. For example, in a few countries, hydrometeorological agencies, which are commonly responsible for a broad range of monitoring, such as ambient air quality, have been placed under ministries responsible for environmental protection.

Table 1. Agencies involved in environmental monitoring in Belarus

Health, including environmental health	Ministry of Health, National Health and Epidemiology Centre, Belarus Hygiene and Epidemiology Research Centre, Belarus Health and Hygiene Research Institute
Air, surface water, radiation, agriculture-related soil contamination	Radiation Control and Environment Monitoring Centre of the Ministry of Natural Resources and Environmental Protection (Minprirody)
Groundwater	Belarus Geological Survey Research Institute of Minprirody
Land/soil	State Committee on Land Resources, Geodesy and Mapping, the Soil Science and Agro-chemistry Institute (a State-owned research establishment), Belarus State University
General atmospheric ozone content	National Ozone Monitoring Centre at the Belarus State University
Earthquakes/seismic activity	Belarus Academy of Sciences Institute of Geological Science
Environment – Complex	Belarus Ekologia research centre of Minprirody
Flora	Belgosles State forestry association, Bellesinvest unified enterprise, Belarus Academy of Sciences Institute of Experimental Botany, Belarus State University
Fauna	Belarus Academy of Sciences Institute of Zoology, Minprirody
Emergencies	Ministry of Emergency Situations, Radiation Control and Environmental Monitoring Centre
Local environmental monitoring	Ministry of Natural Resources and Environmental Protection

Source: Belarus, 2002.

Given the broad array of agencies involved, however, most EECCA countries have instead focused efforts on improving coordination and cooperation among these bodies and establishing a unified environmental monitoring system. In Belarus, the Government approved the National Environmental Monitoring System Programme in 1995, assigning the Ministry of Natural Resources and Environmental Protection to implement it. An interdepartmental supervisory board oversees reforms. The Russian Federation created the Unified State System on Monitoring in 1993. The 2000 Government Decree on the National Monitoring Service further strengthened coordination: the Federal Hydrometeorology and Environmental Monitoring Service (Roshydromet) and the Ministry of Natural Resources have the main responsibility for environmental monitoring, assisted by other agencies. Ukraine established the Interdepartmental Commission on Environmental Monitoring Issues in 2001 (see box 3). These national coordinating bodies and unified systems have worked to establish common standards and procedures for monitoring activities and ensure data exchange.

In a few other EECCA countries, however, national monitoring responsibilities remain loosely defined, resulting in a duplication of effort and a lack of coordination and cooperation among agencies. In one country, data exchange between public authorities is based on payments.

Coordination between central agencies and subnational and local offices is also a major challenge. Subnational and local monitoring needs to respond to specific conditions, policy priorities and institutional arrangement. In the Russian Federation, the Federal Environmental Protection Act gives the local entities some jurisdiction over monitoring. The National Monitoring Service is negotiating cooperative agreements with these entities to devise programmes that provide the necessary data for both national and subnational purposes. More than 70 such agreements had been concluded by mid-2002. (Roshydromet, 2002). Ukraine is also seeking to improve coordination across levels of government (see box 3).

Box 3. Ukraine: improving institutional coordination

While the Ministry of Environment and Natural Resources has a key role in monitoring, in particular through its Hydrometeorological Service, a series of other ministries and State committees are also involved.

In 1998, Ukraine's Council of Ministers established the State Environmental Monitoring System to integrate the different monitoring networks at these entities, improve the compatibility of equipment, data and software and provide timely, accurate data to end-users. In 2001, the Council passed a series of amendments, creating an ad hoc Interdepartmental Commission to strengthen coordination. The amendments also call for the development of common monitoring standards and indicators. The Commission itself created several sections for air, water, land and waste monitoring, as well as an expert board.

The System also intends to integrate subnational environmental monitoring programmes: monitoring of pollution emissions is organized at the sub-national level. In specific areas, such as Zaporozhye *oblast* (in the highly polluted Donetsk-Dnieper area), a regional monitoring system and observation network was created to bring together all active monitoring entities. Similar programmes are under way or planned for other *oblast* networks, though funding difficulties slow their implementation. Coordination within the national system, however, is an important challenge.

A recent strategy proposes short- (2002 and 2003), medium- and longer-term actions to strengthen the System. Key actions include: further coordinating and unifying the different elements of the System; improving harmonization with European approaches in areas such as indicators; setting priorities for data collection; and improving data quality.

Sources: Ukraine, 2002; UNECE, 1999.

Despite these goals and actions, coordination among the organizations involved in environmental monitoring remains poor overall across many EECCA countries (EEA, 2003).

Funding

Financing remains a significant obstacle to improving monitoring systems across EECCA countries.

As noted, a few EECCA countries have been able to maintain the basic outlines of their monitoring systems and start reforms. In some cases, in particular in Belarus and the Russian Federation, off-budget environmental funds have at times played a vital role by financing environmental monitoring in the face of budget cuts. However, even in these countries, monitoring equipment is ageing and needs replacement. Modern computer systems are needed to collect, analyse and share data (see chap. II). In addition, environmental authorities have difficulty hiring and retaining monitoring experts.

In other EECCA countries, funding problems are much more acute, and routine monitoring activities have been sharply reduced or discontinued altogether. Many industrial facilities also lack the financial resources to maintain the equipment that measures their pollution. The reliability and accuracy of available ambient data are highly uncertain for some areas. Thus, it is impossible to fully evaluate the environmental situation in these countries (UNECE, 2000d).

International assistance programmes have provided some support for new equipment and ongoing monitoring work. International assistance has also supported monitoring programmes, for transboundary ecosystems such as the Caspian and Aral Seas. For example, the European Union (EU) TACIS Programme has financed water pollution accident and emergency warning stations in the Republic of Moldova and Ukraine for the Danube River Basin Programme.

Specific monitoring activities

The reporting process for the third pan-European environmental assessment report (*Kiev Assessment*) identified important gaps across specific monitoring areas. The biggest gaps in data availability across the EECCA subregion are related to urban air pollution, soil contamination, soil remediation, waste management systems including hazardous waste, water quality, waste-water treatment and discharge to water and hazardous substances. In contrast, coverage was relatively good for soil erosion, land cover, and water quantity and use (EEA, 2003).

Monitoring coverage and data availability for Urban air quality are poor in some countries. This is a concern in particular as air pollution in relation to human health is a serious problem in EECCA cities (box 4 provides an overview of air pollution monitoring in Central Asia). Other areas of air monitoring, in particular for transboundary pollution, described in the following section, need to be strengthened across the region.

Box 4. Urban air pollution monitoring in Central Asia

Environmental monitoring systems across Central Asian countries have declined severely over the past decade, owing in particular to insufficient funding. The situation varies significantly, however. The problems are the most obvious in Tajikistan, where the number of fixed ambient air pollution stations declined from 21 to 3. In Kyrgyzstan, only a dozen stations continue to operate in four cities.

Other Central Asian countries have been able to maintain more elements of their air-monitoring network. In Uzbekistan, for example, 69 stations operate in 25 cities. However, some key stations in these countries have been closed: Tursunzad, in Turkmenistan, for example, has lost three stations that track air pollution from the nearby Tajik Aluminium Plant. In addition, sampling has been reduced at many monitoring stations that continue to operate.

Source: Regional Environmental Centre for Central Asia (RECCA, 2002).

For soil and land use, monitoring related to *soil contamination* is another important gap. Although more data on the number of contaminated sites have gradually become available, their analysis is hampered by a lack of comparability and information on progress in and costs of remediation. In contrast, information on the extension of the area affected by *soil erosion*, especially the area of agricultural land affected by erosion, is available (most countries have data for the past 10 years). However, not all countries have data on the amount of soil lost by erosion; moreover, units measured are not homogenous, making comparisons difficult. The most complete data set concerns *land use* with time series covering the past 10 years.

Although data on the generation and management of *solid waste* – both total levels and for key categories – are generally accessible, data quality is not good enough for analysis in all countries. In several countries, *hazardous waste* data are also unreliable because of inaccurate inventories and different classification systems. Quantitative and qualitative data on the generation, use, disposal and environmental effects of *industrial waste* are not reliable in a number of countries (UNECE, 2000d). Industrial waste and chemicals monitoring in Armenia is described in box 5.

Box 5. Chemicals and industrial waste monitoring in Armenia

Since 1988, a severe earthquake, economic difficulties in the transition and war have all significantly reduced industrial production as well as the monitoring of industrial waste and hazardous chemicals. Industrial production started to recover in the late 1990s. While industrial waste statistics are collected from enterprises, overall these are not very reliable. Armenia does not have an inventory of contaminated sites and land, although land contamination is reportedly a widespread problem at heavy industries. Before 1990, about 5000 different chemicals were produced, exported, imported or used in Armenia. Today, however, there is no systematic information on hazardous chemicals stored at active and closed plants and other locations. New laws and programmes have been prepared to improve waste and chemicals management, including monitoring.

Source: UNECE, 2002a.

An overview of waste monitoring in three Central Asian countries is presented in box 6.

There is a general lack of environmental monitoring and comparable data and information on the *water quality* in EECCA (across rivers, lakes, groundwater and coastal waters). National surface-water monitoring systems are not coherent, as neither the data reporting systems nor the methodologies are harmonized. One issue affecting many countries is that tasks and mandates of various ministries and agencies involved in monitoring water quality and quantity are not well defined, leading to overlapping efforts and lack of coordination. In Ukraine, seven national bodies – ministries and State committees – had a role in different aspects of water monitoring in the late 1990s (UNECE, 1999). In Uzbekistan eight major agencies are involved, together with an extensive network of their subordinate departments and other local entities (RECCA, 2002). The lack of coordination can reduce the effectiveness of environmental policy instruments, contributing to low collection rates for water use and water pollution charges and penalties.

In most EECCA countries, monitoring systems for *biodiversity* are cumbersome and expensive to manage (UNECE, 2000d). This is a problem also for shared ecosystems, such as marine and coastal areas of the Caspian Sea (UNECE, 2000b). In some cases, biodiversity monitoring has largely ceased, for financial reasons. This is the case in Uzbekistan, whose wetlands are of global and regional importance (UNECE, 2001), and in Armenia, whose Red Data Books are based on data from the 1970s and early 1980s (UNECE, 2002a).

Box 6. Waste monitoring in Central Asia

The Kazakh National Statistics Agency has considerably improved its reporting system for industrial waste generation, including hazardous waste, over the past 10 years. In contrast, data on municipal waste generation are poor and in some cases unreliable. Kazakhstan does not have an inventory of contaminated sites. Data on hazardous wastes stored at industrial areas are also incomplete.

In Kyrgyzstan, the National Statistics Committee has collected data on hazardous industrial waste from enterprises via questionnaires since 1994. However, the accuracy of responses is not verified. Mining industry, in particular for uranium, has been a major sector in Kyrgyzstan – one specific concern is the need to improve monitoring of mine tailings for soil and water contamination and other threats. Unmonitored mine tailings are a potential concern in other Central Asian countries as well.

In Uzbekistan, data on solid waste generation and disposal are fragmentary and conflicting. Among the areas that require attention is hazardous medical waste, a potential health risk. Its transport and disposal are not tracked.

Source: UNECE, 2000b, 2000c and 2001.

Beyond specific environmental issues, the environmental impacts of *major economic sectors* such as transport, energy and agriculture are poorly monitored. In many countries, emission data on polluting enterprises are lacking, and environmental performance reporting (including data on environmental expenditures) by companies is only just starting. Moreover, the emission data available in some EECCA countries give only a rough idea of the role of transport in air pollution (often, the share of pollutants such as carbon monoxide and lead emissions that originate from transport is not estimated). (UNECE, 2000d)

Sampling and measurement of *industrial emissions* are often uncertain, even in countries that have largely maintained their monitoring systems (box 7 describes the situation in Ukraine). In countries facing severe funding problems, this monitoring has been significantly curtailed. In Kyrgyzstan, for example, only two of the Ministry of Environmental Protection's six regional offices regularly carry out emissions sampling (UNECE, 2002c). Self-monitoring by industry poses a problem of information reliability on several levels, including the often poor condition of measuring equipment used. In Uzbekistan, highly polluting facilities, such as oil and gas processing plants and coal-fired power plants, lack efficient monitoring equipment (UNECE, 2001). Weak monitoring of compliance with permits discourages their strict application by industry in many cases.

Box 7. Monitoring industrial air pollution in Ukraine

In the late 1990s, Ukraine had over 2,500 inspectors who checked emissions at major polluting facilities. Random inspections were also made. Samples were analysed at 49 inspectorate laboratories across the country. Overall, however, equipment was ageing and the inspectorate was not able to ensure regular and complete control of major polluters. Moreover, most industries had little capital investment: factories typically were poorly equipped with pollution measuring devices. Samples were taken only occasionally – there was no equipment for continuous emissions measurement. These were important concerns, as factory pollution control equipment had been ageing and emissions in some cases rising. Air emissions were and continue to be calculated based largely on production processes, energy consumption and mass balances.

Source: UNECE, 1999.

One issue across different monitoring activities is that EECCA countries often lack national guidelines that ensure uniform sampling, measurement and analytical work. Moreover, in many countries there is no system in place for accrediting laboratories that analyse samples (UNECE, 2000d).

Case study: monitoring transboundary air pollution

Eight EECCA countries are Parties to the Convention on Long-range Transboundary Air Pollution (CLRTAP). Among these, the Russian Federation also participates in the Arctic Monitoring Assessment Programme (AMAP) and the Helsinki Commission for the Convention on the Protection of the Marine Environment of the Baltic Sea Area. These and other international conventions and programmes call on member countries to submit information on transboundary air pollution. Currently, however, limited measurement data make it impossible to develop an overall pattern of pollution in EECCA. (This section is based on Meteorological Synthesizing Centre - East, 2002.)

Some countries provide only partial data on emissions levels. For example, in its reporting for the CLRTAP, Armenia does not estimate lead emissions from road transport, although for the majority of countries this is the main source. Other countries (including Belarus and Ukraine) assess only ammonia emissions from industrial sources, while the main input of ammonia is typically from agriculture.

The EECCA subregion has few air pollution monitoring stations that contribute data to transboundary air pollution programmes, such as the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) under CLRTAP. For example, the Russian Federation provides measurement data on nitrogen and sulphur compounds to EMEP. Figure II shows that there are few monitoring stations, and these are located mainly in the northwest of the Russian Federation.

The primary network of long-range atmospheric transport monitoring stations, particularly for persistent organic pollutants (POPs), was developed during earlier AMAP activities. Recently this network has been expanded to fill gaps in geographical coverage. A POPs monitoring station was established in 2000 in Amderma, in the Russian Arctic, within the framework of a joint Russian/Canadian AMAP project.

Along with monitoring data, mathematical modelling provides information about pollution levels from national and external sources, long-term trends, seasonal variations, contributions of different source categories, and exceedance over critical loads. The EMEP Meteorological Synthesizing Centre – East (MSC-E) in Moscow performs calculations of heavy metal and POP transport and deposition in Europe and provisional model runs for the northern hemisphere, providing estimates for Central Asia.

Figure II. Map of East European monitoring stations involved in EMEP, HELCOM and AMAP

Ukraine provides an example of the availability of environmental information and the use of modelling techniques. At present, Ukraine submits only emission totals for the pollutants required under EMEP. Spatial distribution of emissions for the evaluation of transboundary transport has been estimated by MSC-E. Modelling is used to calculate the spatial distribution of environmental pollution: figures III to VI show emissions levels, emission trends and related modelling results for lead.

The results show that the bulk of the pollution emitted in Ukraine (55%) is deposited within its borders. Figure V shows that the main countries-receptors of lead deposition from Ukrainian sources are the Russian Federation (19%), Romania (4%) and Belarus (3%). Some 7% of lead is deposited in the Black Sea. In its turn, Ukraine is polluted by emissions from the Russian Federation, Romania, Poland and other countries (fig. VI).

Figure III. Spatial distribution of lead emissions for Ukraine for 1999, 50X50 km^2, kg/km^2/year

Figure IV. Trend in lead emissions for Ukraine to other countries (Expert estimates), tons/year

Figure V. Lead depositions from national sources in Ukraine in 1999

Figure VI. Lead depositions to Ukraine from external sources in 1999

Figure VII shows calculated trends in lead depositions from European countries to Ukraine, from 1990 to 1998.

