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Committee on Environmental Policy

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Preface

The EPR project in Kazakhstan had originally started in September 1997, but had to be interrupted for organizational reasons. A second preparatory mission therefore had to be organized and took place in October 2000. It resulted in a new structure for the report, which was adapted to the many changes in the country that had occurred in the meantime. The review team for the project was constituted following these decisions and included national experts from Finland, France, Denmark, Germany, Romania, Slovakia, Slovenia, Spain and Uzbekistan, together with the ECE secretariat, UNEP and the Bilthoven Division of the WHO European Centre for Environment and Health. The costs of the participation of experts from countries in transition, as well as the travel expenses of the ECE secretariat, were covered by extrabudgetary funds that had been made available from Finland, Germany and Italy. In addition, the Netherlands contributed funds to the Kazakh expenditures for the organization of the project, in a bilateral project. All contributions were essential to the implementation of the project.

The review mission to Kazakhstan was undertaken in May 2000. The draft of the EPR report was finalized subsequently and was submitted to Peer Review by the ECE Committee on Environmental Policy at its annual session in Geneva on 26 September 2000. The Peer Review was prepared by the EPR Expert Group, which discussed the draft report and its recommendations with a high-level delegation from Kazakhstan. The discussion resulted in proposed modifications of the EPR recommendations, which were forwarded to the Committee, which finally approved the recommendations as they are set out in this report at the end of its deliberations.

The review of Kazakhstan's environmental performance in many ways concentrated on the difficulties of national environmental management in a country of a considerable surface but low population density. The intensity of many problems of environmental degradation add to the problems. The adopted recommendations therefore often focus on questions of how to cope with strong regional differences in environmental conditions as well as with the most complex threats to human health and nature. In general, the report conveys the need for well-coordinated and decisive action in many areas, if the requirements for an improved and sustainable socio-economic development are to be met.

The ECE Committee on Environmental Policy and the ECE review team wish the Kazakh Government success in their important future tasks, including the implementation of the recommendations contained in the present report

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ABBREVIATIONS

ADB	Asian Development Bank
ASBP	Aral Sea Basin Programme
BAT	Best available technology
BOD	Biochemical oxygen demand
CEEC	Central and Eastern European Countries
CFC	Chlorofluorocarbon
ChNPP	Chernobyl Nuclear Power Plant
CHP	Combined heat and power plant
CIS	Commonwealth of Independent States
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPC	Cleaner Production Centre
CRTC	Caspian Regional Thematic Centre
CT	Cleaner technology
DDE	Dichlorodiphenyl dichloroethylene
EBRD	European Bank for Reconstruction and Development
EIA	Environmental impact assessment
EIS	Environmental impact statement
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EPR	Environmental Performance Review
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
FCCC	United Nations Framework Convention on Climate Change
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gases
GIS	Geographic information system
GOST	Former USSR standard organization
GTZ	German Agency for Technical Cooperation
HCFC(s)	Hydroclorofluorocarbons
HCH	Hexochloro cyclohexane
IAEA	International Atomic Energy Agency
ICAS	Interstate Council for the Aral Sea Problems
ICRP	International Commission on Radiological Protection
ICWC	Interstate Commission for Water Coordination
IEA	International Energy Agency
IFAS	International Fund for the Aral Sea
IFRC	International Federation of Red Cross and Red Crescent Societies
IMF	International Monetary Fund
IMO	International Maritime Organization
ISO	International Organization for Standardization
IUCN	World Conservation Union
JSC	Joint-stock company
JV	Joint venture
KAEE	Kazakh Agency of Applied Ecology
LEP	Law on Environmental Protection
LPG	Liquefied petroleum gas
MARPOL	Convention for the Prevention of Pollution from Ships
MEIT	Ministry of Energy, Industry and Trade
MNREP	Ministry of Natural Resources and Environmental Protection
MoA	Ministry of Agriculture
MoF	Ministry of Finance

MoT	Ministry of Transport
MPC	Maximum permitted concentration
MPP	Maximum permitted pollution
NBSAP	National Biodiversity Strategy and Action Plan
NEAP	National Environmental Action Plan
NEC/SD	National Environmental Centre for Sustainable Development
NEHAP	National Environmental Health Action Plan
NGO	Non-governmental organization
NMVOCs	Non-methane volatile organic compounds
NSAPCD	National Strategy and Action Plan to Combat Desertification
ODS	Ozone-depleting substance
OECD	Organisation for Economic Co-operation and Development
OSCE	Organization for Security and Cooperation in Europe
PAHs	Polyaromatic hydrocarbons
PCB(s)	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF(s)	Polychlorinated dibenzofurans
PHARE	Assistance for Economic Restructuring in the countries of Central and Eastern Europe
PM	Particulate matter
PNEs	Peaceful nuclear explosions
POP(s)	Persistent organic pollutant
REAP	Regional Environmental Plan
REC	Regional Environmental Centre for Central Asia
SMEs	Small and medium-sized enterprises
SNTS	Semipalatinsk Nuclear Test Sites
TACIS	Technical Assistance to the Commonwealth of Independent States and Georgia
TCDD 2,3,7,8	Tetrachlorodibenzo-p-dioxin
TSP(s)	Total suspended particulates
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Funds
UNIDO	United Nations Industrial Development Organization
UNV	United Nations Volunteers
US$	United States dollar
USAID	United States Agency for International Development
VAT	Value-added tax
VOC(s)	Volatile organic compound
WHO	World Health Organization

SIGNS AND MEASURES

-	nil or negligible
.	decimal point
..	not available
Bq	Becquerel
cap	capita
Ci	Curie
cm^2	square centimetre
eq	equivalent
g	gram
Gcal	gigacalorie
GJ	gigajoule
GWh	gigawatt-hour
h	hour
ha	hectare
Hz	hertz
kg	kilogram
km	kilometre
km^2	kquare kilometre
kt	kilotonne
kV	kilovolt
kW_{el}	kilowatt (electric)
kW_{th}	kilowatt (thermal)
l	litre
m	metre
m^3	cubic metre
mg	milligram
min	minute
ml	millilitre
mm	millimetre
mSv/a	millisievert per year
MW	megawatt
MW_{el}	megawatt (electric)
MWh	megawatt-hour
MW_{th}	megawatt (thermal)
^oC	degree Celsius
pg/g fat	picograms per gram of fat (of mother's milk)
s	second
t	metric tonne
toe	ton oil equivalent
TWh	terawatt-hour
y	year

Currency

Monetary unit: Tenge

Exchange rates: The Kazakh National Currency, the tenge, was introduced on 15 November 1993.

Year	1 US$
1993	4.70
1994	39.91
1995	61.64
1996	67.66
1997	75.34
1998	79.41
1999	120.33
2000	141.12

Source: The National Bank of the Republic of Kazakhstan, 2000

FEATURES OF KAZAKHSTAN

F.1 Physical and social conditions

Geography

Kazakhstan is situated in the north of the Central Asian republics and is bounded by the Russian Federation in the north (6,467 km), China in the east (1,460 km), and Uzbekistan (2,300 km), Turkmenistan (380 km) and Kyrgyzstan (980 km) in the south. Its territory extends from the Volga and the Caspian Sea in the west to the Altai Mountains in the east, and from the West Siberian Plain in the North and Southern Urals to the Tien Shan Mountains and the Kyzylkum Desert. From west to east, Kazakhstan extends over more than 3,000 km and from south to north 1,700 km. The territory covers 2.72 million square kilometres, divided into 14 regions and 2 republic cities, and 158 districts. Kazakhstan's population of around 15 million (1999), or 5.5 inhabitants per square kilometre, makes it one of the most sparsely populated regions in the world.

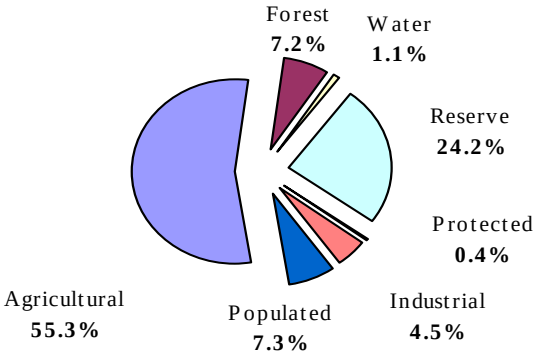
The lowest point of Kazakhstan is the Karagiye depression 132 m below sea level, located to the east of the Caspian Sea. In the south and southeast, on the border with Kyrgyzstan and Uzbekistan, rise the Tien Shan mountains, the peaks of the mountain chain are from 3,991 m (Djungarski Alatau) to 6,995 m (Terskei Alatau) high.

Kazakhstan has 7,000 rivers more than 10 km long; the longest are the Irtysh (4,248 km long, of which 1,700 km within Kazakhstan), the Ishim (2,450 km, 1,400 km within Kazakhstan), the Ural (2,428 km, 1,082 km within Kazakhstan), and the Syr Darya (2,219 km and 1,400 km within Kazakhstan). The country has more than 48,000 lakes and reservoirs, with a total water surface of over 45 000 square km (without the Caspian and Aral Seas), the largest among them is Lake Balkhash with a water surface of 18,200 square kilometres. The total water consumption of Kazakhstan in 1998 was 16,805 million cubic metres; 75 per cent is used for agriculture, 18 per cent for industrial water supply, and 4.5 per cent for household and drinking purposes.

The climate of Kazakhstan is continental, with hot and dry summers and cold and relatively dry winters. The average temperature in January ranges from -5°C in the southernmost areas to -20°C in the north, while the average temperature in July ranges between 19°C in the north and 26°C in the south. Precipitation on the plains is generally low, from 400 mm in the north to 150 mm in the southwest. In the mountainous regions, precipitation ranges from 400 mm to 1,600 mm. The growing period lasts 190-200 days in the north and 230-290 in the south.

The diversity of geological, geomorphological, climatic, soil and vegetation conditions implies a variety of landscapes. With the increase in temperatures from the north to the south and the reduction in precipitation, there is a gradual change of natural zones: forest, steppe, semi-desert, desert, as well as meadow and bush in the floodlands.