A similar situation exists in most EECCA countries in terms of the availability of emission and measurement data. Modelling could therefore be an important source of information on the state of the environment.

Overall, EECCA countries need to develop their transboundary air monitoring networks. Given the high cost, however, an integrated approach strengthening both monitoring networks and modelling techniques to evaluate pollution levels appears appropriate. In addition, EECCA countries should consider further accession to international agreements, conventions and protocols: among the benefits, international cooperation under these instruments can help improve air pollution monitoring through technical assistance and training as well as the harmonization of methods.

Figure VII. Trend in total (wet and dry) deposition densities of lead to Ukraine, kg/km^2/year

Recommendations to strengthen environmental monitoring

While monitoring systems vary among EECCA countries, a series of common gaps and constraints are apparent across the subregion (see box 8).

The UNECE Working Group on Environmental Monitoring has provided a forum to address common problems, integrate monitoring systems more closely into international networks, and strengthen cooperation both among EECCA countries and across the pan-European region. At its special session in February 2003, the UNECE Committee on Environmental Policy approved a set of recommendations, prepared by the Working Group, on strengthening national environmental monitoring and information systems in EECCA countries. This section summarizes these recommendations, which were endorsed by Environment Ministers at the Kiev Conference in May 2003 (the full text is available in annex I).

Policy context

The recommendations call for a continuous dialogue between policy makers and those who design and implement monitoring systems. Priorities for environmental monitoring should be identified. Moreover, environmental monitoring systems should be periodically reviewed to strengthen their operation, prioritize new information needs and evaluate costs.

Institutional framework

National legislation should regulate data management and identify or establish a lead agency for core monitoring activities. At the same time, a workable structure should facilitate inter-ministerial cooperation and coordination. Specialized institutions and subnational and local bodies should have authority for relevant monitoring and information activities, as well as necessary advice and support. Common data analysis protocols should be developed to facilitate cooperation between agencies.

Funding

Countries in the EECCA subregion need to provide continuous public funding for core monitoring activities. A mix of funding sources and mechanisms is desirable to ensure the necessary investment in the basic monitoring infrastructure; this mix may include external assistance where necessary. Major polluters should regularly monitor their emissions and waste flows and should also support the cost of environmental monitoring at the local level, to the extent possible.

Box 8. Environmental monitoring in EECCA: common gaps

- Monitoring systems need to be linked more closely to the policy context.
- Greater coordination is needed among national institutions responsible for different areas of monitoring, and often between institutions at different levels of government.
- Funding mechanisms need to be strengthened.
- Essential sampling and laboratory equipment is often old and needs maintenance or replacement to ensure data quality. Data-processing networks also need to be modernized.
- There are several difficulties in monitoring, in particular in monitoring urban air quality, soil contamination and remediation, solid and hazardous waste management, water quality and hazardous substances.

Sources: UNECE, 2000d; EEA, 2003.

Specific monitoring activities

Countries should harmonize their definitions, classifications and monitoring protocols with international standards. Where the original monitoring networks are significantly degraded, countries should focus their restoration initially on a limited number of major pollutants and major polluting sources. At the same time, they need to ensure continuity in the monitoring of "traditional" parameters to be able to track long-term environmental trends.

The recommendations also call for stronger monitoring across a series of themes, including biodiversity, air pollution and waste management.

International cooperation

The Working Group has provided a forum for cooperation on these issues across the UNECE region and in particular in EECCA. The Working Group plans to continue its efforts, focusing on three monitoring areas where common difficulties were identified: inland surface water monitoring; air pollution monitoring; and waste classifications and inventories.

B. Information systems: using computer-based technologies

Information systems provide the link between monitoring data and reporting that can be understood and used by end-users (chap. II in turn focuses on reporting). Information systems cover a wide variety of functions: from transmitting, compiling and storing monitoring data, to their analysis and synthesis, to reporting formats for end-users.

This section focuses on the use of computer-based technologies, including the Internet, in environmental information systems. These technologies can link the various elements of the "pyramid" into a network and provide reporting approaches for different types and levels of uses. Computer-based technologies are an area for development in EECCA countries, and also a focus of attention for the UNECE Working Group.

Databases and information exchange in EECCA countries

Most EECCA countries lack advanced computer systems to collect, store, analyse and work with monitoring data. Moreover, databases at different national agencies, and those at different levels of government, are rarely connected and often use different formats for data storage. In a few countries, some monitoring data are still provided in writing. Overall, the exchange of data is often difficult, owing to both technical and institutional constraints, hindering reporting and information efforts.

Central Asian countries, for example, lack unified databases for environmental information: databases are scattered among different ministries and organizations, including international ones. Moreover, many government ministries and departments are involved: they do not always share the statistics they produce, nor do they make them easily available to the public. In Kyrgyzstan, the Hydrometeorological Institute monitors air quality – however, its monitoring results are not regularly transmitted to the Ministry of Emergency Situations and Environmental Protection. Access to databases in Central Asia is at times difficult. In Uzbekistan, data and information are often in closed archives and sometimes on paper rather than

in electronic form. Moreover, databases often contain contradictory data (RECCA, 2002).

Across EECCA, countries are planning and introducing new information technologies for creating digital environmental databases, inventories of natural resources and ecosystem maps. Box 9 describes the national goals in Belarus. In Georgia, the Ministry of Environment intends to build a system for the collection, compilation, processing and storage of data on environmental pollution, and a suitable geographic information system. In Ukraine, an important objective for the State Environmental Monitoring System is the use of Internet technology to submit and process data, and also to provide wide public access.

Strengthening networks

In 2001, the Working Group on Environmental Monitoring established a Task Force to develop recommendations for practical tools, using modern information technologies, to improve the use and exchange of environmental information within EECCA, and to harmonize their approaches with those of European networks. The Task Force reviewed the current state of environmental databases and computer technology used in EECCA.

Throughout this work, the Task Force has focused on harmonizing EECCA information networks with EIONET, the EEA information network (see box 10). The Task Force supported the development of a prototype web site for presenting environmental information using EIONET formats. The prototype covers information on air quality in EECCA countries, and has been tested using data from the Russian Federation (from the report on "The State of atmospheric air contamination in the cities of the Russian Federation in 2000") and Kyrgyzstan (from the national state-of-the-environment report for 2000). In addition, a prototype meta-database, using EIONET software, was developed.

Harmonization with EIONET would help EECCA environmental information networks move towards higher standards. However, significant efforts will be needed. Further work is required to understand the needs of EECCA environmental authorities in terms of access to environmental information in electronic form. New equipment and software, as well as major changes in the management and communication of data, will be needed. Concerted approaches and facilities will have to be developed across EECCA for receiving, preparing and disseminating environmental information on the basis of the EIONET approaches and technology. Moreover, government authorities will need to build capacity in using electronic facilities for receiving environmental information of interest to them.

Technical assistance will also be needed to help integrate EECCA environmental monitoring information systems into EIONET. Initial steps are under way to develop national web sites on sources of environmental information. Collaboration with EEA and integration with EIONET technology will continue to be important.

Box 9. Belarus: unifying databases and analysis centres

In Belarus, establishing a unified information system is a key goal for the national environmental monitoring system, as various government bodies hold databases related to the environment, without an overall system of organization. Developing common standards for data storage and analysis, including the development of common indicators, is an important related goal. Moreover, computer technology needs to be installed or upgraded. The Government intends to build a unified information network step by step. To begin with, analysis centres for different monitoring areas should be integrated into the Main Information Analysis Centre. In addition, dedicated operating software is needed for the overall network.

Source: Belarus, 2002.

Box 10. EIONET

EIONET is a collaborative network of the European Environment Agency and its 31 member countries (the 15 current EU members, the 10 accession countries, Iceland, Switzerland, Turkey and other European countries). EIONET is both a network of organizations and the electronic network (e-EIONET) linking these together.

The network of organizations is comprised of four main types of institutions:

- National focal points, the offices responsible for national coordination of activities related to the EEA work programme;
- Main component elements, key institutions of national networks that regularly collect and supply environmental data;
- National reference centres, which are nominated to cooperate with EEA on specific topics; and
- European topic centres, consortiums (each with one leading institution) that undertake specific tasks in the EEA work programme (topics include air quality, air emissions, soil, inland waters, marine and coast, nature, land cover, waste, and cataloguing of data sources).

These institutions jointly provide the information used for reporting to support EU and European environmental policies.

The EIONET electronic network is organized in concentric layers, including the EEA Intranet, an "extranet" connecting the main institutions, and public Internet sites providing data and reports. The network has developed and uses a variety of software for communication (for example, supporting various interest groups), project cooperation, common database and document management, and web-based reporting. The electronic network establishes a common European approach to collecting data and information on the state of the environment. The work programmes through its topic centres will help harmonize data collection approaches.

Among the applications in development, EIONET will provide EEA member countries a single gateway – called Reportnet – for reporting to different MEA secretariats, international organizations and other forums. For EU members, Reportnet will assist with reporting requirements under environmental legislation. EIONET is also seeking to connect to databases on economic sectors, to provide information, including indicators, to support policy integration, a key EU goal.

Sources: EEA and EIONET (http://www.eea.eu.int and http://eionet.eu.int).

Recommendations and upcoming work

The UNECE recommendations on strengthening national environmental monitoring and information systems in EECCA countries call for greater use (resources permitting) of computer networks, with common databases and software, and improved access to information.

The Working Group and its Task Force will continue to focus on these and related issues. Among the topics of the Task Force's upcoming activities are:

- Using EIONET standards to develop and organize databases and communicating data;
- Developing national meta data bases on the Internet using EIONET software; and
- Using common formats for presenting environmental information and supporting decision-making.

Chapter II

REPORTING AND INDICATORS

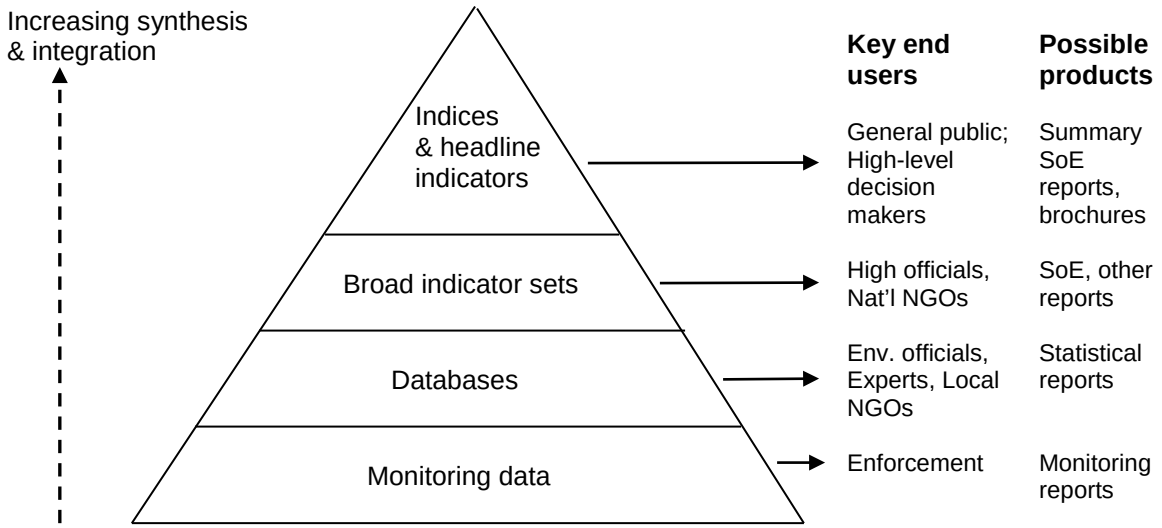
A. Environmental reporting

Reporting is the "output" of monitoring systems, communicating environmental information to end-users. Indeed, different levels of synthesis or detail are appropriate for the needs of different end-users (see box 11).

Box 11. The information pyramid

Monitoring data provides the foundation for environmental information (fig. VIII). Local inspectorates and enforcement officials typically work with detailed emissions data, while officials in national environment ministries more typically want aggregated information. Environmental indicators (described in section II.B) are a key tool. Their information can be presented in detailed SoE reports as well as documents to support policy on specific issues, e.g. air or water pollution, or sectors, e.g. transport. At the pinnacle, high-level decision makers – as well as the general public and most journalists – are interested more in information that briefly summarizes and explains detailed data (such as "headline" indicators and indices).

Figure VIII. The information pyramid, end users and possible products
(Based on EEA, 2002)



This section reviews state-of-the-environment (SoE) reporting in the EECCA countries. It also covers international reporting issues. Indicators, which are a key tool for presenting complex environmental information in SoE reporting, are discussed in section II.B.

State-of-the-environment reporting

Effective SoE reporting can:

- Assess and describe environmental trends and conditions, their causes and consequences;

- Provide a foundation for improved decision-making, and facilitate the measurement of progress towards policy goals; and
- Increase awareness and understanding of environmental issues among decision makers, key stakeholders and the general public.

All EECCA countries have produced state-of-the-environment reports in the last ten years. Kyrgyzstan, Kazakhstan, the Russian Federation, Ukraine and Uzbekistan have published reports on a regular basis – for some, such as the Russian Federation and Ukraine, every year. Other countries have produced fewer SoE reports: Armenia, Azerbaijan and Turkmenistan each published one SoE report in the 1990s. In Georgia, two SoE reports were published (UNECE, 2003b). Tajikistan has produced three reports over the past five years: its most recent was released in early 2003.

This section's review of SoE reporting is based on research for and discussions within the UNECE Working Group, including an overview prepared with the support of Eco-Accord of Moscow: UNECE, 2002a.

Legal and institutional context

In most EECCA countries, national environmental laws and regulations call for regular environmental reporting, often specifying SoE reports.

In a few countries, laws and regulations set out detailed requirements and approaches. In Georgia, a 1999 presidential decree regulates the legal arrangements for the development of national SoE reports, its submission to the President, as well as public access. Under Ukraine's 1991 Law on Environmental Protection, the Ministry for Environment and Natural Resources must submit annual SoE reports to Parliament; subsequent cabinet decrees set specific requirements and created an inter-ministerial commission for the reports. The legal framework in the Russian Federation is described in box 12.

The development of SoE reports requires cooperation across government ministries and agencies (indeed, reporting can be an important driving force for inter-ministerial cooperation on data and information exchange). In most EECCA countries, SoE reports are prepared and written by a network of government experts and institutions. The ministry responsible for environment typically has a central, coordinating role.

In Kyrgyzstan, for example, almost 20 institutions are involved in the development of SoE reports, including the National Committee for Statistics, the Public Health Ministry, the *Kyrgyzenergo* company, institutes of the National Academy of Sciences and NGOs. In the Republic of Moldova, the Ministry for Environment develops SoE reports; other agencies and ministries contribute, and specific chapters are developed through a network of experts established under the National Institute of Ecology. In Ukraine, several ministries and other government institutions, the National Academy of Science and NGOs all contribute to the annual SoE reports. Many national and sub-national bodies are involved in preparing the Russian Federation's reports (see box 12). In a few countries, environmental NGOs are consulted; however, their participation is generally limited.

Some countries, however, have not used a broad network of experts and institutions. In Georgia, for example, individual chapters are prepared by staff members of the Ministry for Environment and Natural Resources and the Institute for Environmental Protection.

Even where numerous bodies are formally involved in SoE preparation, obtaining necessary data is often difficult. In many countries, however – including Georgia, Kyrgyzstan, the Republic of Moldova and the Russian Federation – the offices coordinating SoE preparation do not have direct access to databases in other ministries and agencies, and obtaining necessary data often requires specific inter-ministerial requests and agreements.

Another key issue regards costs and funding. In most EECCA countries, the budgets to develop, write and publish SoE reports are insufficient. As a result, printing is limited to a relatively small number of copies, the use of colour or user-friendly graphic design is restricted. In the Russian Federation and Ukraine, for example, budget allocations are approximately $20,000 a year, most of which is needed for salaries. Other countries that encounter budget difficulties include the three Caucasian republics: Armenia, Azerbaijan and Georgia. In contrast, some Central Asian countries have sufficient funding to produce SoE reports using colour charts and diagrams as well as modern printing technologies.

Box 12. The legal and institutional framework for SoE reporting in the Russian Federation

The Russian Federation's 1991 Law on Environmental Protection and a presidential decree call for the preparation of annual SoE reports. A 1993 government decree specifies that SoE reports are official documents that provide government agencies and the public with analytical information on conditions and trends related to the environment and natural resources. It calls for the reports to describe the implementation of government measures for environmental protection and natural resources conservation and to provide a framework for the development of government programmes and review priorities.

The Ministry for Natural Resources is responsible for developing national SoE reports, and a wide array of other ministries, agencies and institutes provide information, analytical material and assessments. Indeed, participation in the Russian Federation's SoE reports extends across almost 40 federal ministries and agencies, agencies in the federation's 89 constituents, major corporations and NGOs. Officials appointed by these bodies are members of the inter-ministerial working group that prepares material for the SoE report.

Contents and coverage

The SoE reports prepared in EECCA countries cover a broad array of topics. Their structure and contents reflect national environmental priorities and urgent local problems. All reports provide information on environmental conditions and pressures and government actions, to the extent that data are available (see table 2).

Naturally, reports in different countries cover slightly different topics and issues, reflecting national context and priorities. Kyrgyzstan's SoE reports, for example, contain chapters on the transboundary environmental impact of mining operations and on environmental conditions in the city of Bishkek. The Russian Federation's national SoE report provides a comprehensive review, covering essentially all the issues listed in the table, as well as others such as the environmental impacts of the Armed Forces and the development of environmental NGOs and the environmental movement. Its review of policy work includes sections on environmental security, enforcement, and information support for environmental activities.

Table 2. Main issues covered in EECCA SoE reports

Environmental issues	Economic sectors	Environmental policy actions
Air: emissions and quality	Energy	Pollution abatement and control activities
Inland water bodies: quality and quantity	Transport	Economic instruments
Groundwater: quality and quantity	Agriculture	Environmental expenditures (including foreign assistance)
Coastal areas and seas (where applicable)	Forestry	Subnational/local authorities
Soil contamination	Fisheries	NGO and public participation
Chemicals	Tourism	Environmental education
Industrial accidents	Other sectors	Environmental research and development
Solid waste: generation, storage and treatment		International cooperation
Biodiversity and nature protection		
Urban environment		
Environmental health		

In most EECCA countries, SoE reports cover issues identified as national environmental priorities. Fewer reports, however, provide information related to the implementation of policy efforts to address these priorities.

The Russian Federation covers a huge land area, and it is difficult to identify common, nationwide environmental priorities. National SoE reports include information on the different priorities across *oblasts* and other units of the Federation. Moreover, the reports provide information on progress in the implementation of NEAPs and special federal programmes, as well as compliance with international commitments.

The issues covered in Ukraine's reports generally reflect national policy priorities, and also cover important *oblast* ones. The information provided allows some assessment of progress towards national goals and international commitments. Moreover, the structure of the report is adjusted year to year to reflect urgent subnational issues.

Supporting environmental policy

Environmental reporting – and SoE reporting in particular – is a key tool to support policy. At present, however, coverage of policy issues and implementation varies significantly across EECCA countries. Most reports make some limited use of indicators tied to policy targets (see sect. II.B). A few SoE reports, such as those of the Russian Federation, have extensive chapters on policy.

Only a few SoE reports in the subregion draw specific conclusions regarding upcoming issues for policy attention. The Russian Federation's SoE reports provide one example: they end with a section providing forecasts and recommendations to improve national legislation as well as strengthen the implementation of national actions. These have encouraged the development of some short- and long-term policies, as well as programmes addressing national issues such as drinking-water supply and waste management. Ukraine's reports also contain summaries, including policy conclusions and recommendations, addressed to the Cabinet and Parliament and are also used by the Ministry's Board of Senior Officials.

Public access to SoE reports

In many EECCA countries, national legislation establishes the public's right to environmental information. Moreover, most EECCA countries have ratified or acceded to the 1998 Aarhus Convention, which calls on national governments to publish regular, public SoE reports (see box 13).

Across EECCA countries, however, SoE reporting is currently not widely disseminated. One key problem in most countries is that financial considerations keep the print run of SoE reports too low to meet the information needs of all interested organizations. For example, in Kyrgyzstan, only 300 copies of the SoE reports are published. As a result, most copies are distributed to national ministries and agencies, subnational and local offices. Print runs are slightly higher in the Russian Federation (about 1,000) and in Ukraine, where they increased from 1,000 in 1992 to 2,000 in 2001. Nonetheless, these print runs are relatively low in comparison with the countries' large populations.

The price of SoE reports, on the other hand, is not a significant obstacle to public access: in many EECCA countries, these reports are free. Kyrgyzstan's national SoE report is available to all interested parties (within the limits of its print run); copies are distributed free of charge to government offices, NGOs, and selected schools and universities. In Ukraine, SoE reports are distributed on request – they are available free of charge to the general public – and at environmental conferences and meetings. Distribution, however, is restricted by the relatively low print run.

A few EECCA countries have produced summary SoE reports. In Georgia, summary versions (about 25 pages long) are prepared for the general public and presented via the press. The full versions are distributed mainly among government agencies. In the Republic of Moldova, a 1997 agreement between the Environment Ministry and NGOs led to various information dissemination commitments, including the preparation of summary SoE reports, to be distributed via mass media. With the country's economic difficulties, however, the Ministry does not produce annual SoE reports, nor has it published summary versions.

Box 13. The Aarhus Convention

The UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters was adopted on 25 June 1998 in the Danish city of Aarhus, at the fourth "Environment for Europe" Ministerial Conference. The Aarhus Convention links environmental rights and human rights, acknowledges an obligation to future generations, and declares that sustainable development can be achieved only through the involvement of all stakeholders.

The Convention establishes citizens' rights in three key areas: access to information, access to participation and access to justice. Among its requirements, the Convention states that environmental information held by government authorities should be available to the public through clear and transparent procedures. Exemptions should be limited and clearly defined. Moreover, public authorities must collect, update and disseminate essential environmental information, including regular state-of-the-environment reports.

The Convention's first protocol, on pollutant release and transfer registers (PRTRs), was open for signature at the 2003 "Environment for Europe" Conference in Kiev. Under the protocol, large polluting enterprises in ratifying countries will be required to report annually on their releases (to the environment) and transfers (to other companies) of 86 key pollutants, including greenhouse gases and heavy metals. This information will be gathered on a public register accessible to the public via the Internet. The registers can play a key role in pollution reduction: in countries that have adopted PRTRs, many large enterprises have striven to reduce pollution levels beyond permit and other legal requirements.

Source: UNECE. (http://www.unece.org/env/pp/).

In the Russian Federation, the national SoE report is presented annually to journalists. However, interest in the mass media appears limited given the many other pressing social problems (crime, living standards and more). Excerpts and summaries of yearly SoE reports are also provided in some newspapers and journals, in particular those with an environmental focus, such as *Zeleniy Mir* newspaper and *ECOS-Inform* magazine.

In Kazakhstan, some information based on SoE reports and their conclusions may be published in the mass media. Moreover, summary brochures and leaflets based on SoE reports are commonly prepared for specific events, but generally are not distributed to the public.

Language can be a factor for public access. In some countries, such as Kyrgyzstan, SoE reports are prepared in Russian only. In Kazakhstan, reports are published in Russian, though in recent years Kazakh versions have been produced (few copies were printed, however).

Internet versions can also help to disseminate SoE reports. In preparation for the fourth pan-European Conference of Environmental Ministries in Aarhus, in 1998, most EECCA countries produced electronic versions of national SoE reports, with English translation (the UNEP GRID network provided several countries with training and support for these efforts, and the reports are available on the GRID Arendal web site, (http://www.grida.no/enrin). A few countries have produced more recent electronic versions, and some, such as Ukraine, have posted SoE information on national ministry web sites. A few countries, including Ukraine and Uzbekistan, have published SoE reports on CD-ROM.

Although web-based versions are an important step in providing broad public access to SoE reports, in many EECCA countries few people have regular access to the Internet. Moreover, in most EECCA countries the demand for environmental information from both the high political level and the general public is relatively low, often overshadowed by attention to pressing economic and social problems. As economic recovery continues, public interest in the environment should become more prominent. Moreover, public awareness and participation can be important support as well as a key driving force for environmental policy. Some policy instruments, such as pollutant release and transfer registers (PRTRs), the subject of the Aarhus Convention's first protocol, make explicitly use of public information (see box 13).

Statistical and other reports

More detailed reports can provide important information for particular policy work and for specific audiences (see box 11). Many EECCA governments produce reports of environmental statistics. These typically have a restricted audience of environmental officials, experts and researchers. Moreover, their print runs are limited, and these compendiums are largely used within government only.

In Belarus, both the Ministry for Natural Resources and Environment and the Ministry for Statistics and Analysis publish regular statistical information on the environment. In Turkmenistan, the National Institute of Statistics publishes annual documents on the environment and natural resources. Uzbekistan's Ministry for Economic Statistics prepares a report on environmental protection and natural resources use, but it has a circulation of only 30 copies, intended mainly for official use.

Other publications cover specific themes. In Belarus, the Ministry for Public Health, the Ministry for Forestry and other bodies publish reports on environmental issues within their competence. In the Republic of Moldova, some units of the Ministry for Environment, Construction and Territorial Development, such as the State Environmental Inspectorate, publish their own annual reports. The Russian Federal Hydrometeorology and Environmental Monitoring Service publishes surveys and maps on key themes such as air and water pollution. Policy documents, such as environmental strategies, National Environmental Action Plans (NEAPs), Biodiversity Strategies and Action Plans and Reports on Sustainable Development include information on environmental conditions and trends.

In addition, nearly all constituents – *oblasts*, autonomous republics and others – of the Russian Federation publish their own annual SoE reports. These largely follow the structure of the national report though with specific attention to important local factors.

International reporting

The EECCA countries are Parties to several multilateral environmental agreements (MEAs) and members of various international organizations. In many cases, these international commitments include requirements to report regularly on national environmental conditions and trends. (Table 3 provides an overview of data requested by key MEAs and organizations.)

In addition, the EECCA countries agreed at the 1998 Aarhus Conference to provide information to pan-European environmental assessment reports. Some also participate in subregional frameworks for shared ecosystems – for example, for the Aral Sea, the Black Sea, the Caspian Sea and transboundary watercourses – and these require regular provision of environmental data.

Across EECCA, there are some significant gaps in meeting international reporting commitments. A number of countries submit incomplete data, often due to gaps in monitoring systems (see chap. I). Moreover, some countries still follow old monitoring and calculation methods that are not harmonized with evolving international methodologies, creating problems of international comparability (EEA, 2003; UNECE, 2002b).

Strengthening the effectiveness of MEAs is an important issue in international forums, including UNECE, which provides the secretariat for several pan-European MEAs. Parties need to improve their compliance, by reporting on their overall implementation and, where requested, by reporting relevant environmental data, statistics and indicators. Recent UNECE recommendations call on Parties to prepare, where needed, "a plan for capacity building and technical and financial assistance" for carrying out data reporting (UNECE, 2002c). Here and in other contexts, international cooperation can help strengthen national monitoring and information systems. Moreover, growing international cooperation plays an important role in national policies.

Strengthening reporting in EECCA

The UNECE overview of SoE reporting notes that in EECCA countries, the "development of SoE reports is prone to serious difficulties". Among common problems, countries across the sub-region need to strengthen the legislative basis, financing and inter-ministerial coordination in this field. Moreover, report objectives, structure and target audiences should be better defined. The use of indicators can be strengthened (see sect. II.B).

Table 3. Reporting requirements for selected MEAs and international organizations

Selected global MEAs	**Topic**	**Data requested/database**	**EECCA**
Vienna Convention for the Protection of the Ozone Layer and Montreal Protocol	Ozone layer	Data on production and consumption of ozone-depleting substances (CFCs, etc.).	All EECCA
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Hazardous and other waste	Data on generation, import, export and transit of hazardous and other wastes	All EECCA except KAZ, TJK
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Species	Data on international wildlife trade	AZE, BLR, GEO, KAZ, MDA, RUS, UKR, UZB
Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat	Wetlands	Information on sites protected under the Convention: ecological character, conservation measures taken, tourism activities, etc.	ARM, AZE, BLR, GEO, MDA, RUS, TJK, UKR
United Nations Framework Convention on Climate Change (and 1997 Kyoto Protocol)	Climate change	Emissions of six GHGs (including CO_2, CH_4) and emissions of CO, NO_x, NMVOCs, SO_2	All EECCA except KGZ, TJK
Selected regional MEAs	**Topic**	**Data requested/database**	**EECCA**
Convention on Long-range Transboundary Air Pollution and its protocols (UNECE region)	Air pollution	Air emissions of: SO_2, NO_x, NH_3, NMVOCs, CH_4, CO, CO_2, heavy metals (Cd, Hg, Pb), and selected persistent organic pollutants (POPs)	ARM, AZE, BLR, GEO, KAZ, KGZ, MDA, RUS, UKR
	Air pollution effects: crops	Ozone injury to agricultural crops (updated regularly) and heavy metal deposition on mosses (every five years)	RUS
	Air pollution effects: forests	Crown condition, foliar condition, growth of trees (annually) and soil condition, deposition, meteorology, and more (updated regularly).	BLR, MDA, RUS, UKR
	Air pollution effects: materials	Atmospheric pollution corrosion of important materials	RUS
	Air pollution effects: water	Data on chemistry and biology (invertebrates) of surface waters (reported annually). Preliminary data on Pb, Cd, Zn, Cu and Ni	BLR, MDA, RUS
	Air pollution effects: ecosystems	Chemical, biological and physical data on selected ecosystems, incl. air, soil, soil water; groundwater and run-off water chemistry; hydro-biology of streams and lakes (reported annually)	BLR, RUS
	Air pollution effects: mapping	Data on critical loads of acidity (S and N) and nutrient nitrogen and their exceedances, on critical levels of ozone; preliminary data on critical loads of Pb and Cd. Updated regularly	BLR, MDA, RUS
Selected international organizations and programmes	**Topic**	**Data requested/database**	**EECCA**
Arctic Monitoring and Assessment Programme	Various	Wide range of data sets on POPs, radionuclides, heavy metals.	RUS
United Nations Statistical Division (UNSD)	Environ-mental statistics	Data on air emissions, air quality, water resources, water pollution and quality of selected water bodies, waste generation and treatment, land use and land degradation	All EECCA except UZB
UNECE and Food and Agriculture Organization of the United Nations (FAO)	Forests	Forest resources, conditions management, biodiversity and protection	All EECCA

Source: UNECE, 2002b.

Note: EECCA countries: Armenia (ARM), Azerbaijan (AZE), Belarus (BLR), Georgia (GEO), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Republic of Moldova (MDA), Russian Federation (RUS), Tajikistan (TJK), Turkmenistan (TKM), Ukraine (UKR), Uzbekistan (UZB).

The UNECE Guidelines for the preparation of governmental reports on the state and protection of the environment, developed by the Working Group on Environmental Monitoring and endorsed by Environmental Ministers in Kiev in May 2003, propose approaches to address these problems and to strengthen SoE reporting in EECCA countries. The Guidelines are found in annex II.

B. Environmental indicators

Methodological approaches

Environmental indicators are a key tool for environmental reporting. Appropriately chosen indicators, based on sufficient time-series data, can show key trends, help describe causes and effects of environmental conditions, and track and evaluate policy implementation (see box 14). The present section describes methodological aspects of indicator development as discussed within the UNECE Working Group on Environmental Monitoring.

The assessment framework provides a structure for indicator sets and helps identify the functions of individual indicators. For example, the sustainable development indicators of the United Nations Commisssion on Sustainable Development (UNCSD) follow a three-part framework, *driving forces-state-response*. EEA has developed an extended version: the *Driving forces - Pressures - State - Impact - Responses (DPSIR)* framework (see fig. IX), as follows:

- *Driving forces* are socio-economic factors and activities that increase or mitigate pressures on the environment. These can include, for example, the volume of industrial, transport or tourism activities (specific modes and technologies employed also play an important role). Specific indicators may refer to, for example, the production level of an industrial sector or total passenger car use (which can be measured in terms of vehicle-kilometres).
- *Pressures* include direct anthropogenic stress and impacts on the environment, such as pollution releases and natural resources use (for example, the emission of carbon dioxide by passenger cars or the volume of fishing in a water body).
- *State* refers to the current conditions and trends of the environment, including: quality parameters (such as pollution levels) in air, water bodies and soil; diversity of species in a specific geographic region; and availability of natural resources such as timber or freshwater.
- *Impact* stands for the effects of a changed environment on the health of human beings and other organisms and on the effects on nature and biodiversity (for example, human health effects related to air pollution in a large city).
- To close the loop, *responses* are societal efforts to address environmental problems. These can include specific policies, such as government charges on natural resources use. Choices made by enterprises and individuals are also important – for example, enterprise investments in pollution control, or household purchase of recycled goods.