Figure F.1: Distribution of State land*



Source: Agency on Statistics.
* not including Zakazniks and natural monuments

About 130 million ha (47.8 per cent) of the country's total surface is used for agricultural purposes, of which 68 per cent are pastures, 16 per cent arable area, 2 per cent meadows for haymaking, 2 per cent ley (shallow land), and 0.06 per cent perennial plantations. Forest and woodland cover only 7.3 per cent of the land area.

Kazakhstan is richly endowed with oil, gas, and mineral resources, including gold, iron ore, coal, copper, silver and zinc. Of the 105 elements in the periodic table, 99 can be found in Kazakhstan. Deposits of 70 elements have been explored, 60 of which are extracted. Large-scale commercial exploitation began only in the 1960s and 1970s.

Population and social conditions

The 15 million inhabitants today belong to more than a hundred different ethnic groups. According to 1997 data, the largest ethnic groups were the Kazakhs with 48 per cent, followed by the Russians 34 per cent, the Ukrainians 5.2 per cent, the Germans 3.3 per cent, the Uzbeks 2.7 per cent, and the Tartars 2 per cent. Over the past 10 years, the ethnic Russian population has fallen by 26 per cent, the Ukrainian population by 37 per cent, the Tartar population by 22 per cent, and the ethnic German population by 63 per cent.

During the past two decades the population has shrunk, due to migration on the one hand and the decrease in the absolute and relative fertility rates on the other. Between 1991 and 1999 the birth rate per 1,000 inhabitants decreased from 21.5 to 14.2, and the mortality rate increased slightly to 9.8 per 1,000 in 1999. Although the infant mortality rate is relatively high, 21.8 per 1,000 live births in 1998, it has been decreasing slightly from its 1993 level of 28.7 per live 1,000 births. In recent years, the migration process has been stabilized; there is a trend towards a return to "motherlands". Emigration is predominantly a process involving Russians, Germans and Ukrainians. More than 1 million people have emigrated since 1991.

Almost two thirds of the population lives in the southern and northern regions, which make up about half of Kazakhstan's territory. Only one eighth of the population lives in the western region, which accounts for more than one quarter of the country's territory. Some 55 per cent of the people live in towns and the remaining 45 per cent in rural areas. The official language is Kazakh, but Russian is widely spoken.

Worsening living standards and social and economic insecurity have an impact on human health and life expectancy. Life expectancy at birth is below the European average, in 1998 it increased to 65 years. Life expectancy for women is 11 years longer than for men. Heart disease and cancer have traditionally been the most common causes of death in the Republic. The third most prevalent cause has become accident and trauma, which has overtaken respiratory diseases.

Legal, administrative and institutional structures

The principle of independence and the political system were formulated in the first Constitution of Kazakhstan of January 1993, which was approved by referendum on 30 August 1995. Kazakhstan has a parliamentary system with a President as head of State. The last presidential election was in January 1999 for a seven-year term. The Parliament is the supreme legislative body and consists of two chambers, the Senate (Upper House) and the *Mazhilis* (Lower House). The 47 members of the Senate are indirectly elected representatives of regional assemblies and appointees of the President. The *Mazhilis* is composed of 67 elected deputies. The Parliament is elected for a four-year term.

The Prime Minister is the head of the executive branch of government and is appointed by the President, with the approval of the Parliament. He chairs the Cabinet, which, as of January 1999, consists of three Deputy Prime Ministers, the Ministers of the 14 State Ministries and the 5 Chairmen of the State Agencies. The heads of the local administrations (*Akims* of 14 *oblasts* and 2 cities) are appointed by the President.

Since December 1997, the capital of the Republic has been Astana, with a population of over 318,000 . From 1929 to 1997 the capital of the Republic was the city of Almaty, founded in 1854. At present, Almaty is the largest business and cultural centre in Kazakhstan with a population of 1,129,000.

F.2 Economic policy and development

Economic policy

After proclaiming independence in December 1991, Kazakhstan embarked on a wholesale transformation of its economic system. The reforms aim at the creation of a market economy through the introduction of competition and the development of a private sector. The economic reform process in Kazakhstan has passed through four main stages: the liberalization of prices of most goods (January 1992); the constitutional recognition of the right of individuals to own private property (January 1993); the adoption by the Government of the National Programme of Privatization and its gradual implementation in

FIGURE F.2:

MAP OF KAZAKHSTAN

industry, agriculture, transport, trade and services (April 1993); and the departure of Kazakhstan from the "rouble zone" and the subsequent introduction of a national currency, the tenge (November 1993). These events resulted in Kazakhstan's independence in financial and monetary management.

Controlling inflation is regarded as the main achievement of the economic reforms. Annual inflation was calculated to be 3,061 per cent in 1992 and 2,265 per cent in 1993. Major reforms were introduced in the banking and financial sector and, as a result of these policies, inflation was reduced to 27.4 per cent in 1997, 7.3 per cent in 1998 and 8.4 per cent in 1999.

A major priority in Kazakhstan's fiscal policy is to restructure and improve the tax system. In January 1995, the Government developed a new Tax Code, which was amended in 1997. Instead of 50 taxes and duties, the new Tax Code envisages only 18, out of which 10 are nationwide and 8 are local taxes. Its intention is to simplify the work of tax collectors, introduce the filing of income tax returns, and, as a result, increase the taxation base and growth of the State's revenues.

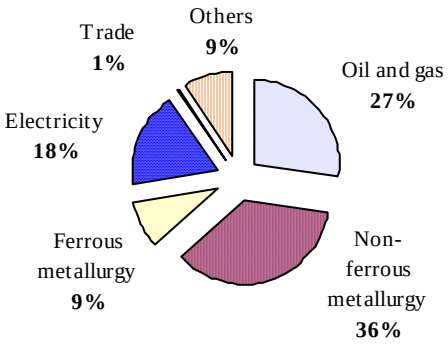
Kazakhstan's long-term sustainable development policy is formulated in the Presidential programme document "Kazakhstan-2030", announced in October 1997. This document identifies seven long-term priorities: national security; domestic political stability; market-based economic growth with high levels of foreign investment; health, education and the well-being of citizens (including improvement of the environment); the development of power resources; infrastructure, focused on transport and communication; and the development of a professional public sector. Long-term sectoral priorities, outlined in one-year, three-year and five-year plans, complement this overall strategy.

Economic development

During the 80s, Kazakhstan's real GDP grew by 1 per cent a year. After independence, GDP fell by about half to US$ 21 billion in 1996. Agriculture represented the most important source of income and employment, and produced about one fifth of the Soviet Union's grain. The coal industry also supplied about a fifth of Soviet production. Manufacturing was confined to light industry, with markets largely in Central Asia, and some specialized defence industry products. Kazakhstan's oil and gas industries were largely suppliers to the rest of the Soviet Union. At independence, the Republic had three major oil refineries producing 361,000 barrels a day. So the Kazakh economy, geared to supplying the Soviet market, was in need of significant investment to increase output and reduce environmental degradation. Many manufacturing companies needed to switch to new products and product specifications.

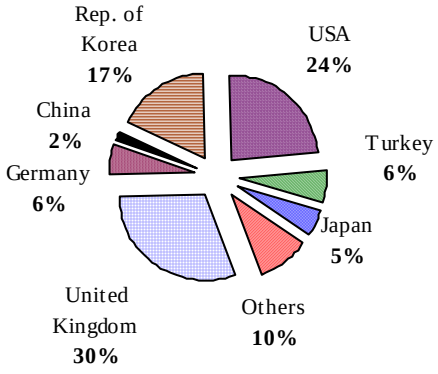
The breakdown of regulating mechanisms and the collapse of intra-Soviet trade relations account for Kazakhstan's sharp economic decline from 1992 to 1995. But subsequently, the Government has made much progress in introducing a market-based economy and achieving macroeconomic stabilization. The strength of the economy currently rests on export-oriented sectors dealing with oil, gas, and ferrous and non-ferrous metals. These sectors have been the largest recipients of foreign direct investment (FDI) in the country.

Figure F.3: Foreign direct investment by industry, 1997



Source: Agency on Statistics.

Figure F.4: Foreign direct investment by country, 1997



Source: Agency on Statistics.

In 1996, real GDP growth was positive for the first time since 1991, as GDP reached US$ 21 billion, or 100.5 per cent of the previous year. This positive trend was confirmed in 1997 (+1.7 per cent over 1996), but in 1998, Kazakhstan was hit by a series

of large external shocks: a fall in the prices of oil and other primary commodities, a sharp real depreciation of the Russian rouble, turmoil in emerging markets, and a severe drought. Performance picked up in the second half of 1999, and real GDP grew by 7 per cent in the first quarter of 2000. Industrial production grew by 15.2 per cent and fixed investments by 29.7 per cent.

The contribution of industry to GDP in 1999 was 22.5 per cent. The main branches are the fuel industry (oil producing, oil refining, gas industry, coal industry) with 27 per cent, non-ferrous and ferrous metallurgy with 26 per cent, the food industry with 17 per cent, and the electric power industry with 14 per cent.

With the move towards a market economy, the structure of employment has changed. The strongest decline in employment has been in the agricultural and industrial sectors. Self-employment and employment in the small service sector (mainly trading) have and will continue to grow.

Recorded unemployment was 292,800 (4.6 per cent of the workforce) at the end of February 2000, up by 19 per cent from 246,000 (3.6 per cent of the workforce) a year earlier. The true level of unemployment in Kazakhstan probably exceeds the officially recorded figure. The average monthly wage, calculated by dividing the total payroll by the total number of employees, was 10,984 tenge (US$ 91) in 1999.

Foreign investment, financing and trade

The Government of Kazakhstan is giving high priority to the establishment of a legal and commercial environment that is attractive to foreign investment. Foreign investment is specifically governed by two laws – the Foreign Investment Law (enacted in December 1994) and the Law on State Support for Direct Investment (enacted in February 1997). The Foreign Investment Law sets out the basic framework of privileges and protection offered to, and obligations on, foreign investors making direct or portfolio investments in Kazakhstan and Kazakh enterprises with foreign participation. The Investment Support Law accords certain privileges and preferences to investors concluding contracts with the State Investment Committee. However, problems of law enforcement are frequently reported.

Table F.1: Exports and imports by main trade partner, 1998

%

Main trade partners	Imports	Exports
Russian Federation	39.3	29.3
Turkey	4.8	1.7
Ukraine	2.2	4.9
Rep. of Korea	2.4	0.7
China	1.2	7.1
United States	9.3	1.4
Switzerland	1.6	6.1
France	1.9	0.3
Germany	8.6	5.2
United Kingdom	5.0	8.9
Italy	2.1	9.1
Netherlands	1.6	5.1
Others	20.0	20.2

Source: Agency on Statistics.

Table F.2: External trade, 1996-1999

Million US$

	1996	1997	1998	1999
Total trade turnover	**10,152**	**10,798**	**9,785**	**9,275**
of which:				
CIS	6,124	5,314	4,229	3,056
Non-CIS	4,028	5,484	5,556	6,219
Total exports	**5,911**	**6,497**	**5,436**	**5,592**
of which:				
CIS	3,179	2,982	2,170	1,461
Non-CIS	2,732	3,515	3,266	4,131
Total imports	**4,241**	4,301	4,350	3,683
of which:				
CIS	2,946	2,332	2,060	1,594
Non-CIS	1,260	1,969	2,290	2,088

Source: Agency on Statistics.

In October 1996, Kazakhstan for the first time received international credit ratings, heightening further the confidence-building climate for foreign direct investment. New foreign direct investment rose from US$ 567 million in 1994 to US$ 801 million in 1997. From 1993 to 1997 the most important sources of investment were the United States (32 per cent), the Republic of Korea (22 per cent), and the United Kingdom (14 per cent). During this period, the oil and gas sector attracted about half of the new investment, and ferrous and non-ferrous metallurgy about 30 per cent. Figures F.3 and F.4 show the foreign direct investment by industry and by country in 1997.

External financing and the relationship with international financial institutions are important for the development of the Kazakh economy. Kazakhstan joined the International Monetary Fund (IMF) and the World Bank in July 1992. Since then, the World Bank Group has provided 21 loans to Kazakhstan totalling US$ 1,819 billion. Of this, US$ 1,148 billion have already been received. Kazakhstan's outstanding use of IMF financing currently totals US$ 461 million (US$ 503 million current quota, December 1999).

Kazakhstan is traditionally an exporter of raw materials: fuel and oil products, ferrous materials, copper, grain, inorganic chemicals, zinc and ores, salt, and cotton. Its major imports are also fuel and oil products. 36 per cent of all petrol used in Kazakhstan is of Russian origin. Machinery, electrical equipment and vehicles are other major imports.

The orientation of Kazakhstan's foreign trade is changing. Although trade with the members of the Commonwealth of Independent States (CIS) is still high (40 per cent of exports and 47 per cent of imports in 1998, total trade turnover was 45 per cent in 1998), there is a steady increase in the share of foreign trade between Kazakhstan and non-CIS members. Among the CIS members, the Russian Federation remains the country's main trading partner, with a total trade turnover of US$ 3,279 million in 1998 (30 per cent of exports and 40 per cent of imports). Kazakhstan's trade with non-CIS members was worth US$ 3,688 million in 1998. Its main trade partners are the United Kingdom, Italy, Germany, the United States of America, China, and the Republic of Korea.

PART I: THE FRAMEWORK FOR ENVIRONMENTAL POLICY AND MANAGEMENT

Chapter 1

LEGAL INSTRUMENTS AND INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL PROTECTION

1.1 The legal framework

Basic legal instruments

The 1995 Constitution of the Republic of Kazakhstan stipulates and that "protecting the environment favourable for life and health shall be the goal of the State". Each individual and all State officials are responsible for a healthy environment, and officials shall report on the state of the environment. Other general laws that are important for environmental protection are the Civil Code, the Presidential Decree on procedures for dealing with appeals by the population (1995), the Law on the Organization of Government, the Law on Public Associations (1996), the Code on Administrative Violations of Environmental Legislation, with a special chapter on environmental crimes, and, for more important violations, the Criminal Code (1998).

The new social conditions in the country after independence required a major legislative effort, including the adoption of a new Law on Environmental Protection in 1997. Some of the many new laws are listed in Box 1.1.

Box 1.1: Selected legal instruments

The list includes documents that determine competence, use, management, conservation, licensing, responsibilities for sanctioning violations, the division of functions and international cooperation for environmental protection and the protection and use of natural resources.

1. Law on Environmental Protection, 1997
2. Law on Ecological Expertise, 1997
3. Decree on Licensing, 1993
4. Law on Specially Protected Natural Territories, 1997
5. Law on Air Protection, 1981
6. Law on the Protection, Reproduction and Use of Animals, 1993
7. Forestry Code, 1993
8. Water Code, 1993
9. Decree on Land, 1996
10. Decree on Underground Resources and their Use, 1995
11. Law on Oil, 1995
12. Law on the Social Protection of Citizens Harmed by the Environmental Disaster near the Aral Sea, 1992
13. Law on the Social Protection of Citizens Harmed by Nuclear Testing in the Semipalatinsk Nuclear Testing Polygon, 1993
14. Law on Radiation Safety, 1998

Draft laws in preparation:
- Draft law on the control of environmental protection and natural resources use
- Draft law on production and consumption waste
- Draft law on payments for bioresource use
- Draft law on biodiversity
- Draft law on climate and zone layer of earth

The environmental legislation contains around 170 legislative, normative and methodological documents that regulate environmental protection and the rational use of natural resources. Some are not considered to be working well. The future strategy is to have as few by-laws as possible and to revise the laws. Further laws are envisaged on ecological control, on investment, and on ecological audit. Other gaps that need to be regulated concern ozone depletion, biodiversity protection, water resources, air and flora. Also, some instruments from Soviet times are still in force. The Law on Air Protection and groundwater protection regulations, as well as standards for air, water and land quality, fall into this category. Regulations regarding the use and protection of

natural resources are also still based on Soviet regulations. As a result, there is a need to incorporate environmental protection provisions into these laws (water, mineral resources, oil, land, forest). The introduction of the spirit of the Law on Environmental Protection into other laws is still under way, and contradictions still exist.

The Law on Environmental Protection views environmental protection as a precondition for sustainable development. Its declared aims are to maintain ecological safety, prevent entrepreneurial and other activities from having a harmful effect on natural ecosystems, preserve biodiversity and ensure the efficient use of nature. The Law defines the rights and responsibilities of citizens and social associations. It describes the duties of governmental bodies, the requirements of nature use and its regulation, and measures to prevent and clean up environmental pollution. It lays down the regulation of environmental emergency situations and environmental disaster zones, objects of environmental protection of special environmental, scientific or cultural value, environmental monitoring, information and statistics, environmental education, economic mechanisms, and the control of environmental protection.

The Law designates organizational structures for environmental protection, establishes the basis for environmental standards and requirements, procedures for licensing, permitting and control, economic incentives for nature and environmental protection, and environmental auditing, and creates a framework for international environmental protection. It allows fees to be charged for pollution below the permitted limits, it underscores the right of the public to live in a healthy environment and to claim compensation for damage to health and environment. Most of these rights are given to non-governmental organizations rather than to individuals. For example, public associations have the right to exercise public control over environmental protection, to participate in the discussion of draft laws, to demand and carry out public studies, to take environmental protection measures and to cooperate with international environmental organizations.

As existing enterprises do not fall under the Law on Ecological Expertise, the ‘ecological passport’ was introduced on the basis of a by-law. The ecological passports include assessments of the environmental impact of an enterprise in terms of GOST environmental norms. The assessment is controlled by inspectors. The Law on Environmental Protection also lays down eco-audits, which will control the compliance of existing enterprises or organizations with norms and regulations of environmental protection. The audits should be undertaken by independent auditors. To date, no by-laws on this subject have been prepared. In practice, some audits are carried out in connection with the preparation of ecological passports and in the process of privatization, but audits should be regulated by law. The law is expected to include the possibility of closing down an enterprise.

Liability

The provisions on liability for environmental damage are not included in the Law on Environmental Protection, but are part of administrative, civil and criminal law. The only general provision is in article 86 of the Law on Environmental Protection, which states that natural and legal persons that have damaged the environment, health or property of the population by breaking the environmental legislation are liable under the law. The Law on Specially Protected Natural Territories includes similar provisions. Compensation for damage is imposed by the courts.

Compensation for damage caused by violating environmental legislation is assessed in accordance with approved rates and damage-accounting methodologies. Should they be lacking, the actual costs for environmental rehabilitation are taken into consideration. The damage caused to health and property is to be fully compensated. In theory, investors have to insure their activities for hazardous impact, but no such insurance is practised, as there is no law with detailed rules and obligations. Liability for past damage lies with the State, and past damage is cleaned up with the help of State programmes. The lack of finances slows the process considerably. See below for liability issues arising during privatization.

Citizens and NGOs do not generally have the right to sue for compensation. They can merely request the suspension of actions that harm environment and health, but this right does, however, exist for NGOs in the Law on Specially Protected Natural Territories in the case of damage to a protected territory.

Privatization

The first decree on privatization was adopted in 1991 and revised in 1995. It applies to all enterprises, but not land. Land is leased to

agricultural enterprises for a renewable period of 99 years. The Committee on State Property and State Privatization is currently in charge of privatization. It was created in 1997, integrating its two predecessors, which had worked under different ministries. All income from privatization goes directly to the State budget.

Privatization is scheduled in 4 stages. The first was devoted to small enterprises and housing units. It started in 1991. Sales were primarily by auction. This stage was basically concluded in 1997.

The second stage is that of mass privatization. It concerned medium-size enterprises and started in 1993 on the basis of a voucher scheme (a Decree on the National Privatization Programme was issued). It too was mainly concluded in 1997, when about 60 per cent of the enterprises concerned were privatized. The privatization of agricultural farms involved on the one hand the creation of small private farms, and on the other, the restructuring of State farms into cooperatives and joint-stock companies. Privatization was aimed at the former workers of the collective farms. The size of each member's claim depended on the time he had spent working on the farm. Machinery, irrigation networks, etc. were shared out. Leases of agricultural land can be inherited and transferred.

The third stage of privatization involved large, 'individual' enterprises (around 100 enterprises with more than 5,000 employees, of which 25 were listed as open to a controlling foreign stake, including oil and gas industries), natural monopolies and infrastructure. It began in 1995 under the new law, and was virtually completed in 1999. Enterprises can appeal their privatization during 6 months. Buyers are granted control of the land on which the property is located.