Box 14. Defining environmental indicators

Environmental indicators describe environmental conditions and trends. They synthesize often complex numerical data, turning it into "information" that can be communicated to end-users such as policy makers and the public. Environmental indicators are commonly classified along three main lines:

- First, by *topic* – either an environmental *issue*, such as air pollution, climate change, or waste management, or an economic *sector*, such as energy, transport and agriculture;
- Second, indicators fit within a broad *assessment framework;*
- Third, different *types* of indicators have specific functions, related to the specific policy questions they answer.

Indicators are typically used as part of a coherent set: a *core set* that covers a broad array of topics, across all categories of the assessment framework, a *sectoral indicator set* for specific economic sectors, or a small set of *headline* indicators for audiences such as the general public and high-level decision makers.

Figure IX. The EEA framework for indicator reporting on environmental issues

There are several types of indicators based on the policy questions they answer:

- *Descriptive indicators* answer the question: "How are pressures on the environment and how is the quality of the environment developing?" They are usually presented as a line diagram showing the development of a variable over time. Examples include: "emissions of CO_2" or "the number of indigenous species in biogeographical regions". Descriptive indicators cover all five areas of the EEA framework.
- *Performance indicators* answer the follow-up question: "and is that relevant for policy goals?" Generally these indicators use the same variables as descriptive indicators but are connected with target values. One example is: "The number of days in which ozone levels exceed ambient air standards". Performance indicators thus use policy targets.
- A third category is *eco-efficiency indicators*. These answer the question "have we become more efficient in our economic processes?" Eco-efficiency indicators link driving forces with state or pressure indicators. This refers to an overall goal for policy integration and sustainable development: "decoupling" economic growth from environmental pressures. Here, efficiency refers to pressures such as emissions or natural resources use.
- EEA identifies two other indicator types whose use at national and international level is only just beginning. *Policy-effectiveness indicators* answer the question "what has been the effect of policy?" (in terms of, for example, air pollution emissions reduction). They can require, however, detailed numerical analysis of policy effects based on extensive monitoring and other data. Only a few countries, such as the Netherlands, have made serious use of these indicators. *Welfare* indicators are connected with the question: "and are we on the whole better off?" and ask for a balance between economic, social and environmental progress. These include approaches to integrate environmental conditions and trends into economic accounting, such as the United Nations Statistical Division's work on satellite accounts.

Indicators used in EECCA SoE reports

The EECCA countries use a wide variety of environmental indicators in their SoE reports (see annex III). In a few areas, however, EECCA countries encounter difficulties related to: the quality of data and information, incomplete coverage of measurements, limited time series available, and poor compatibility of data from different sources. In addition, there is concern that high-level officials cannot use effectively the extensive indicators and statistics currently presented to make decisions – thus, a more focused approach may be useful. Finally, harmonization with international indicator approaches is a key area for attention (UNECE, 2003b).

The indicators used in SoE reports mainly present descriptive indicators, in particular state and pressure indicators. In all countries, SoE reports employ pressure indicators of atmospheric air emissions. The reports differ, however, by level of data aggregation. Categories include: total aggregate emissions, emissions from stationary and mobile sources, emissions by pollutant, emissions by subnational region, or emission by sectors. As a rule, data refer to the reporting year and the previous year. In many reports (including those of Armenia, Belarus, Kyrgyzstan, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan), air emissions indicators include some broader time series.

For climate change, however, emissions of main greenhouse gases are presented only in the SoE reports of Armenia, Belarus, Republic of Moldova, Tajikistan, and Turkmenistan. State indicators of climate change – such as annual average surface air temperature and average precipitation – are presented in the SoE reports of Belarus, Kyrgyzstan, Republic of Moldova, the Russian Federation, Tajikistan, and Turkmenistan. A pressure indicator of ozone layer depletion – consumption of ozone-depleting substances – is used in the reports of Belarus, Tajikistan and Uzbekistan.

The SoE reports use impact indicators for a few specific issues, such as damage to land due to construction (Armenia) and soil erosion (Armenia, Belarus, Kazakhstan, Ukraine, Uzbekistan) and contamination of crops due to soil contamination (Ukraine). Indicators of driving forces are also used

in some reports (Republic of Moldova, Tajikistan, the Russian Federation and Uzbekistan).

Most SoE reports use performance indicators, in particular for air and water quality. In most reports, air quality in urban and industrial areas is assessed against national standards (maximum allowable concentrations (MAC) for peak, daily average and annual average values). In some countries (Belarus, Georgia, Kazakhstan, the Russian Federation and Uzbekistan), an index combining different measures of ambient conditions against standards is used to assess urban air quality.

In some SoE reports, eco-efficiency indicators are used. Often, however, these use population figures as a driving force, rather than the level of economic activity. For example, Uzbekistan's SoE reports present aggregate air pollution emissions per capita; Kazakhstan's report presents indicators of aggregate emissions from point sources and from mobile sources per capita.

Throughout EECCA reports, indicators present mainly national data. One exception is Azerbaijan's SoE report, whose indicators include some data for comparison with other countries.

While SoE reports include some performance indicators, overall the UNECE Working Group studies and discussions have shown that across EECCA attention needs to be paid to the use of information and reporting to support environmental policy. Indicator development can strengthen this link.

Further indicator development in EECCA

Experience in the UNECE Working Group and in other forums has helped identify a number of factors related to the effectiveness of indicators to support environmental policy. These include the following elements:

- Indicators should report progress over time and should be accompanied by an assessment of the reasons explaining their development;
- They should be relatively few in number, allowing users to become used to their presentation;
- They become more powerful as performance indicators, linked with formal targets or informal or indicative reference values.

UNECE recommendations on monitoring and information systems call on EECCA countries to develop their environmental indicator sets, using international experience and improving harmonization with international approaches. International approaches, including the indicator set for the *Kiev Assessment*, can provide a reference for EECCA indicator work. The recommendations suggest that countries should give priority to indicators that can measure performance in relation to national environmental policy goals. The development of indicator-based reports is another suggested area for work.

The section that follows describes the indicator development work at the international level that has been discussed within the UNECE Working Group with a view to providing guidance to environmental authorities in EECCA countries. In reviewing international indicator sets, EECCA countries should give attention to the specifics of their national context, including environmental policy priorities and goals.

Indicator development at the international level

United Nations indicators for sustainable development

UNCSD has developed a set of 58 indicators across the four dimensions of sustainable development (social, environmental, economic and institutional). This work follows Agenda 21, which called for the development of indicators to support sustainable development decision-making at all levels and the harmonization of indicator efforts at national, regional and global levels. The indicators were prepared and tested through a global process including: broad discussion; training and capacity building; national testing; and evaluation and revision. The UNCSD indicators and their methodology sheets, presented in 2001, cover six key environmental themes: atmosphere; land; oceans, seas and coasts; fresh water; and biodiversity. These indicators are intended to help countries around the world track national progress towards Agenda 21 and subsequent sustainable development goals. (UNCSD, http://www.un.org/esa/sustdev)

The United Nations Statistics Division (UNSD) collects environmental data from United Nations Member States and is involved in the development of methodologies for environmental statistics and environmental indicators. For example, UNSD has established a database to support the United Nations 48 social, economic and environmental indicators selected to help track

progress towards the Millennium Development Goals (UNSD, http://www.un.org/depts/unsd).

In addition, UNSD works on the integration of environmental data into economic accounting and the preparation of key economic indicators such as gross domestic product (GDP). UNSD has developed a system of satellite environmental accounts to flank national economic accounts, covering four categories:

- Flows of input materials, energy and pollution, providing information at industry level;
- Environmental protection and resource management expenditure accounts;
- Natural resource asset accounts, tracking stocks of fish, forest, mineral and other resources; and
- Valuation of non-market costs and benefits.

Satellite accounts commonly use the same underlying monitoring data and statistics as environmental and sustainable development indicators.

United Nations work on sustainable development indicators and environmental accounting bears consideration in the development of EECCA environmental indicators. Global sustainable development goals provide a broad context for environmental indicators, underlining the need for integration between data and information on the environmental, social and health, and economic dimensions. This work is complementary to the development of environmental indicators. In addition, at both national and international levels, coherence and cooperation need to be assured between the various initiatives.

Kiev Assessment indicators

The *Kiev Assessment* focuses on progress in the implementation of international environmental conventions as well as progress in environmental management in general across Europe, including all of EECCA. The report thus supports Europe-wide environmental policy initiatives and coordination. EEA coordinated the report's preparation, and the UNECE Working Group on Environmental Monitoring provided an important forum for cooperation on data collection as well as on environmental monitoring and information systems, in particular in EECCA.

The *Kiev Assessment* is indicator-based: it uses a set of about 80 indicators – this set provides both a central part of the report's structure as well as the basis for its analysis. The Kiev indicators are related to the EEA overall core set: the report follows the core set of issues and sectors, with additional issues and topics added for the broader pan-European context (for example, soil salinization and the Aral Sea).

The Kiev indicators are provided in annex IV (EEA, 2001b). Countries in the EECCA subregion may wish to consider this set closely: these indicators contribute essential information on the Eurasian environment across all countries and geographic regions, and can provide a useful reference point for developing common EECCA indicators.

EEA core set of indicators

The EEA core set, unveiled in April 2003, includes about 400 indicators. These are closely linked to EU policy on two levels. First, the "strategic" level of broad programmes, such as the current Sixth Environmental Action Programme, which set overall goals. Second, the "operational" level of European legislation (environmental directives), which establishes standards across areas such as ambient air quality and urban waste-water treatment.
The core set is organized across six environmental themes – air pollution, climate change, water, waste and resource use, terrestrial environment (land and soil contamination), and biodiversity – and five economic sectors: transport, energy, agriculture, fisheries and tourism.

The core set is intended to provide information to allow policy makers at different levels to monitor the progress and effectiveness of environmental policies, in particular EU policies. The set will thus be used for regular reporting on several themes, such as the EU Sustainable Development Strategy, initiatives to encourage policy integration, and environmental strategies such as the Sixth Environmental Action Programme.

OECD core and sectoral indicator sets

The OECD core set, covering about 40 indicators across 14 issues, has been agreed among the advanced market economies. The set is used internationally to measure environmental performance (via the OECD performance reviews), as well as in OECD reports on environmental issues across its member countries. OECD has also

developed three sets of sectoral indicators: energy, transport, and household consumption patterns. Its work has been used as a basis for indicator development at national and international level.

Headline indicator sets

Both internationally and nationally, there has been an attempt in recent years to identify small sets of easily understandable indicators that could communicate environmental issues effectively to high-level policy makers and the public. (An eventual goal is to develop indicators that could serve as a counterpart to key socio-economic indicators, such as GDP, unemployment and inflation.) For example, EEA has identified 11 "key indicators" from its core set: these are referenced to EU policy goals set in the Sixth Environmental Action Programme. OECD has proposed 10 "headline indicators", drawn from its core set.

The development of headline indicators may be of interest to EECCA countries as part of the broader development and use of indicators. Headline indicator sets may be valuable in terms of communicating key information to high-level national officials, including those outside environmental policy, to the public, and possibly also to international forums.

Chapter III

CONCLUSIONS

Environmental monitoring and reporting are vital for environmental policy. Over the past 10 years, the countries of Eastern Europe, the Caucasus and Central Asia (EECCA) have struggled to maintain monitoring systems in the face of often severe economic difficulties and public budget constraints.

In this period, EECCA countries have sought to improve coordination among the many ministries and agencies involved in monitoring. Countries have sought to improve information and reporting for policy needs and other requirements. However, these important areas continue to require attention. Another issue for attention is the establishment of stable financing for monitoring systems.

Several *specific monitoring activities* need strengthening. These include air quality, water pollution and waste management. Enterprise resource use and pollution emissions need to be monitored more effectively – this will improve the enforcement of key policy instruments such as pollution and natural resource charges.

In the area of *environmental information systems*, greater use of computer-based networks can improve links between databases across different monitoring agencies and between different levels of government. Harmonization with international approaches can provide a path for this work.

For nearly all EECCA countries, *environmental reporting* needs to be improved, including reporting to international databases. *State-of-the-environment (SoE) reporting*, which provides key information for policy needs and the public, needs strengthening. Key areas for attention include: financing; the quality of underlying data; definition of objectives and audiences; and the effective use of indicators. International approaches, including the indicators used in the *Kiev Assesment*, can provide useful experience for the development of *indicators* in the subregion.

The UNECE Working Group has provided a forum for reviewing and discussing common issues and supporting national efforts to strengthen monitoring and reporting. UNECE Recommendations on Monitoring and Information Systems, provided in annex I, together with the Guidelines on SoE Reporting, found in annex II, provide a common road map.

ANNEXES

Annex I

RECOMMENDATIONS ON STRENGTHENING NATIONAL ENVIRONMENTAL MONITORING AND INFORMATION SYSTEMS IN COUNTRIES OF EASTERN EUROPE, THE CAUCASUS AND CENTRAL ASIA[1]

---

[1] Prepared by the UNECE Working Group on Environmental Monitoring and endorsed by the Fifth Ministerial Conference "Environment for Europe".

In the light of the discussion of the situation with environmental monitoring and information capacities in countries of Eastern Europe, the Caucasus and Central Asia and specific activities undertaken under the UNECE Working Group on Environmental Monitoring so far, it is recommended that the central public authorities that are responsible for environmental monitoring and information in these countries should implement the following measures:

Policy context

1. Promote a continuous dialogue between policy makers and those who design and implement monitoring systems;

2. Elaborate priorities for environmental monitoring activities on the basis of data collection and reporting requirements established in national laws and regulations, environmental action plans and programmes, and requirements emanating from international commitments. Set monitoring priorities with the central administrations concerned and make these priorities available to all in a document and electronically;

3. Regularly review environmental monitoring systems based on the assessment of their benefits in supporting decision-making, the prioritization of new information needs, and the economic evaluation of their costs;

Institutional framework

4. Develop legislation to regulate data management, and designate or establish a lead central environmental monitoring agency responsible for core monitoring activities and coordination with all other administrations, research institutes, regional environmental centres and NGOs, collecting and processing environmental data;

5. Establish or improve a workable institutional structure for inter-ministerial cooperation and coordination as well as a network of experts responsible for specific monitoring and information activities;

6. Delegate authority to specialized institutions and regional and local bodies for relevant monitoring and information activities. Provide regional and local bodies with advice and support;

7. Secure data analysis protocols when changing administrative settings and facilitate the cooperation between analytical laboratories;

Funding

8. As monitoring is by definition a continuous activity, give particular attention to the continuity of financing of core activities from public funds;

9. Develop a mix of funding sources and mechanisms to ensure an appropriate level of investment in basic environmental monitoring infrastructure, in particular, into raw data collection (networks), processing capacities (human resources) and equipment (computer hard and software). Raise external financial support, when necessary;

10. Ensure that major polluters regularly monitor their emissions and waste flows, and that central, regional or local public authorities periodically check compliance with emission standards and other environmental regulations. Share the costs of environmental monitoring at the local level with polluters, to the extent possible;

Information and reporting

11. Progressively (resources permitting) make greater use of computer networks to facilitate environmental information flows within and between institutions, to promote the use of common databases and software at all levels of government, and to facilitate access to information;

12. Improve information quality, giving priority to the development of sets of environmental indicators, using international experience, particularly indicators for measuring progress in environmental performance with respect to national objectives and international commitments; improve compatibility between national and international environmental indicators;

13. Improve state-of-environment reporting to decision makers, the scientific community and the general public by the implementation of Guidelines on the Development of State of the Environment Reports prepared by the Working Group;

14. Make environmental data collected with public funds freely available and use modern information technologies to facilitate access to these data;

15. Produce, at regular intervals, compact, easy-to-read products such as booklets presenting key environmental data, indicator reports and thematic leaflets or brochures produced, and make them available on the Internet;

16. Support actively the cooperation on environmental reporting and information management between countries at pan-European level as well as joint efforts to enhance cross-border comparability of the information, in particular, on air emissions, urban air quality, transboundary inland water pollution, marine pollution, hazardous waste, waste management, and biodiversity;

17. Improve reporting under the applicable multilateral environmental agreements to comply with international commitments and to cover existing gaps in international environmental databases;

Specific monitoring activities

18. Harmonize definitions, classifications and monitoring protocols with international standards, starting with those established under applicable international environmental agreements;

19. Where the original monitoring networks have substantively degraded over past years, undertake their restoration by focusing monitoring activities initially on a limited number of major pollutants and major pollution sources using the inventory of pollution sources as a basis. Aim at establishing a minimal network of stationary sampling sites to monitor discharges from these sources into air and water bodies. Develop practical approaches to extending monitoring activities, step by step to soil, waste, biodiversity and chemicals in ecosystems and foodstuffs;

20. Ensure continuity in the monitoring of “traditional” parameters to assess long-term environmental trends;

21. Improve biodiversity monitoring by measuring land-degradation indicators, key species that are representative of ecosystem status and introducing biodiversity elements into aquatic monitoring;

22. Supplement air-pollution emission data collected by statistical services with data collected by environmental control authorities and establish a central air databank;

23. Strengthen the role of environmental administrations in the collection and harmonization of waste management data in cooperation with statistical services and industry;

24. Promote, step by step, integrated data collection covering quality, quantity, biodiversity and ecosystem aspects;

25. Extend monitoring and assessment activities to measure the effectiveness of environmental policies (“Responses”), and use wider long-term environmental trends data for this purpose;

26. Make use of modelling, where appropriate, to reduce information gathering as such and reduce environmental pollution monitoring costs.

Supporting the Working Group on Environmental Monitoring

27. Participate actively in the activities of the Working Group, particularly those under the Tacis project on strengthening environmental information and observation capacity in the twelve EECCA countries. This should include, in particular, designation of experts and lead organizations, provision of information, hosting project meetings, and effective follow-up to planned activities that are aimed at:

1. Inland surface water monitoring

(a) Preparation of an in-depth study of the monitoring situation in inland surface waters, and the drawing-up of proposals for a basic EUROWATERNET network for each country of operation;

2. Air pollution monitoring

(b) Strengthening the capacity of new Parties to the Convention on Long-range Transboundary Air Pollution to comply with their data collection and reporting obligations under the Convention, including practical knowledge of ways and means to develop air pollution inventories, to apply measurement techniques and emission modelling for major pollutants, and to establish transboundary monitoring stations;

3. Waste classifications and inventories

(c) Strengthening national capacity to collect and assess data on waste generation, recovery and disposal, and to introduce into national information systems indicators on waste and material flows that are compatible with those applied in EEA countries;

4. Environmental indicators and reporting

(d) The application of a core set of environmental indicators used in EEA countries and the production of state-of-the-environment reports using the guidelines developed by the Working Group;

5. Environmental information systems

(e) Establishing, at the national level, Internet-based inter-connected environmental information systems, including reference centres, by using tools and guidelines applied within the EEA;

6. Remote sensing

(f) Identification and mapping of a key set of indicators, derived from remote sensing for environmental assessments in selected Eurasian regions and marine basins, and the development of proposals for a follow-up programme involving a demonstration exercise, an awareness campaign for potential end-users and training activities;

7. National Focal Points

(g) Strengthening technical and communication capacities of national focal points in the Working Group by the organization of training workshops and the provision, where necessary, of computer equipment and telecommunication means.

Annex II

GUIDELINES FOR THE PREPARATION OF GOVERNMENTAL REPORTS ON THE STATE AND PROTECTION OF THE ENVIRONMENT[2]

[2] Prepared by the UNECE Working Group on Environmental Monitoring and endorsed by the Fifth Ministerial Conference "Environment for Europe".

Introduction

1. If environmental protection is to be effective, priorities must be kept under constant scrutiny and reviewed when necessary in the light of changing circumstances; this may allow limited resources to be concentrated on the areas of environmental protection that command the highest priority. It is important for this purpose to have objective and up-to-date information on the state of the environment and natural resources available to both governmental bodies and the general public. Regular State reports on environmental status and protection are key information products in this sense, important components of the corpus of information available and of the entire process by which environmental information is distributed.

2. The present recommendations are based on a study of how reports are produced in 12 countries in Eastern Europe, the Caucasus and Central Asia. They take account of the particular role played by environmental status reports in these countries, notably the fact that they present multidisciplinary environmental information, reflect countries' individual needs as regards solutions to environmental improvement and protection problems, present findings essential to the adoption of environmentally meaningful decisions, provide information for use in preparing national environmental protection and environmental health plans and sustainable development strategies, help to integrate environmental policy into States' social and economic policies, help to select prime requirements and priorities in the environmental protection field, and facilitate exchanges of environmental information between countries.

3. The recommendations take account of international experience with the production of national reports amassed by the European Environment Agency, the Organisation for Economic Cooperation and Development and the United Nations Environment Programme (GRID-Arendal).

4. The objective of these recommendations is to provide the 12 countries' State bodies empowered to deal with environmental protection with methodical guidance on how to improve their production of State reports on the status and protection of the environment. Following such guidance will also help to harmonize the approaches taken by these countries and others in Western and Central Europe, and this will make it easier to conduct overall evaluations of the state of the environment in the UNECE region.

5. Special attention is paid to the choice of environmental indicators needed to evaluate the state of the environment, to the use of modern information technology in the production and distribution of publications, to the use of reports in the design of environmental policy and the taking of environmentally important decisions, to public access to the material in reports, and to methods of assessing the quality of reports once issued.

I. RECOMMENDATIONS ON ORGANIZATIONAL ARRANGEMENTS FOR THE PRODUCTION OF GOVERNMENTAL REPORTS ON THE STATE AND PROTECTION OF THE ENVIRONMENT

1. Legal status of reports

6. Reports should preferably have the status of official documents issued on behalf of the national Government concerned. That status may derive from a specific article in a law (an Environmental Protection Act, for example) requiring the Government to produce and circulate regular reports on the state of the environment, natural resources and nature-protection activities. With a view to stricter compliance with the law in force, it is important to strengthen the system that ensures transparency in the production of the reports and prevents arbitrary administrative decisions, such as decisions to tone down descriptions of serious environmental problems, the reasons why they have arisen or spread, ineffectual action to improve the environmental situation, or failure to respect deadlines for the production of reports.

2. Analytical approach to the preparation and presentation of material

7. Unlike the corresponding compilations of statistics, State reports on the status and protection of the environment should be analytical documents, i.e. present an assessment of the environmental situation and an analysis of the cause-and-effect relationships affecting it. This will allow them to be used as information resources when environmentally significant decisions on improvements in environmental, social and economic policy, laws and regulations, and in the State machinery regulating natural-resource use and environmental protection and monitoring compliance with environmental legislation are taken; when targeted environmental programmes and scientific and technical environmental security schemes are drawn up and put into effect; and when the effectiveness of action taken to protect the environment and make rational use of natural resources in support of sustainable development is assessed.

8. In essence, an analytical approach to the preparation and presentation of material for reports entails:

- The identification, when analysing data on the status of the environment and natural resources, of trends over the period since the production of the previous report as shown by comparisons of the data concerned;
- Identification of the reasons for the changes;
- Forecasts of changes over the forthcoming period;
- An assessment of the effectiveness of State environmental protection policy and steps taken to reduce adverse environmental impacts;
- Qualitative and quantitative evaluations of the status of the environment and natural resources and how they are affected by economic and other activity and by elemental forces.

3. Use of indicators to assess the status of the environment and natural resources

9. The production of environmental status and protection reports must be based on the selection and use of indicators enabling the environmental situation to be assessed with sufficient thoroughness.

10. In selecting indicators, it is important to bear in mind that as a first requirement they must help to give a correct impression in a readily comprehensible form of the processes taking place and the state of the items under observation, and to show how matters progress over time.

11. Indicators may be subdivided into the four main groups below:

(a) Indicators describing environmental impact;

(b) Indicators characterizing the state of the environment;

(c) Indicators describing environmental consequences;

(d) Indicators describing action taken.

12. Various environmental indicators that can be used to assess environmental quality and the state of natural resources, or for the purpose of monitoring, on behalf of the State, compliance by natural resource users with nature-protection laws, can be considered by way of example.

13. Each country must decide, in accordance with its natural, climatic and economic characteristics and the severity of the environmental problems confronting it, how much detail to go into under each heading and what indicators to use for the purpose. In all cases an effort should be made to use internationally developed series of indicators. As an illustration of such environmental indicators one may take those used to produce the Kiev Report on the state of the environment in the countries of the ECE region.

4. Purpose of reports

14. It will be helpful to Governments to define clearly the purposes their reports are to serve and basic report layout and content. It must be stressed that reports should provide a basis for clarifying priorities and aims in environmental protection work, and for the design and execution of programmes to improve the environmental situation in individual countries. They should directly further the goals of environmental policy.

5. Sources of financing for report production and printing

15. Governments need to define clearly the sources of financing for the production and printing of reports. In the main, outlays should be covered by State budgets and the budgets of regional and local State bodies. Budgetary resources must be used to finance report production and printing, but also the distribution of reports to their intended readerships at the State, regional and local levels.

16. Resources for producing, printing and distributing reports may also come from all interested parties: businesses, companies, entrepreneurial associations, domestic and foreign donor organizations and funding bodies.

17. Help with meeting the costs of report production, printing and distribution need not only take the form of financial resources. For instance, non-governmental organizations may help run campaigns to inform the intended readership of the main points in a report, conduct press conferences and briefings, and organize seminars and information meetings on the topics the report covers.

6. Target readership

18. It will be helpful to Governments to define who will make direct use of the report: the findings will be chiefly addressed to those users. Such users may include:

- Legislative and executive bodies;
- Federal ministries and departments;
- Regional and local authorities.

19. It will be helpful if the target readership of environmental status reports also includes the following:

- Scientific and academic organizations;
- Business associations;
- Voluntary organizations (environmental groups, consumer associations, professional associations, women's and youth organizations, invalids' associations) which can make use of the material published in reports to inform the public at large about environmental issues, the use of natural resources and public health.

7. Institutional setting for report production

20. Governments need to ensure that within the institutional setting there is close cooperation between State and other bodies involved in report production by designating a permanent, specially authorized State environmental protection body to be responsible for the production and subsequent distribution of reports. This State body should:

(a) Be entitled to obtain necessary information from State institutions engaged in:

- Monitoring the environment and environmental resources and the state of the country's cultural and archaeological heritage;

- State regulation and control of natural-resource utilization;
- Protection of the natural environment and natural resources;
- State environmental assessment;
- Producing State statistics on natural-resource utilization, environmental impact and expenditure on environmental protection;
- Health and epidemiological monitoring and other functions associated with assessing the effects of the state of the environment on public health;

(b) Determine the principal sources of information for producing reports:

- Organizations assigned to supply information for a report;
- State statistics;
- Data at the disposal of organizations supported by the State budget;
- Data at the disposal of independent experts and voluntary organizations (chiefly for comparison with official information and to identify the reasons for discrepancies);
- Data from international nature-conservation information centres;
- Data obtained by national academic institutions through grant funds;
- Data available from the management of privatized enterprises;

(c) Build up the environmental monitoring system as the primary source of information on the state of the environment with a view to establishing an objective database for subsequent use in producing reports; and institute a unified system of pollution indicators and critical pollution-level and environmental-burden levels;

(d) Launch and update a basic collection of environmental indicators for use at the national and regional levels;

(e) Establish an electronic databank for use in report production;

(f) Consult, and coordinate the activities of, co-users;

(g) Be responsible for systematizing and analysing the information it obtains, drafting a report and submitting it in good time to the Government for consideration and approval;

(h) Make sure that the report covers an optimum range of topics;

(i) See to the creation of an interdepartmental group of experts and consultants comprising responsible representatives of key ministries and governmental departments, academic and voluntary organizations to produce different chapters of the report;

(j) Analyse the material submitted for the report;

(k) Establish a procedure for review of the draft report before it is submitted to the Government, ensuring that representatives of all ministries, governmental departments and services are involved, along with

representatives of leading academic organizations and the public environmental movement helping to produce the draft;

(l) Consult the group of experts and consultants at various stages during the production of material for the report, including the final version before submission to the Government;

(m) Draft Government instructions to the various ministries, governmental departments and regional administrative heads requiring them to take action in response to the proposals and recommendations for improving the environmental situation made in the report;

(n) Determine how often the report should come out;

(o) Help to circulate the report widely after publication;

(p) Initiate an assessment of the quality of the report after it is issued and distributed to its target readership and immediate users.

21. In principle, it would be expedient to have the layout of the report determined by the Government; it is important, however, to allow the State body assigned to produce the report to amend the layout in the light of changing environmental circumstances, priorities, opportunities to obtain essential material and so forth.

8. Use of modern information technology in reports

22. It is important for Governments to initiate the use of modern information technology for the production of reports. This will make reports easier to use, will reduce the volume of material and allow information to be better presented. Tables, diagrams, graphs, sketches and maps accompanied by explanations, analysis and interpretation are examples of modern information technology.

23. Numerical material should not be confined to absolute quantities accompanied by the appropriate symbols and values. Figures must be compared with current health and hygiene standards, emissions standards, established values for critical loads on elements of the environment and standards governing rational natural-resource use.

24. The combination of text with illustrative material helps information to be better understood. This kind of presentation makes reports easy to use not only for an initiated professional readership but also for the public at large.

25. Satellite data have been winning increasing recognition of late. It is important, however, to accompany photographs produced from satellite data with detailed descriptions and interpretation.

26. At the same time, it is a good idea to include maps showing pollution sources, the spread of pollution from particular sources, contaminated areas and specially protected natural areas.

27. It is useful to give diagrams showing, among other things, the ratio in percentage terms between given values, and graphs accompanied by similar interpretations. Presenting information in graph form is a particularly good idea in cases where certain parameters display a trend over a defined period of time.

9. Report distribution procedure

28. It is useful for Governments to establish a procedure for the distribution of reports with due regard for the requirements of the target readership. Reports need to be distributed:

- To the target ministries and governmental departments concerned;
- Over the Internet;

- In the mass media;
- Through voluntary organizations' information services;
- During information meetings with the general public;
- At seminars and conferences on topics relating to nature conservation.

10. Report evaluation

29. It is useful for Governments to initiate an evaluation of the quality of a completed, published report based on the opinions of report users. The evaluation should rest on the following primary considerations:

- The quality, completeness and accuracy of the material presented;
- The layout of the publication;
- Ease of use;
- How easy it is to make use of material from the report in reaching environmentally important decisions and formulating environmental policy.

30. A completed report can be evaluated as follows:

- Polling experts in ministries and governmental departments for their opinions on the utility of the report in their work;
- Polling public opinion;
- Using questionnaires;
- Comments by experts involved in producing the report;
- Media coverage of report content;
- Readers' comments;
- Telephone hotline;
- Surveys.

31. After evaluating the report it is important to consult experts, representatives of the ministries and governmental departments concerned and the general public on how to improve the report and make it more useful in the decision-making process.

II. RECOMMENDATIONS ON BASIC SECTIONS OF THE REPORT

32. The basic sections of a report include:

- Introduction;
- Environmental quality and state of natural resources;
- Environmental impact;
- Environmental situation in the regions;

- Environmental policy measures and governmental regulation of natural-resource use and environmental protection;

- Conclusion.

1. Introduction

33. It is helpful to include in the introduction a short description of particular features of the socio-economic situation in the country and changes in the volume and composition of industrial output (greening of production, reductions in energy intensity of output, depreciation of capital assets, extent to which innovative, resource-conserving and nature-conserving technology is used, changes in per capita consumption of natural resources, per capita environmental emissions), in the urban and rural economies and in the transport sector that have occasioned these and other changes in the state of the environment and environmental resources. An effort should be made to show the environmental impact of social factors such as poverty.

34. The introduction should also list the State, academic, voluntary and other organizations that took part in the production of the report.

2. Environmental quality and state of natural resources

35. Under environmental quality features it is useful to consider the following.

A. Air quality

36. Air quality in cities and industrial centres should ideally be described using the monitoring data below:

(a) The number of cities where, in the reference year, annual average maximum permissible concentrations were exceeded once or more in the case of at least one pollutant, and the proportion of the population exposed;

(b) The number of cities where maximum permissible concentrations for a single occurrence were exceeded 10 or more times, and the proportion of the population exposed;

(c) The number of cities with high air pollution as defined by a combined indicator, e.g. levels more than five (seven) times as high as aggregate yearly average maximum permissible concentrations of all substances measured, expressed in terms of the maximum permissible concentrations of sulphur dioxide, and the proportion of the population exposed to pollution at this level;

(d) The number, and a list, of cities with very high air pollution as defined by a combined indicator, e.g. levels more than 10 (14) times as high as aggregate yearly average maximum permissible concentrations of all substances measured, expressed in terms of the maximum permissible concentration of sulphur dioxide, and the proportion of the population exposed to pollution at this level.