At present, the fourth stage is being prepared. It will deal with the remaining enterprises, but will primarily focus on the 9 "crown jewels" and 49 large enterprises. The large enterprises are mostly in the energy sector. The fourth stage will be finished in 2002. 17 enterprises have been excluded from privatization (on the basis of a governmental decree), and some "crown jewels" might still be added to this list.

The privatization methods were developed with the assistance of the United States Agency for International Development (USAID). In the early stages, the employees of existing enterprises had priority for taking over management, and then purchasing the enterprise. The other enterprises were mainly privatized by auction, but during mass privatization, some enterprises were sold by tender.

Tendering was the main method during the third stage and will most probably also be he main method in the fourth stage. Tender commissions, composed of 10 to 12 persons, representing all interested ministries, are set up for individual objects. For 'individual' enterprises, the price and the physical conditions are assessed by an independent special commission of consultants. The tender commission specifies the requirements for the tender, including investment volumes, possibly broken down for individual areas of production, social benefits for workers, debt payment proposals, and the sales price.

The Government is obliged by law to provide all information on environmental damage on the site of the enterprise. In practice, this means that information is made available, but only on request. According to the law, the privatization of an enterprise should always include an audit of past damage. Environmental audits, if undertaken at all, are usually performed after the purchase agreement is signed. The environmental situation or damage is normally assessed by the privatized enterprise itself. In some cases, an agreement was reached whereby the new owner took over the rehabilitation programme or environmental protection measures in exchange for tax relief. Also, some remedial measures were refunded by the State, in Semipalatinsk for example, but due to the lack of finances this practice is not currently followed. Upon proof of environmental damage in individual cases, arrangements for funding the rehabilitation measures can be negotiated, including tax deductions or other measures.

The main issue raised with the current methods of privatization concerns the settlement of the privatized company's debts to non-State creditors. Proceeds from privatization are channelled to the State budget, where they are used as general revenue. Given the public budget deficit, the proceeds are used for priority expenditures like wages and salaries, and are not available for purposes that would help the privatization process. As a result, fixed assets have sometimes had to be sold in order to satisfy the non-State creditors of individual enterprises, which otherwise could not have been sold. In exceptional circumstances, the sales price of an enterprise has been reduced against an obligation on the buyer to pay back debts to the non-State creditors. Consideration is

currently being given to revising the relevant legal instruments in order to deal with debt payments differently.

1.2 Environmental policies and institutional arrangements

Major policy programmes

A range of environmental programmes existed for individual management areas in the early 90s. In 1994, the basis for an integrated State environment policy was prepared, but not adopted.

The programme for *Governmental Activity for Deepening the Reform and for a Way out of the Economic Crisis, 1994* announced the preparation of an environmental policy. In 1996, the *Concept of Environmental Safety of the Republic of Kazakhstan* was developed. It includes a strategy for the development of economic, social, environmental, organizational and legislative arrangements. *The Strategic Plan Up To 2030 "The Environment and Natural Resources"* was approved by the President in 1998. It includes long-term goals for integrating policies, including on environmental protection. Its priorities are the creation of (a) an effective system for governmental protection of the environment, (b) the bases for the rational use of natural resources, and (c) a system of environmental education. The Environment and Natural Resources has Action Plans for the years 1998-2000, 2000-2005, 2005-2010 and 2010-2030. The National Environmental Action Plan for Sustainable Development (NEAP/SD), was created as a plan for solving the priority environmental issues for the period 1998-2000

Today, the NEAP/SD defines the environmental policy and action programme. The priorities, identified on the basis of wide discussions, are: reduction of industrial pollution, introduction of resource-saving technologies, combat of desertification, stoppage of topsoil destruction, rational use of water resources and avoidance of water pollution, stopping the loss of forest, biodiversity protection, protection against radioactive pollution, and health protection. Actions are being developed to deal with hot-spot problems, i.e. not in the context of a systematic development of environmental policy. Neither NEAP nor local plans are being implemented, due to the lack of finance. Funds earmarked for environmental protection may be used for other purposes. A supplementary problem is that no mechanism exists to ensure incorporation of environmental priorities into sectoral development strategies. MNREP has started to prepare a National Agenda 21 and is involved in a joint programme of 5 Central Asian countries to prepare a regional environmental action plan to deal with regional priorities (see Chapter 3 for details).

Other relevant policy programmes exist in *oblasts*, which have their own environmental plans. Furthermore, cities prepared strategic plans for 1998 to 2000, in accordance with the national strategy (approved by the local councils, the *maszlikhats*), and yearly action plans approved by the executive heads (*akimat*). The plans include nature protection activities, as well as urgent environmental protection activities. Enterprises have annual programmes, which are approved by the relevant public administration and controlled by inspectors.

Further relevant special or sectoral strategic plans exist. Of particular importance are the Strategic Water Resources Plan (prepared by the Ministry of Agriculture), the Forest Programme (by the Ministry of Agriculture), the National Strategy and Plan of Action for Preserving and Balancing the Use of Biodiversity (1996, prepared by the MNREP), the National Plan of Action for Combating Desertification (1997, Ministry of Agriculture), the Programme of Ecological Education (1999, approved jointly by the Minister of Science and Education and the Minister for Natural Resources and Environmental Protection), and the National Programme for Health and Environment (1999, approved jointly by the ministers responsible for health and environment).

The Law on Environmental Protection of 1997 entrusted environmental management to a number of institutions, all of which lack financial resources. This restricts their staffing levels and their work. Furthermore, there is a lack of experts in environmental management. Figure 1.1 details the functions of State institutions of central importance for environmental management.

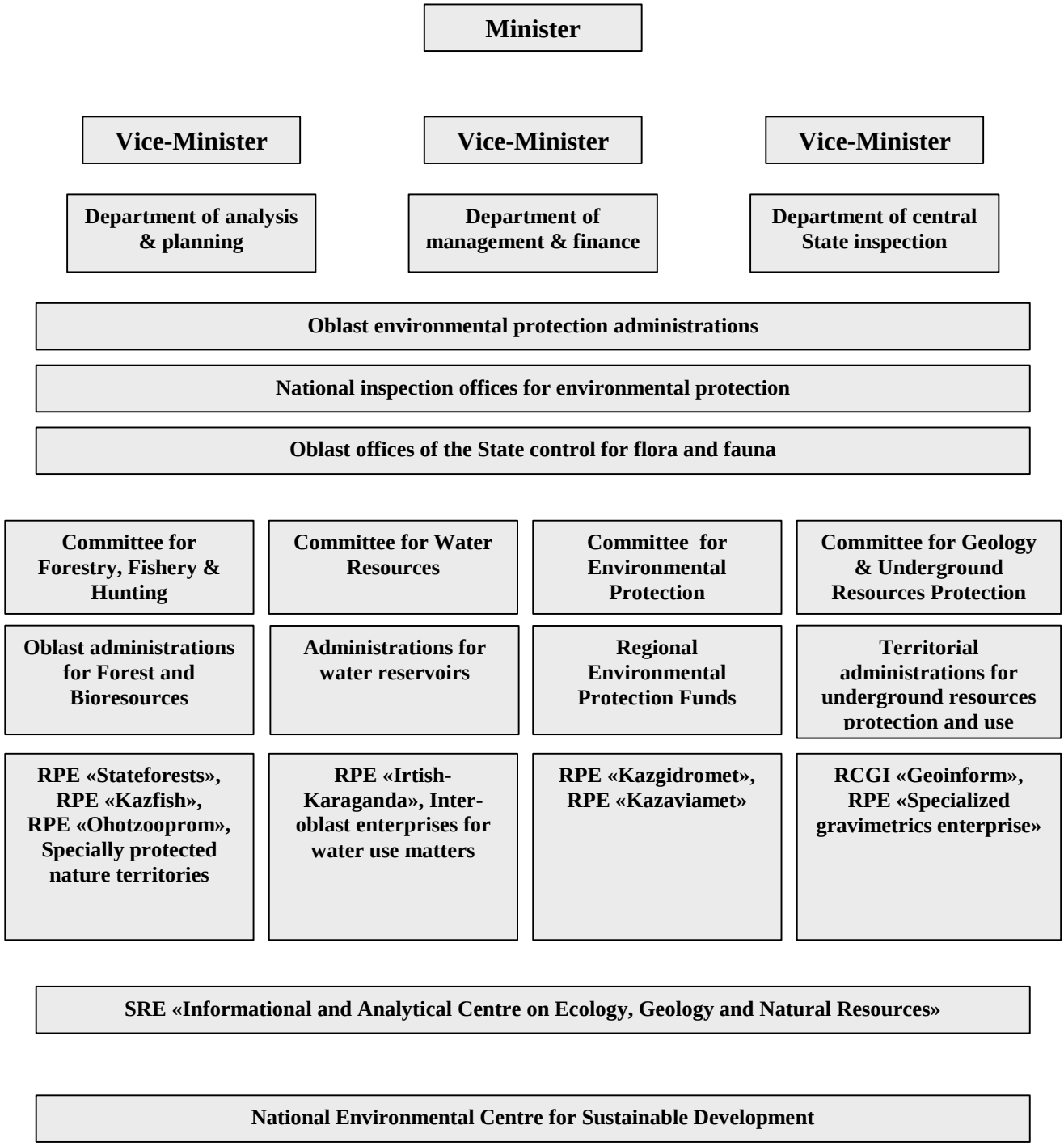
The State Committee for Environmental Protection and Natural Resources was set up in 1988, as a central governmental organ. In 1991, it was transformed into the State Committee of the Kazakh SSR for Ecology and Environmental Management. The Ministry of Ecology and Bioresources became its successor in 1994, before the current Ministry for Natural Resources and Environmental Protection (MNREP) was created in 1997 (see Figure 1.2).