37. Descriptions should also be given of:

(a) Overall nationwide emissions of principal atmospheric pollutants;

(b) Background air quality (preferably in biosphere reserves and other such relatively unpolluted areas);

(c) Transboundary atmospheric pollution by acidifying and eutrophying substances, heavy metals and persistent organic pollutants covered by the 1979 Geneva Convention on Long-range Transboundary Air Pollution and its protocols, and by the 2001 Stockholm Convention on Persistent Organic Pollutants.

38. It is also important in this section of the report to identify the most difficult periods of time as regards declining air quality over the reporting period and to list the reasons for the decline (drought, forest fires, industrial emissions, vehicle exhaust and so forth).

39. This section should be accompanied by a discussion of the reasons for declining air quality (non-compliance with nature-conservation legislation, inadequate financing, poor management skills, breaches of administrative requirements, etc.).

40. The section should close with a list of specific steps to improve the current situation (legislative initiatives, participation in international nature-conservation programmes and projects, investment projects, donor assistance, technical assistance, advanced training for technical experts, etc.).

B. Climate change and change in the ozone layer

41. In presenting information about climate change and change in the ozone layer it is appropriate to:

(a) Describe the climatic features of the year (the course of air temperatures, temporal and geographical distribution of precipitation, when snow cover accumulated and dispersed, etc.) in comparison with the corresponding multi-year averages;

(b) Provide data on greenhouse gas emissions;

(c) Provide data on ozone-depleting substance production and imports;

(d) Describe the status of the ozone layer using figures on overall ozone content across the territory of the country or individual regions in the reporting year by comparison with multi-year averages;

(e) Describe solar activity and its environmental impact, including natural disasters, biodiversity, human health and the climate.

C. Surface and underground water

42. In presenting information on water quality it is helpful to:

(a) Indicate water levels in rivers in the reporting year in comparison with multi-year average flows throughout the country and in individual river basins within it, since the dissipation of run-off depends on water levels in watercourses and reservoirs, and provide figures on average run-off of each of the most widespread pollutants by comparison with the preceding year(s);

(b) Present water quality indicators for specific pollutant content as multiples of the maximum permissible concentration;

(c) Provide figures on both maximum measured values and values averaged over a fairly dense series;

(d) For fished bodies of water, also provide data on acidity; if this drops to dangerous levels it is important to establish the reasons, whether natural or man-made.

43. The report should provide information on the specific action taken by the bodies concerned to improve water quality (water protection, restoration and improvement projects; securing financing and technical assistance for projects; effectiveness of monitoring arrangements; involvement of the general public in efforts to improve water quality, etc.).

D. The marine environment and coastal areas

44. The report can describe the marine environment and coastal areas using indicators of coastal and estuarial water pollution, migration areas and spawning grounds for commercially fished species, and pollution of recreational marine and coastal areas. There may also be movement of the shoreline under the influence of tides and currents and intensified elemental or man-made factors.

45. When looking at coastal areas contiguous with those of other countries, it is important to present information on transboundary pollution and data from reports not only by the country currently preparing its report but also other countries along the coast. For each pollutant, it is important to furnish indicators of how much enters the water from sources within the reporting country and of transboundary pollution as a percentage of the total.

E. Land resources and soil

46. When substantial alterations in land use are taking place, it is important for reports to show the changes: what kinds of land or reserve are diminishing in area and what kinds are expanding owing to shifts of category, and what kinds are shrinking owing to wind and water erosion, becoming desert, being overgrown with scrub and woodland, etc. What changes are occurring as regards soil quality - changes in humus content, acidity, nutrient content, persistent pesticide content, swamp formation, salination, etc.

47. On the basis of the material received it is important to list the main causes of land degradation (urban development, construction of transport systems, hydraulic engineering work, mining ventures), besides erosion, salination, swamp formation, etc.

48. The report should list the main kinds of action taken at different levels to combat erosion and land degradation (sustainable farming, reductions in livestock numbers, establishment of recreational areas, etc.).

F. State of natural plant life

49. In the coverage of this topic special attention deserves to be paid to changes in the state of natural plant communities peculiar to tundra, taiga, steppe, desert and other such environments.

50. The state of woodland should be assessed not only from changes in the overall area of wooded land but also from the ratios of areas of woodland assigned to various use categories, changes in areas under the most valuable species, estimates of annual timber growth, areas harvested, maintenance and preventive felling, forest restoration, losses due to poaching, fire, disease, pest incursions, man-made pollution, etc.

51. This section must include information about action to restore and preserve forest ecosystems: to reduce man-made pollution, plant trees, fight forest pests and diseases, fight forest fires, do drainage and irrigation work, establish recreational areas, conduct sustainable forestry programmes, carry out international technical cooperation programmes and so forth.

52. It is also important to provide information about the activities of national and international companies logging and felling and to consider how well these activities conform to environmental standards and requirements.

53. The report should devote some space to the utility of cultivating genetically modified trees and the preservation of natural diversity among forest ecosystems.

54. The section should close with specific recommendations for improving the state of woodlands, namely increasing the amount of forested land, planting, preventing disease, fighting forest fires and promoting sustainable forestry.

G. State of animal life

55. It is useful, in covering this topic, to present data on changes in numbers of hunted species of wild animals and how they relate to the availability of food, the hunting trade, natural conditions during the year and so forth. It is important to assess the reasons for declining numbers of some hunted species (poaching,

injudicious hunting, pollution, etc.). It is worth while presenting information on national, regional and local action to boost numbers of hunted wild species, such as legislative initiatives, efforts to combat poaching, and artificial breeding.

56. It is sensible to assess the state of fish resources from fish stocks, quality (prevalence of disease resulting from water pollution, presence of contaminants in the flesh) and both marine and inland fisheries. In so doing it is useful to assess the environmental state of rivers and lakes (in terms of fisheries requirements) and provide data on artificial restocking. Countries with a marine fishing industry will also find it helpful to ascertain the status of marine animals, molluscs, crustaceans and so forth. It is important to give such information in comparison with the preceding period.

57. It is important to analyse changes in the state of fish resources and assess the reasons for any deterioration, such as declining catches. Information must be given about national action to increase fish stocks (action to combat poaching, artificial breeding and introduction of valuable species, participation in the implementation of international agreements).

H. Specially protected natural areas, biodiversity, rare and endangered species

58. It is advisable to report on biodiversity in the sense of changes that have occurred over the country as a whole during the reporting period and in those districts where the greatest changes are apparent.

59. It is useful to look separately at each category in the case of changes within specially protected natural areas:

(a) State nature reservations;

(b) State reserves;

(c) National parks;

(d) National monuments;

(e) Spas, health resorts, etc.

60. Among rare and endangered species, priority coverage needs to be given to those that are already listed in the Red Book, and those that ought to be.

61. It is helpful to present information on resources earmarked for supporting the protected-area system and improving laws and regulations with a bearing on the protection of biodiversity.

62. It is also important to present information about action under programmes to prevent degradation, international treaties and biodiversity conventions to which the reporting country is a party.

63. Besides this, reports must contain data on the expansion or shrinkage of specially protected areas; on growing or declining financial support for the protected natural area system; on support for civil initiatives; on involvement in international biodiversity-protection programmes and projects; and on efforts to secure technical and donor backing.

I. State of the geological environment, effects of mining and use of minerals

64. The state of the geological environment should be taken to mean the presence and development of sinkhole formation, thermokarst activity and earth creep, ground subsidence occasioned by underground mineral workings, crustal fissures, rises in ground water resulting from human activity, and other such phenomena causing damage to buildings, transport and power lines and threatening human lives.

65. These need to be evaluated in terms of their scale and the extent of the threat they pose, the speed at which they are developing, and the harm they do to the economy and the general public. It is important to include information on the steps being taken to prevent the emergence or spread of such phenomena and assess whether those steps are adequate.

66. Opencast and underground mineral working should be considered in terms of the concomitant disturbances to the landscape, surface and underground water, and air pollution resulting from blasting, spoil-heap burning and flaring, the venting of hydrogen sulphide from pits and so forth.

67. It is helpful to assess the use of extracted minerals as percentages of minerals extracted from ore, the degree of multiple mineral extraction, the quantity of spoil dumped per unit of final output, etc.

J. Environmental health situation and its effects on public health

68. This section may describe the effects of an unfavourable environment on human health. It should also list measures taken to reduce the health impact of unfavourable environmental conditions.

69. The purpose of this section is not to duplicate reports on public health. If omitted, however, it significantly reduces the value of the report for the purposes of taking environmentally significant decisions and formulating environmental policy.

70. It is helpful to present changes in disease levels resulting from unfavourable environmental conditions against a background of general demographic processes (births, deaths, population increase or decline (corrected for immigration and emigration)) and an assessment of living standards among the population at large.

71. It is important to show the influence of pollution (air, water and soil) by specific contaminants on disease levels (including genetic and reproductive disorders), and on the incidence of disease among principal population groups (children and adults in various age cohorts) during the reporting year. This is usually given in the form of a comparison with disease levels among the corresponding population groups in relatively "clean" cities. It is also important to assess the impact of drinking water quality on public health.

72. In States with radioactively contaminated areas as a result of nuclear weapons tests and nuclear accidents it is important to give an estimate of radionuclide contamination of locally produced foodstuffs and the steps being taken to secure "clean produce".

73. Problems with increasing noise levels, vibration levels and electromagnetic fields and radiation have been growing more severe in recent years, and it is therefore useful to cover these points, too, insofar as they affect people's health.

74. Environmental health also includes matters such as the spread of cellular encephalitis and malaria and outbreaks of malignant anthrax and other dangerous animal diseases that can be transmitted to humans.

K. Environmental contamination with waste

75. The generation of industrial, agricultural and municipal waste, and its storage and transformation into useful products or remediation and disposal, is also an important section of the report. In covering the waste problem it is advisable to show trends in the overall volumes of toxic waste generated and accumulated over the course of the year. It is helpful to show changes in the generation and accumulation of wastes in different hazard categories and in the volumes of waste recycled, remediated, stored and buried nationwide. It is important to show changes in the amounts of land set aside for waste storage, and to establish the reliability of such storage sites together with their impact on surface and underground water quality.

76. Where applicable, the problem of liquid and solid radioactive waste, the accumulation of such waste, and the conditions in which it is temporarily held, reprocessed and buried needs to be treated separately.

77. Information should be provided on municipal-level waste collection and recycling, the financing available for such services, the status of dumps and processing sites, and new waste-processing and resource-recovery initiatives. It is helpful if the report also highlights efforts to inform the public and involve it in the waste-management process.

78. It is also important to provide information on the status of laws and regulations on waste management that are in preparation, on the amount of investment attracted, and from what sources, on technical and donor assistance in the execution of specific municipal and regional-level projects, on exchanges of experience with other countries in running programmes to maximize waste recycling into useful products and adopt low-waste manufacturing techniques, and on avoiding the danger of adopting environmentally dangerous technologies and means of destroying highly toxic waste that do not correspond to environmental requirements.

L. State of the historical and cultural heritage

79. It is sensible to indicate the influence of environmental factors on the state of historical and cultural monuments using data on losses of such monuments over the reporting period to the destructive effects of nature and human agency. Human agency broadly includes acidic air pollution, destructive underflooding of the foundations of historical and cultural monuments, and vibration.

80. The integrity of the historical and cultural landscape has recently come to be marred also by unauthorized construction, disfiguring reconstruction of architectural monuments, looting of architectural sites and so forth.

81. Information on such losses must be accompanied by details of the legislative action taken and of improvements to records and expert evaluations of site condition and preservation.

3. Environmental impact

82. The main indicators of environmental impact attributable to each branch of the national economy and the Armed Forces may be expressed with the help of the following data:

(a) Atmospheric emissions of aggregate, basic and specific pollutants (in thousands of tons/year);

(b) Volumes of waste water discharged (in millions of cubic metres/year) and discharges of basic and specific pollutants in waste water (in tons/year), and indicators such as volumes of water consumed or used and returned, volumes of water saved by using closed-cycle circuits, emissions of waste water purified to established standards, etc., quantities of manufacturing and consumer waste generated over the reporting year, disaggregated by hazard category and by quantities used, remediated and stored over the reporting year, and total volume of waste accumulated including that from previous years;

(c) Quantities of manufacturing and consumer waste generated over the reporting year, disaggregated by hazard category;

(d) Quantities of waste used, remediated and stored over the reporting year and total quantity of waste accumulated including that from previous years;

(e) Land set aside for construction, for mineral extraction, for waste storage, etc.

A. Industry

83. Under industrial impact on the environment it is sensible to provide the data covered in this section for the sector as a whole and data disaggregated by principal industries (electrical power, coal, oil mining, oil refining, gas, ferrous and non-ferrous metals, building materials, chemicals and petrochemicals, timber processing, cellulose and paper manufacturing, machine tools and metal processing, light industry, food, the nuclear industry and nuclear power, etc.).

84. By comparing indicators for the environmental impact of enterprises in the principal branches of industry it is possible to set priorities for the regulation of their impact, in particular by imposing tighter checks on compliance with environmental-protection law, and by reviewing conservation standards, norms and requirements.

85. Data for this section of the report may be easier to collect if the country develops a national register of emissions and pollutant transport.

86. It is important to provide information on steps being taken, nationally and locally, to mitigate the adverse impact of industry on the environment (a review of current regulations, for example, and the introduction of new ones meeting European standards).

B. Transport

87. In assessing the environmental impact of transport it is sensible to provide the data covered in this section for the transport sector as a whole and data disaggregated by principal modes of transport (road, river, sea, rail, air, industrial, etc.).

88. In assessments relating to the transport sector as a whole it is important to determine what proportion of the impact arising from man-made atmospheric emissions, water pollution and waste generation it accounts for.

89. For road transport it is sensible to determine the contribution to urban air pollution due to:

- Total volume of exhaust gas emissions;
- Emissions of individual pollutants, including carbon monoxide, nitrogen dioxide and lead;
- The quantity of rubber dust formed during tyre tread wear.

90. The accumulation of used tyres, lubricants, etc. also merits attention.

91. Under river and sea transport, particular attention must be devoted to water pollution with petroleum products, household liquids and solid waste.

92. Under air transport, particular attention should be paid to noise impact levels on the population living near airports.

93. It is important to provide information on steps being taken, nationally and locally, to mitigate the adverse environmental impact of transport (use of lead-free petrol, adoption of new rules and regulations, increased taxes on old, foreign-manufactured vehicles and so forth).

C. Housing and community services

94. Experience has shown that the environmental impact of housing and community services needs to be assessed in terms of air pollution by furnaces providing heating and hot water, water pollution caused by discharges of insufficiently treated household and communal sewage, and soil pollution by waste dumps which may in turn be sources of soil, water and air pollution.

95. It is important to disclose in the reports what efforts are being made by local authorities to deal with these problems (waste-dump management, construction of new and repair of existing treatment facilities, use of environmentally clean fuels in furnaces, public education and so forth).

96. It is important to indicate how work to mitigate the adverse impact of housing and community services on the environment and human health is being financed (volume and sources of financing, estimated efficiency in the use of funds).

97. It is also of interest to present information on the effects of raising the prices for communal services (improved levels of public service, more efficient management of housing and community services, etc.).

98. It is important to provide information on involvement in international technical assistance programmes to improve the treatment facility system, attract donor support, and make effective use of existing financing.

D. Farming

99. The impact of farming and the environment is most often seen in:

(a) Air pollution by ammonia emissions from poultry-breeding and stock-raising facilities;

(b) Water pollution when manure storage areas at stock-raising facilities are breached and manure is washed away;

(c) Helminth contamination of soil when undecontaminated manure is spread.

100. The environmentally safe destruction of animals that have died or been slaughtered in connection with outbreaks of anthrax and other such dangerous diseases is also a significant problem.

101. The quantities, storage conditions and destruction of out-of-date and banned pesticides are, likewise, very important problems. It is appropriate to provide information on the country's involvement in national and international programmes inventorying and destroying stocks of out-of-date pesticides.

E. Tourism

102. The impact of tourism on the environment merits attention where tourism adversely affects the preservation of declared world heritage sites or the state of nature reservations and reserves.

F. Technology-related accidents and disasters

103. The report should consider all basic technology-related accidents and disasters from the point of view of their consequences for the environment and public health.

104. In industry, such events may be accompanied by accidental atmospheric emissions of noxious substances following explosions and fires, loss of pressure in technological equipment, damage to tanks, factory piping systems and so forth. They may also be accompanied by the release into watercourses or spillage of harmful substances for the same or similar reasons, and by the failure of treatment facilities.

105. In all such cases it is important to estimate the damage caused to public health, plant and animal life, and the economy of the region.

106. Transport accidents and disasters with environmental consequences may be of various natures, and may be accompanied by releases into the environment of ammonia, petroleum-refining and petrochemical products, fluorine and other dangerous substances.

107. Accidents associated with communal services generally involve failures of or damage to sewers as a result of building and repair work, or the failure of water treatment facilities accompanied by releases of sewage into the environment.

108. It is important to present information on steps being taken, nationally and locally, to mitigate the adverse impact of technology-related accidents and disasters, and especially as regards preventive measures.

109. It is important to present information on the steps countries are taking to ensure nuclear and chemical safety and to deal with emergencies associated with technological activity and natural disasters.

G. The Armed Forces

110. It is sensible to regard the environmental impact of the Armed Forces in exactly the same way as that of industry, transport and communal services, but particular attention needs to be paid to details specifically related to military activity (effects of radar systems, ground pollution with liquid fuel components in areas where missiles are launched and parts separating from missiles land, the problems of recycling decommissioned naval vessels including nuclear submarines, removal of the reactor cores from nuclear submarines, the storage of liquid and radioactive solid waste, etc.).

111. It is sensible to present recommendations on financial and technical assistance for the Armed Forces in dealing with environmental problems.

4. The environmental situation in the regions

112. When covering the environmental situation in specific parts of the country, it is sensible to do so on the basis of established administrative divisions.

113. The regional environmental situation can be evaluated using a range of indicators. The percentages of the population living in towns and cities subject to annual average concentrations of atmospheric pollutants of above the maximum permissible concentration, above 10 times that concentration, and to above 7 and above 14 times the Air Pollution Index, aggregate atmospheric emissions of all pollutants from all categories of pollution source in the region and aggregate emissions from enterprises in each industry, and aggregate emissions from all sources of each basic and specific air pollutant may be socially significant.

114. Such estimates may also include comprehensive indicators of pollution in principal bodies of water, aggregate discharges of waste water and of pollutants in waste water, and aggregate volumes of toxic waste accumulated over the reporting period.

115. Indicators of demographic changes and the frequency and nature of illness, especially among children, may also be important socially significant estimates.

116. It is useful to compare all such estimates with those applicable to other regions, ultimately ranking regions by their levels of environmental stress.

5. Environmental policy measures and State regulation of natural resource use and environmental protection

117. It is advisable to provide in the report information on environmental policy measures laid down in legislation, national plans of action and other governmental documents. Indicators describing the outcome of such measures in terms of reduced levels of environmental pollution and better use of natural resources based on environmental monitoring data and environmental burdens must be provided.

118. An analysis of changes occurring in the factors influencing pollution levels may provide a foundation for a forecast of changes in the state of the environment and the development of recommendations for improving it through improvements to legislation, the use of economic levers to influence natural-resource users, the standardization and regulation of environmental impact, closer State monitoring of pollution sources, etc.

A. Improvements to legislation

119. It is sensible to provide, in this part of the report, information on new laws governing relations in the rational use of natural resources and environmental protection that have been drawn up during the period under consideration, and to explain their significance. It is also important to supply data on the effectiveness of existing laws in this area and gaps within them, and to recommend how the system of nature-protection laws could be improved.

B. Improvements to the system of State standards, norms and regulations

120. It is important to provide information on improvements during the reporting period to the system of State standards, norms and regulations on the reporting and limitation of atmospheric emissions, discharges of polluted waste water, the storage of solid waste from all categories of sources, the rational use of natural raw materials, the regeneration of renewable natural resources and so forth. This can helpfully be supplemented by estimates of the efficiency of particular State standards and norms, progress in updating them and bringing them into line with international norms and standards adopted under various regional and global treaties. Special attention should be given to progress in harmonizing State standards and norms in the 12 countries with those of the other countries in the UNECE region, and in particular with those drawn up by the European Union.

C. National environmental plans and programmes

121. It is appropriate to lay out the basic principles of State environmental policy as enshrined in national plans of action for the protection of the environment and the rational use of natural resources and in programmes to improve the environmental situation in specific industrial centres and regions. A discussion of the progress of such plans and programmes, their effectiveness, and how they are provided with financing from various sources is useful. Reports must reflect the way that State authorities interact in the nature conservation and environmental protection field with regional and local authorities, especially as regards financial, administrative and organizational support, the execution of State environmental programmes, and the conduct of a single national environmental policy.

D. Economic tools

122. It is helpful to provide information on the use of economic tools to regulate natural-resource use and protect the environment from pollution and other forms of degradation, on how such tools are bound up with established emission norms and environmental quality standards, and on how economically and environmentally effective approaches to preventing and combating pollution combine.

123. It is advisable to report on the effective application of:

(a) Economic incentives (subsidies, preferential loans, tax advantages and so forth);

(b) Binding economic mechanisms (payments, taxes and fines for polluting the environment, using forestry resources, water, land, etc.);

(c) Restitutive or compensatory mechanisms (insurance liability for environmental damage, material compensation for damage and so forth).

124. In considering the use of economic tools, it is important to take into account the ability of regulatory bodies to set pollution charges at a level that will encourage avoidance of or reductions in adverse environmental impact and ensure that natural resources are efficiently used. It is also important to consider whether resource prices and tax rates are sufficiently high to bring about the desired changes in polluting businesses' behaviour, foster preventive measures and encourage the adoption of clean technology.

125. The report must present information on pollution monitoring and, in particular, the imposition of fines and penalties: how the size of fines and the severity of penalties, depending on how far established limits, standards and norms are exceeded, affect natural resource users' attitudes towards compliance with environmental protection laws.

E. Monitoring of environmental pollution and the state of natural resources

126. The report should briefly set out the situation of the current monitoring system in the country, list monitoring stations, indicate the volume and nature of the information submitted and opportunities to make use of this information in various analytical and planning documents at the national level as a primary source of information on the state of the environment and natural resources.

127. It is important to discuss the possibilities for using data from national monitoring systems in the production of international papers, accounts and reports such as the UNECE region environmental assessments.

128. It is advisable to provide information on financing for environmental monitoring systems, the use of modern technology and future prospects.

F. State monitoring of compliance with environmental legislation

129. The operation of the State system monitoring compliance with environmental protection legislation (State agencies, inspection authorities, the environmental prosecutions authority, environmental police, border service, etc.) must be described and illustrated with concrete data: numbers of checks carried out, number and nature of violations discovered, penalties applied, damage averted or compensated for, etc. It is appropriate to set out the factors impeding more efficient operation of the system and offer recommendations on how to overcome them.

G. State environmental assessments

130. It is useful to present figures on the total number of State environmental assessments carried out at various levels, the number of construction and rebuilding projects and programmes turned down and so forth. The largest projects given an adverse rating should be identified, along with the consequences that carrying them out might have. It is advisable to present information on how the efficacy of State environmental assessment law is evaluated and what needs to be done to improve the operation of State environmental assessment services at various levels.

H. Outlays on environmental protection

131. It is appropriate to present figures for overall outlay on environmental protection (capital construction, major and running repairs, operating costs associated with nature conservation equipment, maintenance costs for nature conservation services, etc.) from all sources during the reporting year, and how much this represents as a proportion of GDP.

132. It is useful to indicate overall outlays in each main area (air-quality protection, protection of water, soil, forests, fish resources, etc.).

133. It is also useful to provide information on sources of financing (the State budget, local budgets, special-purpose funds, subsidies, preferential loans, non-budgetary resources, foreign aid). It is important to provide examples of financing being made available for nature-conservation programmes, indicating how much has been made available and from what sources.

134. It is also important to give figures on aid provided for fulfilling undertakings resulting from countries' accession to international treaties and conventions. Accession to the Stockholm Convention on Persistent Organic Pollutants, for example, enables countries to receive funds from the Global Environmental Facility for use in producing national plans of action to give effect to the Convention.

135. It is sensible to evaluate the effectiveness of outlays on environmental protection and the rational use of natural resources.

I. International cooperation, technical, financial and advisory assistance

136. It is appropriate to indicate in the report the specific outcome of cooperation with international organizations and assistance from other countries, funds and international financing institutions in coping with environmental problems. The report should detail technical assistance provided for the execution of specific environmental protection programmes and projects, indicating amounts and sources. The effectiveness of such assistance must be evaluated, along with the extent to which local experts are involved in joint programmes and projects. It is important for reports to offer specific recommendations

on the proper use of technical assistance in coping with environmental protection issues of the highest priority, especially the creation of pilot versions of the most environmentally advanced technology, equipment, manufacturing processes and tools. There should also be a short description of planned technical assistance programmes in the environmental protection field which the country intends to put before donor organizations.

137. It is sensible for reports to list the international treaties and conventions to which countries are signatories or parties. It is important to provide information on how the requirements of such international agreements are reflected in national legislation.

138. There also needs to be a special section of the report assessing the implementation of resolutions, recommendations and decisions taken by the supervisory bodies of these international agreements. It is important to identify what countries must do to give fuller effect to conventions. Special attention should be given to information on possible sources of financing for attendance at a variety of gatherings held under the different conventions and participating in working groups on particular provisions of international treaties and conventions.

139. It is advisable to consider the question of accession to multilateral environmental agreements on the protection and use of water resources, air-pollution monitoring and control, the handling of dangerous waste, environmental impact assessment, the prevention of industrial accidents, climate change, protection of the ozone layer, biodiversity, protection of the marine environment and access to environmental information.

140. It is important for reports to cover compliance with bilateral treaties and agreements on the protection and use of the environment and natural resources - transboundary watercourses and protected natural areas, for example. It is helpful to describe the actual outcome of such cooperation, including exchanges of information and experience.

141. Reports must provide information on the establishment and operation of institutional machinery to improve coordination among countries in the implementation of international treaties and conventions. Special attention should be paid to countries' involvement in foreign assistance schemes supporting the execution of specific nature-conservation programmes. It is sensible to put forward recommendations on how to make it easier to attract international aid. Attention should in particular be devoted to stimulating investment, boosting potential and expanding reciprocal transfers of technology.

J. Involvement of environmental non-governmental organizations and other major groups

142. The principle of public involvement in efforts to address various social problems has become an inseparable part of the founding instruments of the United Nations and other international organizations.

143. It is therefore sensible for reports to reflect the involvement of representatives of environmental non-governmental organizations in State environmental assessment exercises, inspections of natural-resource users, and the organization and conduct of various activities promoting environmental awareness among the general public and involving the public in nature-conservation activities. Taking due account of public opinion in formulating environmental policy, plans, programmes and economic projects is a matter that merits particular attention.

144. Where voluntary organizations supply specific data on air and water pollution and the efficiency with which natural resources are being used for inclusion in reports, it is sensible to compare these data, at the point when material submitted for inclusion is being considered, with data from official institutions. In the event of discrepancies between the official data and data from independent experts, it is important to establish the reasons for these and to use the more reliable figures.

145. Countries that have ratified or signed the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters need to provide information in their reports on their progress in giving effect to the Convention and the obligations they

have undertaken. It is desirable for reports to include specific examples of environmental information being made available to the public, public participation in environmental conservation questions, and access to justice.

146. There should be a special section of the report dealing with the provision to the general public of information on dangerous activities, the risks of industrial accidents, safety measures, and what to do in the event of an accident.

K. Environmental education and awareness

147. This section should show how the system of continuing environmental education - pre-school, and general and professional - has progressed during the reporting period. It is also important to present information on the training and retraining of environmentalists in secondary and higher educational institutions, advanced courses they have taken, and the promotion of environmental awareness among the general public.

148. It is important to include figures on current publications (newspapers, journals, bulletins) in the environmental field, whether issued by government bodies or by private publishers and voluntary organizations. It is of interest to indicate what proportion of these should be categorized as specialist literature and what proportion is intended for the general reader, and whether these publications are used in the environmental education system. It is also of interest to indicate what environmental material is made available in these publications, how large the print runs are and where the financing comes from.

149. Reports should make available information on higher educational establishments training expert environmentalists, and give a shortlist of academic courses on environmental protection issues.

L. Environmental research and projects

150. It is useful to provide in this section brief information on the role of basic and applied science and of engineering development projects in addressing environmental problems, including environmental safety. It is important to describe the outcome of completed projects of practical significance and describe the potential effects of applying them in practice in the course of natural-resource use and environmental protection.

6. Conclusion

151. It is useful to present, in the conclusion to the report, basic conclusions, forecasts and proposals. There should be a brief account of successes and failures in efforts to improve and protect the quality of the environment. It is sensible to provide a short statement of the reasons for failures and prospects for overcoming environmental protection problems.

Annex III

OVERVIEW OF INDICATORS USED IN EECCA SoE REPORTS

Issue	Indicator	ARM	AZE	BLR	GEO	KAZ	KGZ	MDA	RUS	TJK	TKM	UKR	UZB
Climate change	Emissions of 3 main greenhouse gases (CO_2, CH_4, N_2O)	+		+				+		+	+		
	Annual surface temperature			+			+	+	+	+	+		
	Annual sum of precipitation			+			+	+	+		+		
Air quality	Aggregated emissions from stationary sources	+	+	+	+	+	+		+	+	+	+	+
	Emissions of SO_2 from stationary sources	+		+	+	+	+	+	+		+	+	+

Emissions of NO_x from stationary sources	+		+	+	+	+	+	+		+	+	+	
Emissions of VOC from stationary sources	+		+	+		+	+	+		+	+	+	
Emissions of particulates from stationary sources	+		+	+	+	+	+	+		+	+	+	
Aggregated emissions from mobile sources	+	+	+	+	+	+		+	+	+	+	+	
Emissions of SO_2 from mobile sources	+		+	+	+		+	+			+	+	
Emissions of particulates from mobile sources	+		+	+	+		+	+			+	+	
Emissions of VOC from mobi	+		+	+			+	+			+	+	

le sources												
Emissions of heavy metals from mobile sources	+			+			+	+			+	
Aggregated exceedance of urban air quality standards (API)			+	+	+			+				+
Ambient air concentrations of selected pollutants versus maximum allowed concentrations (MAC)	+		+	+		+	+	+	+	+	+	+
Emission intensity of selected pollutants	+				+	+	+		+			+
Consumption of key ozone-depl			+						+			

	eting substances												
	Import of key ozone-depleting substances								+				
Water resources	Water abstraction	+	+	+	+	+	+	+	+	+	+	+	
	Water supply intensity (per sq. km and per inhabitant)					+							
	Water losses by transportation	+				+	+		+	+		+	
	Water consumption	+	+	+	+	+	+	+	+	+	+	+	+
	Water consumption intensity (per capita per day)					+				+			
	Exploitation index/ consumption			+		+	+	+	+				

index of water quantity												
Drinking water quality (number of samples failed of national standards)			+									
Wastewater discharge	+	+	+	+	+	+	+	+	+	+	+	+
Discharge of organic matter (BOD)				+	+	+	+	+	+		+	
Discharge of total P				+	+	+	+	+	+		+	
Discharge of total N				+	+	+	+		+			
Discharge of heavy metals				+	+	+	+	+	+			
Concentration of selected pollutants in water			+	+	+	+	+	+		+	+	+

	bodies v. MAC													
	Concentration of selected pollutants in groundwater v. MAC						+	+						
	River water quality according to national classification (WPI)		+	+	+			+				+		
	Expenditures for water protection	+												
	Price for water supplied and sewage	+												
Waste & hazards	Industrial waste generation	+		+	+	+	+	+	+	+	+			
	Toxic waste generation	+		+	+	+	+	+	+	+	+	+	+	
	Muni	+					+	+	+		+		+	

	cipal waste generation												
	Waste generation intensities (per capita, per sq. km)	+				+							
	Use of pesticides/fertilisers	+			+	+	+	+			+	+	
	Reuse/recycling of waste	+		+				+			+		
	Recyclng of paper and glass as a % of total consumption						+						
Bio-diversity	Protected areas (in total, by type of protection categories, as a % of country territory)	+	+	+	+	+	+	+	+	+	+	+	+

	Endangered species as a share of total species known	+	+		+		+					
	Population and hunting of main game			+		+			+	+		+
	Ecosystems, flora and fauna species diversity			+			+	+	+	+	+	+
	Number of plant and animal species listed in the Red Data Book	+	+	+	+	+	+	+	+	+	+	+
	Lost plant and animal species	+			+	+				+		
	Road network density	+				+			+	+		
Land resources	Land use changes by selected	+		+	+	+	+	+	+	+	+	

& soil	categories												
	Area of agricultural land affected by water/wind erosion			+	+	+	+	+	+			+	
	Land degradation due built-up, exploitation of mineral resources, landslide, salination, waste disposal	+			+	+		+			+		
	Recultivation of land			+							+		
	Soil contamination by radionuclide, heavy metals, pesticides, etc.	+		+	+			+	+				+
Forest resources	Forest area	+	+	+	+	+	+	+	+	+		+	+

	Growing stock (in total, per ha)	+		+	+	+		+	+	+	+
	Felling of trees	+				+	+	+	+		
	Afforested/reforested areas				+	+	+	+	+		+
	Forest fires (number, area, and volume of standing timber damaged/destroyed)	+		+		+	+	+			+
	Damage from forest fires (in national currency)					+		+			
	Ratio of felling to a net annual increment		+								
Fish resources	Fish stock by key species						+				
	Fish		+		+		+	+			+

	catches					
	Fishing quotas			+		
Socio-economic, sectoral and general indicators (not attributable to specific issues)	Population growth & density	+				
	Structure of energy supply			+	+	
	Percentage of energy supply from renewable sources			+		+
	Energy intensity (total primary energy supply versus GDP)			+	+	

Stock of road vehicles					+
Dynamics of transportation by transport mode				+	+
Environmental investments and expenditures	+		+	+	+

Source: UNECE, 2003b

Note: EECCA countries: Armenia (ARM), Azerbaijan (AZE), Belarus (BLR), Georgia (GEO), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Republic of Moldova (MDA), Russian Federation (RUS), Tajikistan (TJK), Turkmenistan (TKM), Ukraine (UKR), Uzbekistan (UZB).