Institutions for environmental management

Figure 1.1: Responsibilities of representative and executive bodies

Parliament	Approves environmental policy and adopts laws
National Government	Decides on the implementation of environmental acts and controls ministries and agencies
Central executive body: Ministry for Natural Resources and Environmental Protection	Adopts resolutions for implementing laws and organizes ministry and departments for applying the resolutions of the president and parliament, interdepartmental coordination in environmental protection and natural resources, including specially protected natural territories. Environmental inspection and control.
Local representative bodies-*maslikhas*	In accordance with administrative responsibilities, approve the rules for the rehabilitation, renewal and rational use of natural resources, for establishing specially protected areas and the conservation of objects having special scientific and cultural value. They also approve environmental protection programmes, oversee the local executive agencies, approve local expenses for environmental protection and the use of resources, including for environmental expertise, and adopt rules for dealing with breaches of environmental legislation in their competence, control compliance with environmental standards (together with the local executive body), and inform the public about the results of environmental expertise (together with the local executive body).
Local executive bodies – *oblast* and city *akimats*	Implement and control environmental protection and the use of natural resources in their competence Enforce nature use conditions on their territories Establish protected areas of local importance Construct environmental protection facilities Approve charges for pollution, in coordination with the central executive body Advise on ecological expertise for bigger projects and carry it out for smaller ones Have the right to suspend an activity that violates the law

Figure 1.2: Structure of the Ministry for Natural Resources and Environmental Protection



The MNREP is the main State body for environmental policy and management. Its overall task consists of the integration of environmental protection issues into decision-making processes, environmental control and interdepartmental coordination. Besides the protection and management of the environment, it also deals with the management of natural resources (water, forest, mineral and biological resources, but not land). The Ministry includes four committees: for environmental protection; for forestry, fishery and hunting; for water; and for geology and mineral resource protection. They are assisted by consultative scientific and technical councils. The departments of the Ministry and the Vice-ministers design and organize the policies, which the committees implement. The committees also supervise the work of *oblast* and city administrations. The Ministry and the committees have territorial offices in the *oblasts* and the cities

of Almaty and Astana. The Ministry also exercises the State control of environmental protection, with its 1,149 inspectors.

The *National Environmental Centre for Sustainable Development*, with subdivisions in the *oblasts*, is organized on a project basis. The Centre will continue to exist in its present form till the end of 2004. It prepared the NEAP and monitors its implementation. Every 3 months, the Centre surveys regional or local projects. 60 per cent of them are not in accordance with the priorities of NEAP, as it is not treated as a priority for the selection of projects. The Centre also has a project preparation committee and an international conventions unit. They started to work on the national Agenda 21 with foreign financing. The Centre is part of the institutions of the five Central Asian countries that aim to develop a regional environmental action plan. The implementation of international conventions is underfunded, and there is little cooperation with other ministries.

Box 1.2: Local environmental protection institutions in Almaty

These institutions are part of both the regional and the city administrations. The *Oblast* of Almaty has 59 employees for environmental management, of whom 26 are State inspectors. Almaty City has 38 environmental managers, of whom 17 are state inspectors. One of their prerogatives is to set the penalty rates when emission limit values are exceeded. The City imposes high penalties, to force the enterprises to reduce emissions. The *Oblast* administration sets lower penalties. The city and *oblast* administrations agree on the distribution of responsibilities for solving particular problems. For example, water resource management and water supply are in the State/*oblast* competence, responsibility for municipal waste was moved from city to *oblast*, air pollution is a shared responsibility of city and *oblast*. They both informally cooperate daily with bodies representing other ministries.

Inspection

Ministerial bodies ensure State control of environmental protection. Controls include the observation of environmental conditions and the changes caused by economic and other activities, the supervision of plans and measures aimed at the protection and rehabilitation of the environment, the rational use and reproduction of natural resources, the respect of environmental legislation, as well as environmental quality and all other regulatory requirements.

Inspectors control all enterprises (public and private) according to a schedule. Inspection frequency varies from 3 months to 1 or even 5 years, depending on the degree of hazard associated with emissions. Inspectors monitor and control according to their own methodology and equipment and so take the circumstances of each case into account.

Inspectors can determine penalties in accordance with the Administrative Code. The penalties go to the State budget. In the first 3 months of the year 2000, 6,000 inspections were carried out by the MNREP, 11,800 recommendations were made, 150 persons were fined and almost 4 million tenge were collected. Fines for the violation of permitted air emissions totalled 60 per cent of such revenues in 1999, 56 per cent in 1998 and almost 100 per cent in 1997. A total of 30,000 administrative penalties were issued during those three years.

The environmental inspectorates cooperate with the Agency for Emergencies and Health and the Agency for Land Resources, on the basis of respective protocols. They set up ad hoc commissions, if inspection of a particular site requires it.

1.3 Environmental monitoring and information

Right to information

The Constitution and the Law on Environmental Protection rule that all information on the environment must be provided to citizens and NGOs, and may be published in the mass media. The Law provides a definition of information for environmental protection, and includes an obligation to prepare environment statistics. It stipulates that State records and surveys on natural resources, State environmental monitoring and monitoring of natural resources shall be kept for the purposes of preparing regulations on the use of resources. It furthermore provides that State records and surveys should be kept about the condition, the use, the renewal and the protection of natural resources for the population's needs and the various economic sectors. Information on the functional structure of environmental protection and the use of resources is also mandatory, as is information on the content of laws and procedures in legislation. The Law also states that enterprises shall conduct their own industrial monitoring and report results to the Ministry.

The lack of a monitoring system and the dispersal of environmental information make it difficult for the public and NGOs to locate and obtain data. Data identification and retrieval is also difficult for the State institutions. Bulletins and maps, if they exist, are relatively expensive. The decentralized location of the MNREP requires intensive information flows between public administrations, including by modern means of communication.

Environmental monitoring

The Law on Environmental Protection prescribes the establishment of a single State environmental monitoring system and the monitoring of environmental conditions and of conditions of natural resources. The concept of a unified State environmental monitoring system was prepared in 1996. Strategy 2030, in its section on the environment and natural resources, deals with some separate monitoring projects. In practice, the situation does not meet the legal requirements. By-laws for establishing a unified monitoring system have not yet been prepared. State monitoring was operating in Soviet times, but the system collapsed in 1997 and data on quality of water, air, as well as on radioactivity are no longer collected in the necessary extent and detail.

Data collection and dissemination

The main governmental institutions holding environmental data are:

- The National Environmental Centre for Sustainable Development collected a lot of data when it prepared the National Environmental Action Plan
- The MNREP collects data through administrative systems (environmental expertise, permits, inspection), and from users of natural resources through their reports about their effect on the environment
- The Republic's Centre for Geological Information
- Kazhydromet (with 14 *oblast* branches) used to monitor air, water and soil, data cover the years up to 1997
- The Ministry of Agriculture stores data from desertification monitoring
- The Agency on Statistics
- The Agency on Health Affairs processes data on sanitary and health conditions.

Data collected by *oblasts* (environmental expertise, permits, inspection) are sent to the four MNREP committees. It provides data to the Information and Analytical Centre of Ecology, Geology and Natural Resources in Almaty, which is a kind of documentation centre. The Centre also gets information from the Geoinform Centre, the Agency on Statistics and Kazhydromet. The Centre prints information materials, maps, legislative documents, and issues a quarterly Environmental Bulletin. Publications and maps are relatively expensive. The latest environmental report was prepared three years ago, and a report on the state of biodiversity was issued recently. The Centre organizes ecological campaigns such as Earth Day, Water Day, Desertification Day, Wetland Day, Environment Day, and Biodiversity Day. It is a focal point for cooperation with the Ministry of Science and Education and cooperates with NGOs.

1.4 Public participation and NGOs

Right to public participation

The right to public participation is established by the Constitution and the Law on Environmental Protection. The Law assigns the right to participate in the drafting of laws to NGOs, but not to citizens. The Law also determines the rights and duties of citizens and NGOs as regards environmental protection.

The Law on Environmental Expertise includes provisions for mandatory information on the beginning and the results of environmental expertise. The environmental expertise requires public input, which large developers usually obtain by holding public hearings. The public has the right to prepare a voluntary public environmental expertise.

The Law on Specially Protected Natural Territories stipulates public oversight of protected areas. Local self-administration agencies ensure the involvement of the local population.

Kazakhstan signed the Aarhus Convention in June 1998 and intends to ratify it in the year 2000. The Ministry is preparing the plan for implementation. NGOs are involved in reviewing the existing legislation and preparing proposals to adapt it to the Aarhus Convention. NGOs hope that the ratification of the Convention will greatly improve their access to information and public participation.

Industry is rarely represented in any environmental decision-making process.

Public awareness

Public awareness for environmental problems is generally considered to be low. Attitudes toward nature resource use and environmental protection are thought to depend first of all on socio-economic developments. Illegal logging for cooking and heating, hunting, fishing, poaching and trading in rare species, and collecting medical plants seem to have increased. For example, there were 2,500 violations of fish conservation rules in the third quarter of 1996. The increase in unauthorized seizures of State land and pastures by farmers, refugees, migrants, and the deterioration of sanitary and hygiene conditions in poor residential areas are also believed to be due to the socio-economic situation. The introduction of payments for the use of natural resources that were free before is clearly unpopular, particularly when accompanied by worsening sanitary conditions, possibly resulting in increased morbidity.

The overall result, according to the Kazakhstan's environmental managers, is that, despite information and education efforts, environmental awareness remains relatively low and should be improved to better prepare the implementation of environmental policies.

Non-governmental organizations

NGOs have the right to perform their activities independently of the State. They have the right to conduct public environmental expertise, are entitled to receive reliable information from State bodies, and to demand the cessation of activities of enterprises and organizations that have a negative impact on the environment or health. The Law on Non-governmental Organizations (May 1996) defines the sources of their funding, including commercial activities as far as they serve to help achieve the goals for which the NGO was set up. There are about 300 active and registered NGOs with a wide range of interests. They actively participate in the preparation of laws. In 1997, the first NGO forum was convened in Almaty. It brought together around 170 participants and paved the way for participation in the 1998 Aarhus Conference. The forum conducted a survey of civil servants, press, NGOs and the public on environmental awareness. NGOs play an important role at local level.

The NGO community suffers from a lack of financial resources for involving paid specialists in their work, and for travel. They feel that the taxation system does not provide incentives for improving environmental conditions. NGOs complain about a lack of information in general, and some reported during the EPR Review Mission that sometimes they had been refused information by some ministries. At the same time, they also noted that the MNREP is trying to improve the situation. One full-time MNREP staff member is working on this. NGOs feel that the location of MNREP causes problems in coordination with other ministries and the public, and they want to see this Ministry more powerful. They also deplored the absence of a 'green lobby' in Parliament.