Annex IV

INDICATORS FOR THE KIEV ASSESSMENT

Chapter		Analysis	Indicator	Data sets required for indicator
Socio-Economic Issues				
A	Energy sector	Environmental impacts of the energy sector	Energy-related emissions of CO_2, SO_2 and NOx	Annual emissions of SO_2, NOx, NH_3 and NMVOCs in total, by sector and energy related.
				Annual emissions of individual greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) and weighted to GWP, total, by sector and energy-related.
			Nuclear waste generation	Quantity of waste generated by the energy sector
		Energy consumption	Total primary energy supply versus GDP	GDP at market prices (constant prices)
				Total primary energy supply by fuel type
			Total primary energy supply by fuel	Total primary energy supply by fuel type
		Energy efficiency	Power plant efficiency	Fuel inputs for thermal electricity generation
				Thermal electricity generation
		Renewables	Percentage of energy supply from renewable sources	Total primary energy supply by fuel type
B	Industry sector	Industry and the environment	Index of industrial production	Index of industrial production
			Emissions of major air pollutants by industry	Annual emissions of SO_2, NOx, NH_3 and NMVOCs in total, by sector and energy related.
				Annual emissions of individual greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) and weighted to GWP, total, by sector and energy related.
C	Agriculture	In what direction is European agriculture developing? And its relations with the environment?	Consumption of pesticides	Total consumption of pesticides
				Agricultural land area
			Fertilizer consumption	Total consumption of fertilizers
				Agricultural land area
			Number of livestock	Number of cattle, pigs, sheep, goats and chickens
				Total number of agricultural holdings
				Average size of agricultural holdings
D	Forestry	Effects of transition on the forestry sector	Total felling as a % of annual increment	Felling of trees
				Total annual increment
E	Fisheries	Over-fishing	Fishing effort: tonnage of the fishing fleet (by main target stock?)	Fish catches by species and area
				Fishing fleet in tons by vessel type and by country
			Spawning stock and catches	Total fish catches by regional sea area
				Total spawning stock

F	Transport	Is the environmental performance of the transport sector improving?	Emissions by the transport sector	Annual emissions of SO_2, NOx, NH_3 and NMVOCs in total, by sector and energy-related.
				Annual emissions of individual greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) and weighted to GWP, total, by sector and energy related.
		Are we getting better at managing transport demand and improving the modal split?	Passenger transport by mode	Annual passenger transport by car, bus and coach, rail, water and air.
			Freight transport by mode	Annual freight transport by road, rail, water and air.
		Are spatial and transport planning becoming better coordinated so as to match transport demand to the needs of access?	Number of passenger cars	Total number of passenger cars by country
		Are we moving towards a better-balanced intermodal transport system?	Investment in infrastructure	Annual investment in transport infrastructure
		Are we moving towards a fairer and more efficient pricing system which ensures that external costs are recovered?	Transport fuel prices	Price of road transport fuel – leaded petrol, unleaded petrol and diesel
		How rapidly are improved technologies being implemented?	Uptake of cleaner fuels	Transport fuel consumption – total, leaded, unleaded petrol and diesel
			Share of cars with catalytic converters	Number of petrol cars fitted with a catalytic converter
				Total number of petrol cars
			Energy efficiency	Total final energy consumption by sector
G	Tourism	Impact of tourism	Arrivals of visitors at borders by type of entrance in country	Arrivals at borders by type of entrance

Chapter		Analysis	Indicator	Data sets required for indicator
Environmental Issues				
3	Climate change	Signs of climate change	European average temperature 1860-2000 (+ projected 2100)	Annual average European temperature 1860-2000
				Projected annual average temperature (2100)
			European precipitation 1860-2000 (North-South/Summer-Winter)	Annual European temperature 1860-2000
			Sea level rise – past trend and projected to 2100	Annual sea level rise (+ projected to 2100)
			Sea ice and glaciers	Distribution of the growth and melt of sea ice
			Regional indicators for signs of climate change (ecosystems)	
			Regional indicators for impacts of climate change	
		Progress in the implementation of the Kyoto targets and mechanisms	Emissions of greenhouse gases with respect to Kyoto targets	Annual emissions of individual greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) and weighted to GWP, by sector
			Emissions of individual greenhouse gases by sector (outlook to 2010 and 2020, including estimation of EU member State and accession countries use of the Kyoto mechanisms.	2010 and 2020 projections for emissions of greenhouse gases (CO_2, CH_4, N_2O) by sector.
		Progress in the implementation of the Kyoto targets and mechanisms (continued)	Cost estimates for policies and measures for the baseline outlook and cost-effective reduction potential of additional measures.	Description of possible indicators
		Greenhouse gas sinks	Not yet defined	
4	Strato-spheric ozone depletion	Progress in the implementation of the Montreal Protocol	Production of key ozone depletion substances	Production of key ozone depletion substances
			Consumption of key ozone depleting substances	Consumption of key ozone depleting substances
			Selection of effect/impact indictors taken from the UNEP assessment.	To be built on indicators from the UNEP assessment available in 2002.
5	Air pollution	Progress in the implementation of the protocols to the UNECE Convention on Long-range Transboundary Air Pollution: Reduction of air pollutant emissions	Emissions of SO_2, NOx, NH_3 and NMVOCs in total, by sector, 1990-2010-2020, compared with 2010 targets.	Annual emissions of SO_2, NOx, NH_3 and NMVOCs in total, by sector.
				Annual emissions of PM10 in total, by sector.
				2010 and 2020 projections for emissions for SO_2, NOx, NH_3, PM10 and NMVOC by sector.
			Cost ranges of abatement measures	Description of possible indicators
			Outcome indicators of "what if" ancillary benefits study	Description of possible indicators
		Urban air quality	Exceedances/reductions in urban air quality (1990-2010-2020)	Population exposed to an exceedance of SO_2, PM, NOx and O_3 (1990-2010-2020)
6	Chemicals	"Chemicalization" of society	Production and import of hazardous chemicals	Production and import of hazardous chemicals
7	Waste	Decrease in the direct	DMI in European countries	DMI by country

	generation and manage-ment	material input (DMI) of economies	Total waste generation	Total waste generation
				Waste generated from energy production
				Mining waste
				Construction and demolition waste
				(waste from electric and electronic equipment)
		Waste generation	Municipal waste generation vs. household expenditure	Municipal waste generation
				Household expenditure by country
			Industrial waste generation vs. industrial production	Waste from manufacturing industries
				gross value added by sector, constant prices
			Overview of total waste managed/total waste recovered-recycled	Recycling of waste as a % of total disposal by waste type
			Eastern Europe: Disposal facilities and their capacities	Number and capacity of disposal facilities by country
		Hazardous waste management	Generation of hazardous waste	Hazardous waste production; shipment of hazardous waste
		Progress in the establishment of waste management plans	Progress in the establishment of waste management plans	Fiscal and economic instruments
				Status of waste management plans
8	Water stress	Trends in water stress on a regional basis	Exploitation index/consumption index of water quantity	Total water abstraction by region
				Final water consumption by region
				Long term average renewable freshwater resources
			N, P and organic matter in rivers	Annual concentrations of N, P and organic matter in rivers by catchment size
			N and P in lakes	Annual concentrations of N and P in lakes by catchment size
			Overall river water quality index: biological and physico-chemical classification of river lengths	River water quality by country
			Pesticides in groundwater and surface waters	Annual average concentrations of pesticides in groundwater
				Annual average concentrations of pesticides in surface water
			Nitrate in groundwater	Annual average nitrate concentrations in groundwater
			Radionuclides in groundwater	To be built on indicators from the AMAP 2002 nuclear assessment
			Urban waste-water treatment capacity	Capacity of urban waste-water treatment plants
			Drinking water quality	Number of samples failing European drinking water quality standards
		Link between eutrophication and land and sea	Nutrient inputs to sea	Annual average N and P loadings to sea
			Nutrient concentrations in sea and coastal waters	Annual average concentrations of N and P in marine and coastal waters
		Hot spots in marine water quality	Bathing water quality	Annual average quality of bathing waters
			Input and concentrations of hazardous substances in marine waters	Annual average loadings of hazardous substances to marine and coastal waters

				Annual average concentrations of hazardous substances to marine and coastal waters
			Oil pollution from maritime transport and offshore activities	Regular marine oil spills
		Progress in the implementation of the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes	Implementation of programmes of measures for shared waters	Number of programmes for the protection of shared waters and the state of implementation of the programmes.
			Implementation of monitoring requirements for shared waters	Number of programmes for the protection of shared waters and the state of implementation of the programmes.
9	Soil degradation	Soil erosion problems	Estimate of soil loss per year from agricultural land	Volume of soil lost annually from agricultural land
		Salinization in the southern Russian Federation and the Central Asian States	Area of land affected by salinization	Area and severity of salinization in the Russian Federation and Central Asian States
			Table: Restoration projects undertaken/planned	Number and type of soil restoration projects in place and proposed
		Aral Sea follow-up problems	Change in the water balance in Central Asian States	Water balance in Central Asian States
			Area with problems due to wind erosion and salt deposition	Land area with problems due to wind erosion and salt deposition
			Table: Wind erosion prevention projects	Number and type of wind erosion prevention projects in the area of the Aral sea
		Contaminated sites	Estimated number of potentially contaminated sites	Number of contaminated sites or area pf contaminated land by country
			Clean-up projects/costs	Number and cost of clean-up operations of contaminated sites in Europe
10	Techno-logical and natural hazards	Technological hazards	Number of industrial accidents	Number of industrial accidents by country
			Number of nuclear incidents	To be built on indicators from the AMAP 2002 nuclear assessment
			Tanker oil spills	Number of spills and volume of oil spilled by tankers in European seas
		Radionuclides	Radioactive waste	To be built on indicators from AMAP
			Distribution of nuclear power stations, fuel processing plants, nuclear weapons, dumping sites	To be built on indicators from AMAP
			(Arctic) examples of doses to population	To be built on indicators from AMAP
		Natural extreme events	Number of natural disasters, excluding earthquakes and volcanic activity	Number of natural disasters, excluding earthquakes and volcanic activity
11	Bio-diversity	State and protection of ‘high-quality’ habitats	Protected areas (IUCN categories)	Area of protected land by IUCN category
		Safeguarding ‘ordinary’ nature	Number of habitats and species protected under EU Directives/Bern Conventions with a better/worse status, or semi-natural grasslands as percentage of agricultural areas.	

12	Progress in managing the environment and sustainable development	Integration of environmental considerations in other policies	Table: Progress in policy integration	
		Price signals (economic integration)	Environmentally unfavourable subsidies	
		Environmental impact assessment (management integration)	Appliance of EIA/SEA in Europe	
		Urban planning (institutional integration/management integration)	To be defined	
		Coastal zone management (spatial planning/institutional integration)	Qualitative indicator on pressures on coastal zones	
			Progress in integrated coastal zone management	

BIBLIOGRAPHY

Belarus. The National Environmental Monitoring System in Belarus - status and prospects (CEP/AC.10/2002/12), UNECE, January 2002.

European Environment Agency (2001a). Waste data and classifications: towards a hierarchy of indicators on waste and material flows (CEP/AC.10/2002/8), UNECE, Geneva, January 2002.

_____ (2001b). Methodology for indicators in the Kiev Report (CEP/AC.10/2002/3), UNECE, Geneva, December 2001.

_____ (2003, prepared with UNECE secretariat). Lessons learned from data collection for the Kiev Report (CEP/2003/10 - CEP/AC.11/2003/15), UNECE, Geneva, December 2002.

Georgia. Outline plan for modernizing and developing the National System for Monitoring Environmental Pollution in Georgia (CEP/AC.10/2002/5), UNECE, January 2002.

Meteorological Synthesizing Centre - East (2002). Participation of newly independent States (NIS) and some other countries in transition in international air pollution monitoring and assessment networks (CEP/AC.10/2002/6), Geneva, January 2002.

Regional Environmental Centre for Central Asia (RECCA). Environmental monitoring in Central Asia (CEP/AC.10/2002/11), UNECE, January 2002.

Russian Federation. Service for Hydrometeorology and Environmental Monitoring (Roshydromet). Ways to improve environmental monitoring in the Russian Federation (CEP/AC.10/2002/16), UNECE, Geneva, June 2002.

Ukraine. State of the National Environmental Monitoring System in Ukraine and prospects for development (CEP/AC.10/2002/17), UNECE, Geneva, June 2002.

United Nations Economic Commission for Europe (1998). Environmental Performance Review of the Republic of Moldova, New York and Geneva, 1998.

_____ (1999). Environmental Performance Review of Ukraine, New York and Geneva, 1999. Sales No. E.00.II.E.1

_____ (2000a). Environmental Performance Review of Armenia, New York and Geneva, 2000. Sales No. E.01.II.E.7

_____ (2000b). Environmental Performance Review of Kazakhstan, New York and Geneva, 2000. Sales No. E.01.II.E.3

_____ (2000c). Environmental Performance Review of Kyrgyzstan, New York and Geneva, 2000. Sales No. E.01.II.E.2

_____ (2000d). Gaps and bottlenecks in environmental monitoring in countries in transition, (CEP/AC.10/2000/5), Geneva, September 2000.

_____ (2001). Environmental Performance Review of Uzbekistan, United Nations, New York and Geneva, 2001. Sales No.E.02.II.E.5 and Sales No.R.02-II-R.5 (in Russian)

_____ (2002a). Status of environment record-keeping in the newly independent States (NIS) (CEP/AC.10/2002/18 and Corr.1), Geneva, June 2002.

_____ (2002b). Inventory of major international environmental databases in the UNECE region (CEP/AC.10/2002/19 and Add.1), Geneva, June and July 2002.

_____ (2002c). Task Force on Environmental Compliance and Enforcement (CEP/2003/7 - CEP/AC.11/2003/18), Geneva, December 2002.

_____ (2003a) Environmental Performance Review of Georgia, New York and Geneva (forthcoming).

_____ (2003b) Review of the use of indicators for state-of-the-environment reporting in Eastern Europe, Caucasus and Central Asia. Prepared in the light of the joint UNECE/EEA Workshop on Environmental Indicators and Networking, Geneva, February 2003.