The following objectives were widely shared among environmental NGOs:

- The alignment of environmental legislation on international practices
- A better application of environmental legislation
- A better application of international conventions
- The preparation of clear programmes and procedures for projects for international funding
- Fund raising for the protection of human and nature rights
- The establishment of an independent newspaper and the improvement of existing Web sites

1.5 Environmental education

Environmental education is required by a number of legal instruments and policy strategies. It concerns pre-school, secondary, vocational, special secondary and higher education, as well as specialist training. The programmes of all educational establishments include environmental subjects. Environmental education is obligatory for all top executives and specialists working in activities causing negative impacts on the environment. In particular, economists, auditors, information managers and lawyers lack training in environmental management.

The MNREP organized the participation of 45 Kazakh schools in the international educational programme GLOBE. In 1999, the State environmental education programme was adopted in cooperation between the two ministries, MNREP

and Ministry of Science and Education. The same ministries also signed a decree on basic scientific measures, enabling environmental goals and programmes to figure more effectively in work with the mass media, in foreign relations and in the financing of the programme. A unit of four staff implements the programme in the Ministry of Science and Education.

Environmental teaching material is being prepared for pre-school children. The primary education programme includes the subject of ecology. New textbooks will be prepared for the first four years in the Kazakh language. 36 schools teach a special ecological programme. The subject of environmental protection and conservation is part of the curriculum for the sixth to eighth years. The College for Agriculture and 15 universities include the subject of ecology in their courses, and Kazakhstan also intends to establish a special college for ecology. Kokshetau University is trying to develop an ecological education model. In 1997, 158 ecological specialists were trained out of a total of 1,260 students. Other educational centres are the Semipalatinsk Ecological Centre and the Baravoja Seminar for teachers to share their experiences. Training for farmers is organized in the *oblasts*.

1.6 Conclusions and recommendations

Kazakhstan is a vast country, with widely varying natural conditions, and a low population density, i.e. intrinsically low population pressure overall. The current economic depression, together with the implications of the transition from a centrally planned to a market economy, and a considerable endowment with economically exploitable natural resources provide further framework conditions for environmental management. As a result, nationwide environmental policy and management are very difficult to define and implement, and public support for urgent measures can only be expected at a decisive scale, if special efforts are being made in this direction.

In this situation, Kazakhstan has taken the strategic decision to support sustainable development and the corresponding sectoral integration of environmental targets. The translation of this basic decision into practice has started with the building-up of the necessary legal framework, and some successes have been scored in this regard. Today, the general legal framework is outlined, although in some important areas of environmental management the legal provisions of the former Soviet Union are still in force, creating uncertainties as to their applicability to the new social realities.

The Law on Environmental Protection, like other laws, requires by-laws before it can be fully implemented. Many of them are still missing, especially those that provide operational procedures. Their lack creates many problems, leads to inconsistency in the implementation of environmental policies, and limits their effectiveness. Of particular importance are operational regulations on environmental monitoring, on procedures for environmental expertise, on environmental auditing, on environmental insurance, on public access to information and public participation, and on procedures for certification, and on handling emergency situations. The provisions of the Law on Environmental Protection should also be reflected in other relevant laws. Furthermore, the air, water and land-quality standards need to be revised, or established where missing.

Recommendation 1.1:
Further work on the legal framework for environmental protection should concentrate on the development of the by-laws and laws that are necessary to close existing gaps in legislation (ozone, biodiversity, flora) and to fully enforce the existing laws. The priorities should be the by-laws enabling environmental monitoring, completing the procedure for environmental expertise, establishing an environmental insurance scheme (including liability schemes), and clarifying procedures for public participation as well as for enforcing the right to obtain environmental information. The legal instruments that retain practices from the former Soviet Union should be modernized. A department for environmental legislation should be established in the Ministry to coordinate work on all environmental legislation. *See Recommendations 3.1, 5.1, 7.1, 8.1, 9.1, 13.1.*

The most important problem is, however, law and policy enforcement. Not only are many implementing regulations missing, but one of the main causes of unsatisfactory law implementation is that the gradual emergence of an internally consistent overall legal system requires frequent adaptations of its parts. The more it is implemented and enforced, the more gaps and discrepancies appear.

To remedy the situation, an adequate, single reference document for environmental policy implementation is needed. The most natural

candidate for this role is the NEAP, after appropriate revision. For the time being, NEAP may be a little too hot-spot oriented. It should be updated to reflect a more comprehensive and strategic vision, while retaining its consistency with the *Strategic Plan Up to 2030: The Environment and Natural Resources,* Its authority should be increased through parliamentary approval. A mechanism for regular updating should be agreed and published, including satisfactory public participation. Finally, the projects included should be accompanied by funding provisions. At present, earmarked environmental funds are not necessarily used for environmental purposes.

Recommendation 1.2:
The National Environmental Action Plan should be revised and complemented with clear priorities to become the only core plan for systematic environmental actions. The actions included in the plan should be accompanied by funding provisions. The revision should preserve consistency with other strategic policy documents. The revised plan should be widely published and brought to the attention of Parliament. A regular monitoring of implementation and updating mechanisms for the plan should be agreed and published. See also Recommendation 14.2.

The responsibilities of governmental bodies are not clearly defined. Environmental protection and natural resource management are two different tasks. Their allocation to different departments of the MNREP should be complemented with mechanisms for intensive cooperation. Informal cooperation and coordination at working level between different ministries and departments need to be encouraged, but contacts with other ministries may also have to be formalized. For example, water issues are dealt with in various ministries, committees and agencies. An interdepartmental body for coordination or any other clear and practical mechanism may be considered.

Environmental inspection faces many problems: low wages, poorly trained inspectors, not enough financial means (they have to travel long distances), and outdated technology of laboratories. This situation must be improved to ensure future successful environmental management

Recommendation 1.3:
All the tasks and responsibilities of environmental management institutions should be optimized and made transparent. In this process, contacts within the Ministry of Natural Resources and Environmental Protection and with other ministries and administrations should be improved. The institutions responsible for radioactivity management should be identified. The department responsible for the preparation of state-of-environment reports should be designated. Environmental inspections should be strengthened, primarily with training, equipment and operational means. See Recommendation 6.5.

Information management is of strategic value. Firstly, the relevant information has to be available. Secondly, it needs to be used in various ways, of which the preparation of policy scenarios, the monitoring of the results of environmental actions and the raising of public awareness are among the most important. In Kazakhstan, environmental information is a very weak link in the management chain. Environmental monitoring was discontinued in 1997. Available information cannot easily be identified. Access to relevant information is not always easy. The solution of these serious problems is very urgent and requires the cooperation of all actors and partners in society: government, public, scientists, media, NGOs.

The creation of an information system should be given a high priority. The development should begin with an inventory of all relevant environmental databases and its publication. The complete future system should be based on the resumed environmental monitoring of air and water, and the monitoring of protected areas should be extended (i.e. should not only cover national parks). Data collected by the MNREP, especially those on emissions to the environment (including waste), should be given priority in the information system. The information system should include the regular dissemination of state-of-the-environment reports, both in the form of hard copies and on the Web. A time schedule for filling information gaps, like a database on contaminated sites, should be established.

Recommendation 1.4:
An integrated environmental information system should gradually be established. The dissemination of environmental information should be regulated in the system. It should start with an inventory of environmental information available in the Ministry for Natural Resources and Environmental Protection and other government institutions. The early and systematic publication of the inventory would facilitate the required public access to environmental information. See Recommendations 10.1and 12.4.

The Kazakh Government attaches adequate importance to environmental education, as the only long-term solution to the country's needs for more qualified environmental managers in the future, and for raising public awareness. As far as awareness and public participation are concerned, the intended ratification of the Aarhus Convention will help to streamline laws and regulations, and to improve relations with NGOs and the public at large.

Both public awareness and cooperation with NGOs would also benefit from closer working contacts between the MNREP and the NGO community. For example, the NGOs at local level could probably be more involved in the organization of workshops on environmental protection, and NGOs might also be good partners for the development of teaching material for use in environmental education. Such initiatives, as well as training programmes, could perhaps benefit from some form of joint financing by the MNREP and the Ministry of Science and Education.

Recommendation 1.5:
The Ministry for Natural Resources and Environmental Protection should consider cooperating more with non-governmental organizations to raise environmental awareness. Possible cooperation might also be explored in the area of environmental education. Cooperation with the Ministry of Science and Education could be extended to the joint funding of environmental training programmes. Training programmes of staff in the Ministry for Natural Resources and Environmental Protection, as well as in the relevant environmental administrations of oblasts, should be identified. *See Recommendation 10.1.*

Chapter 2

REGULATORY AND ECONOMIC INSTRUMENTS

2.1 Regulatory and planning instruments

Permits for pollution discharges

A permit for the discharge of polluting substances is necessary for each pollution source. The basic criterion in determining the dischargeable amount is the toxicity of the discharged substance for the human organism. The toxicity of substances is defined by a toxicity coefficient, which is inversely proportional to the maximum permitted concentration (MPC). MPCs define the maximum concentration of toxic substances in air or water that is not supposed to harm human health and can therefore be allowed at a certain distance (so-called sanitary zone) from the pollution source. MPCs, as well as sanitary zones for different enterprise activities, are defined by the Agency of Health. The current norms are based on the old Soviet standards.

Enterprises' maximum permitted discharges or emissions (MPEs) are derived from MPCs, through the application of standardized distribution models, which had been used in the former Soviet Union and have not been changed since. The calculation includes estimated activity levels of the enterprise (average number of operating hours) as well as a large amount of technical information. The enterprise combines this information in an MPE project, which it submits to obtain an emission permit.

The system of environmental permits is undergoing major changes in Kazakhstan. The temporary continuation of the system described above will most probably give way in the long run to a new quota system. A new form of permits, called Permits for Special Nature Use, were introduced at the beginning of 2000 by the Order on the Ratification of Regulations Concerning Special Nature Use. The system separates State control from economic and administrative functions. Currently, these new instructions are with the Ministry of Justice for approval.

The main novelty of the permitting system will be that it introduces a combined permit document for emissions and discharges of pollutants, the disposal of industrial wastes, the use of flora, and geophysical and exploratory works. However, the different parts of the combined permit are not jointly evaluated. Permits are given yearly by local environmental administrations or the Ministry, depending on the amount of discharges. Permits are given by the Ministry in the following cases:

- for air emissions exceeding 1,000 tonnes/year
- for waste-water discharges exceeding 10,000 m^3/year
- for waste discharges of toxicity classes 3 and 4 exceeding 10,000 tonnes/year
- for waste discharges of toxicity classes 1 and 2 exceeding 1,000 tonnes/year
- for all enterprises acting in the areas of the Baikonur cosmodrome, the Caspian Sea, and the basins of the transboundary rivers Irtysh, Ili, Ural, Tobol and Syr-Darya.

All permits have to be registered with the Environmental Protection Committee in the MNREP. At local level, the responsible organs are the Departments on nature resources and environmental protection. The objective is to create pollution quotas for the main polluting substances for the country as a whole, as well as for the individual regions. These quotas will be calculated in the Ministry with the help of a computerized registry, including basic information on all enterprise permits in Kazakhstan. At the moment, the registry has information on some 4,300 enterprise permits, of which 4,200 are given by local environmental administrations and 100 by the Ministry. As the registry is currently incomplete, the basis for calculating MPEs is the discharge level of the previous year. The permitted discharges

of an enterprise cannot exceed the amount allowed for the previous year by more than 50 per cent.

Nature use licences

Licences for mineral resources exploration and use have been given since 1997 by the Agency for Investments, which draws up governmental agreements with mineral resource users. An enterprise that plans to explore or use mineral resources submits an application to the Agency. The Agency organizes a tender, and the winner of the tender is awarded a licence.

There are three different types of licences: a fixed-term exploration licence, a fixed-term mining licence and a combined exploration-and-mining licence. An exploration licence is issued for a term of up to 6 years, while a mining licence may be issued for up to 25 years. Combined licences may be issued for a term of up to 31 years. The holder of an exploration licence will have the first right to obtain a mining licence for the area. Depending on the type of the licence, it defines the area of exploration, the duration of contract, work plan and minimum annual exploration expenditures, the minerals to be extracted, the expected yearly revenue of the enterprise, and bonuses, royalties and excess revenue to be paid to the Government.

Licences for surface water use are based on the 1993 Water Code. Depending on the size and importance of the watercourse, they are issued by the central or regional departments of the Committee on Water Resources of the Ministry of Natural Resources and Environmental Protection (MNREP). Licences are needed for special water users, including enterprises, organizations providing communal services, industry (including energy production), agriculture and fisheries, hydropower stations and water transport. Licences are issued for a certain amount of water use or, in the case of hydropower stations, for a certain amount of energy produced. There are seven different water basins in Kazakhstan, with different payment rates.

The Committee for Water Resources in the MNREP is responsible for granting licences for surface water abstraction. The Committee of Geology of the MNREP is responsible for groundwater abstraction licences.

According to the Forest Code (1993), licences for forest use are issued by central and regional departments of the Committee of Forestry, Fishing and Hunting of the MNREP. Licences include the amount and type of forest to be felled. Fishing and hunting licences too are granted by the same committee. The licences stipulate the amount and species of animals that can be hunted or fished. The Law on the Protection, Reproduction and Use of Animals (1993) is the main legal basis for hunting and fishing licences.

Ecological expertise and environmental impact assessment

The Law on Environmental Expertise (1997) acknowledges such expertise as one of the main tools for determining the environmental requirements that condition economic and other activities. A number of by-laws are in place regulating environmental expertise. They have grown historically rather than systematically:

- Normative documents for organizing and conducting environmental expertise for the introduction of new technologies and materials, 1992
- Temporary instructions for conducting environmental expertise of planned activities issued at ministerial level, 1993
- Instructions for conducting environmental expertise of pre-projects and project materials, 1995
- Guidelines for the initiation of an economic activity and the development of project and pre-project documentation on the organization of the study and taking account of public opinion during the environmental impact assessment (EIA), 1997
- Recommendations on EIA for biological resources (not obligatory)

These by-laws are not harmonized with the 1997 Law on Environmental Expertise. Amendments to the Law are envisaged, as is the preparation of new and revised by-laws (order on licensing for environmental expertise, new instructions for conducting EIA). The Law on Environmental Expertise requires that the preparation of State environmental expertise should be an open public process. However, it requires only the distribution of information, but not actual public participation in the process. In some large projects (i.e. some TengizChevroil and canal building), there have been public hearings.

An environmental expertise corresponds to the environmental impact statement (EIS) known in

Western Europe and the United States. The law requires the preparation of State environmental expertise for all projects, new enterprises, and also enterprises that are privatized or alter their production processes. It is also required for:

- proposals on projects, contracts and international treaties which may affect the environment
- draft laws and other legal documents that are likely to affect the environment if adopted
- documents on monitoring environmental requirements during the operation of an economic activity
- applications for licences and certificates for the use of natural resources.

The environmental expertise cannot influence the location of a project. The process of obtaining consent for the allocation of land to a development project is separate from the environmental expertise and is conducted in a different ministry.

There are two types of environmental expertise, State and public. State expertise is binding, public environmental expertise is voluntary and not financed from the State budget. State environmental expertise must be prepared for any project on the list of projects for which it is obligatory, whether it is developed by the State or privately. The responsibility for environmental expertise is at State level for big projects, and at *oblast* and city level for small projects. The cost is paid by the developer. If a negative decision is taken at *oblast* level, the developer can appeal to the Ministry. In Almaty *oblast*, environmental expertise is conducted about 900 times per year, and in about 50 per cent of cases developers are required to improve or complete their initial projects. Altogether in 1999, environmental expertise was carried out 8,694 times in Kazakhstan.

An environmental impact assessment (EIA) is one of the documents required for the preparation of an environmental expertise. The EIA is prepared by certified experts. Certification of EIA experts is going to be the subject of a future regulation. The EIA process includes the determination of the types and levels of the impact of the activity on the environment, the prediction of probable environmental changes if the project were implemented, the development of environmental protection measures in the project implementation and the definition of environmental protection requirements in the project. Legislation also requires EIA to include alternatives to the proposed action, including that of no action. Socio-economic effects are included in the EIA.

Territorial planning

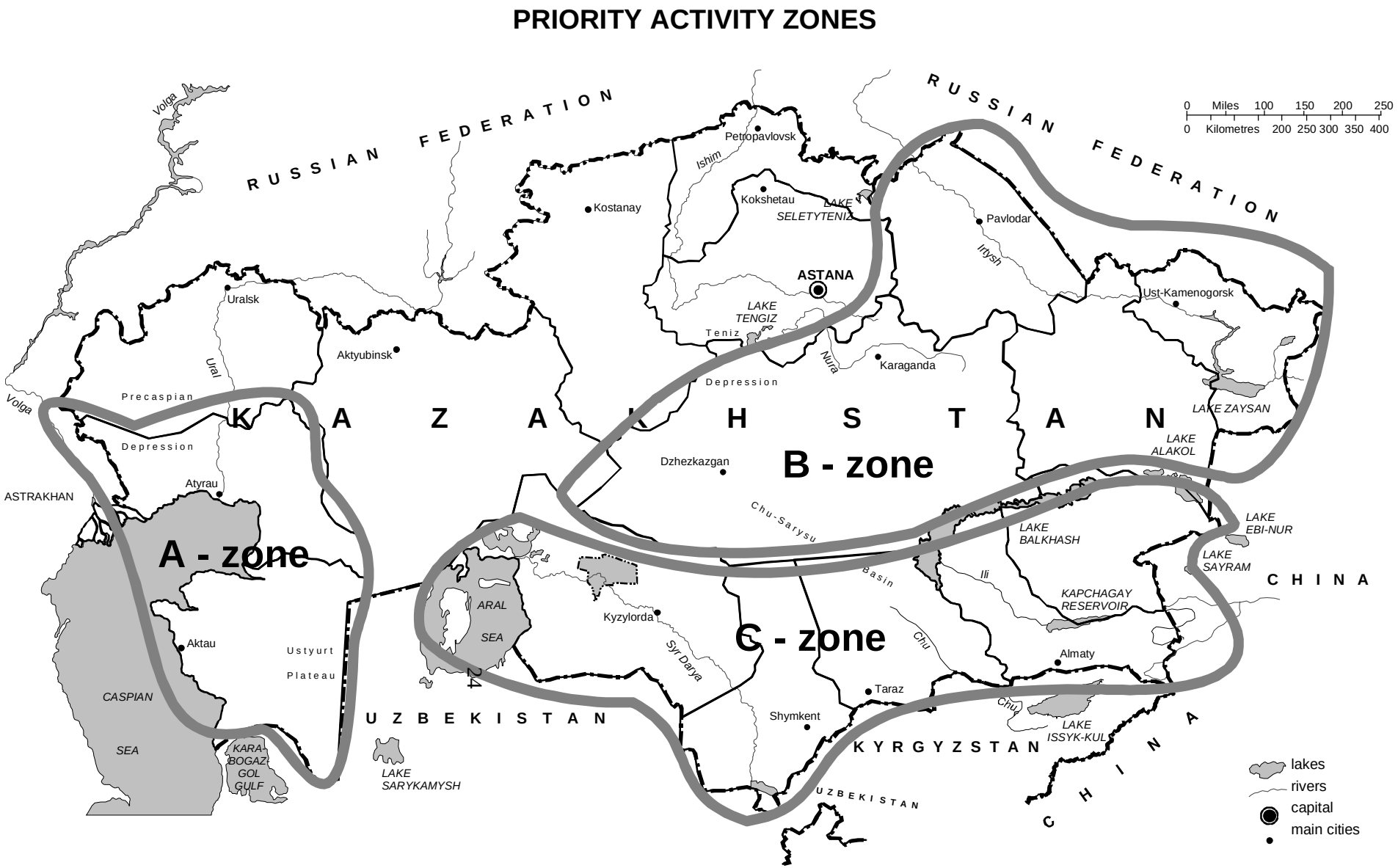
There is no comprehensive system of territorial planning whereby all levels of the administration draft territorial plans, followed by the lower-level planning authorities. The only planning instruments in use are the general plans of cities. They do not include ecological considerations, although article 56 of the Law on Environmental Protection states that, in the construction of cities and other built-up areas, environmental protection and safety must be taken into account, and that special attention must be paid to waste disposal, forests and parks. A global zoning of regions, in accordance with environmental problems has been established, although it does not cover the country as a whole.

Most of the general plans in use were drafted during Soviet times, which means that they no longer address the current needs of industrial and residential construction. For example, in Almaty, new industrial enterprises were built in residential areas and within the city limits, although air pollution levels are already high. Although the decisions are in contradiction with the general plan of Almaty, they have been approved by a special committee, which consists of representatives of various city authorities. The special committee can overrule the provisions of the general plan.

The authorities are currently drafting a new general plan for the city. They intend to establish a system of ecological zones as the basis for this new plan. The ecological zoning process started in 1999. Its purposes are:

- to define maximum permitted ecological pressures in different districts, and an allowable level of development for different branches of industry in each part of the city
- to assess ecological and health risks in different districts
- to establish a continuous monitoring system of environmental conditions in the city
- to create a geographical information system (GIS), including all relevant ecological, health and industrial information
- to draw up a list of priority environmental actions and projects in the city

Figure 2.1: Environmental priority zones of the NEAP



In the NEAP process, three different ecological zones have been identified for the country as a whole according to the industrial structure and main environmental problems of different regions. The environment priority zones of the MEAP are presented in Figure 2.1. Zone A is the Caspian region, in which oil production and refining are concentrated. Zone B is the eastern part of Kazakhstan, which is the most highly developed industrial region in the Republic. The most acute problems are industrial wastes, air pollution, forest degradation and the lack of protected territories. Zone C is the southern zone, which is agricultural. The deficit of water resources, the pollution of water bodies by waste waters, the degradation of pastures and the destruction of cultural and natural monuments are the most important environmental problems. A set of priority environmental projects has been established for each region.

The basic problem with the zones and their priority projects is that the decisions on regional environmental projects are made at *oblast* level. All three zones consist of many *oblasts,* and there is no joint decision-making mechanism to ensure that coherent projects are implemented. The NEAP process is not tied to Kazakhstan's budgetary process, which means that projects are rarely financed by the Government or local authorities. Moreover, regional/local enterprises are not involved in the process. So projects can normally only be implemented if they obtain foreign funding.

2.2 Economic instruments

Basic principles

The Law on Environmental Protection (1991, revised in 1997, see Chapter 1) established the main economic instruments and the principles for their application. There are three basic instruments:

- Pollution payments
- Nature use payments
- Payments for the protection and renewal of natural resources

Pollution payments are divided into normative and extra-normative payments. They were introduced in 1989. Nature use payments relate to the use of mineral resources, water, land, forest, hunting and fishing. The amount of nature use payments collected is very small compared to pollution payments. Payments for the protection and renewal of natural resources are mentioned in the Law on Environmental Protection, but in practice they are not demanded.

Other economic instruments are mentioned in the Law:

- Subsidies to stimulate environmental protection
- Ecological insurance
- Environmental protection funds

Only the last is currently in use. Finally, administrative penalties for breaking environmental protection legislation can be imposed on individual workers, authorities and enterprises.

The polluter-pays principle is not mentioned directly in the Law on Environmental Protection (1997). However, the Law does state that special nature users, i.e. legal persons, must pay for the use of nature, whereas for ordinary Kazakh citizens it is free.

Pollution payments are paid into the federal budget, and 50 per cent of them are redistributed to local environmental protection funds. According to the MNREP, some 60 per cent of all pollution payments are actually collected.

Air and water pollution taxes

Payment levels are defined each year by the local authorities (*akimats*), and then approved by the Ministry for Natural Resources and Environmental Protection (MNREP). The payments are due for emissions or discharges of pollutants, and different rates are applied, depending on whether the polluting source has emitted a volume within or outside permitted levels (see below). Rates also vary depending on the toxicity of substances for humans, which is the basis for the toxicity coefficients determined for each substance.

Extra-normative charges – i.e. those charges that are due for reported emissions above permitted levels – are usually 4-10 times higher per emitted unit than the rate for permitted pollution. Whereas pollution payments for pollution within permitted limits are part of the operating costs of an enterprise, fines for exceeding permitted limits are to be covered by enterprise profits. The amount of fines collected for excess discharges remains small, as most enterprises are currently working at reduced capacity.

Pollution payments are calculated by multiplying the amount of discharges by their toxicity

coefficient, before applying the charge rate fixed by the local authorities. The local authority fixes payments at levels that would finance the environmental protection expenditures of the *akimat* for the next year. As a result, substantial variations occur between regions. Before 1999, there was a wide variation in pollution payments between different regions. The MNREP, however, is trying different regions.

Waste-water pollution payments are calculated similarly. If an enterprise discharges waste water directly into a watercourse, it pays pollution payments to a local environmental protection fund. If it discharges waste water into a city sewer, it pays pollution payments in the form of user charges for communal services. The payment depends on the amount and toxicity of the discharge and on the characteristics of the watercourse receiving the waste water.

Households pay waste-water treatment charges to the municipal water companies ('vodokanal'). Charge rates are the same for households and enterprises. Prices are calculated to cover operating costs. In practice, however, the high amount of non-payments means that operating costs are not covered entirely, and municipalities have to subsidize.

Waste taxes

Payment rates for the disposal of urban solid waste were established in 1988, when some waste materials (e.g. paper, glass, textiles) were still recycled. Wastes were classified and payments defined according to different waste materials. After 1991, many waste recycling and reuse enterprises closed down, and wastes are now mostly dumped in landfills. Environmental protection funds collect payments from the legal person that owns the landfill (reported in Table 2.1). The owner, in turn, bills the enterprises responsible for waste collection and removal. Households pay a waste-disposal charge to the collecting enterprises. This charge is proportional to the number of inhabitants in the flat.

Waste charges are a function of the volume of buried waste and its toxicity. Industrial waste is classified into five classes, of which four are "toxic" and one is not (see Table 5.1). Rates are set annually by local authorities.

Charges for the collection of hazardous and industrial waste (introduced in 1988) were initially meant to create incentives for the mining industry to neutralize and reuse the large amount of toxic mining tailings which they produced. Solid hazardous wastes are divided into four toxicity classes. Charge levels for all four are decided yearly by regional administrations.

The evolution of pollution taxes between 1996 and 1999 is shown in Table 2.1. The ranges are determined by the lowest and the highest oblast rates.

Payments for nature use

Taxes for the use of surface and groundwater are based on the Water Code (1993), the Government Decree (1997) on Calculating and Collecting Charges for the Use of Surface Waters from Different Branches of the Economy and on the Presidential Decree of 24 April 1995 on Taxes and Other Payments to the Budget.

Water use taxes are collected from all water users. Payment levels depend on the economic activities. For enterprises and organizations using communal services, for industrial and agricultural water users,

Table 2.1: Pollution taxes, 1996-1999

Tenge/ tonne

Type of tax	Regional ranges			
	1996	1997	1998	1999
Air pollution	6.2 - 316	8.6 - 341	10.7 - 388	30 - 384
Water pollution	1 000 - 26 929	1 000 - 26 929	1170 - 29 417	1850 - 29 500
Non-toxic and municipal waste	2.6 - 356	2.6 - 385	10 - 413	10 - 454
Hazardous waste (class 1 only)	32 - 11 392	32 - 12 320	320 - 13 216	320 - 14 528

Source: MNREP.

payment is proportional to the amount of water taken from the source. For hydroelectric power stations, the payment depends on the level of power generation.

Households pay the same price as all other water users. The amount of water used is measured with water meters. Water prices are in principle calculated in such a way that they cover the operating costs of municipal water-supply plants, but, as with waste-water payments, the rate of non-payment is high and therefore operating costs are actually not covered. It is not considered possible for social reasons to raise the prices.

Taxes for forest and plant use are based on a document drafted by the USSR Ministry of Finance on 31 March 1987, on the Forest Code (1993), and on the Decree (1995) on the Ratification of Principles of Stumpage Payments in Kazakhstan. The principles of the payment rates for forest use are based on two decisions by the Forestry Committee of 1994. The payment depends on the wood species, quality of timber, location of logging area, etc. Government *leskhozes* are responsible for collecting the payments, which go to the State budget. Payment rates for the use of other forest products, such as mushrooms, are defined by the local representative bodies, the *masklihats*.

Taxes for fishing and hunting are based on the Law on the Protection, Reproduction and Use of Animals (1999), and on the Law on Environmental Protection (1997). Minimal payment rates for hunting are established in two governmental decrees (1998), distinguishing Kazakh and foreign citizens. According to the budget law from 1999, all payments go to the State budget. The Ministry of Finance redistributes these funds to the local level for the protection and reproduction of game. Fishing taxes and payments are based on a governmental decree (1998) that lists payment rates for industrial and recreational fishing. Rates are amended annually. Regional branches of the Forest, Fishing and Hunting Committee, acting under the MNREP, used to collect the fees, which are to be used for the protection and reproduction of fish. Since January 1999, taxes have been collected by the federal budget.

Payments for nature park and protected area use are based on the Law on Specially Protected Natural Territories (1997). Payments are set by local authorities, and go to the local budgets.

Special payments, taxes and royalties on the mining and use of mineral resources are based on various legal documents concerning government taxes, underground resources use, environmental protection, compensation for past damage and production-sharing agreements. Their main basis is the Decree on Underground Resources and their Use (1996). The principal institution responsible for the development of taxes on mineral resources was till 1997 the Ministry of Geology, but the Agency for Investments is now drafting the mineral resource use contracts with enterprises and other organizations.

Enterprises, governments and international organizations pay special taxes and fees for the right to carry out exploration and mining activities. In addition to these bonuses and taxes on licensing, commercial exploration, production, etc., enterprises pay royalties on mined minerals. Royalties are defined by the Ministry of Finance (MoF) as a percentage of the profit rate of a company. Levels of royalties differ according to the type of the mineral resource, varying from 1-20 per cent of the estimated profit rate. Royalties do not depend on the ecological damage done by the excavation work, and they are not used for financing environmental rehabilitation. Payments for production rights of minerals totalled about 9.8 billion tenge in 1998, and approximately 8.4 billion tenge in 1999.

All taxes, bonuses and payments are governed by agreements between the Agency for Investments and the enterprise or organization. The regional offices of the MoF are responsible for collecting the payments. Payments for mineral resources are not used for environmental protection purposes. Since 1996, all payments have gone directly to the State budget. Special taxes and payments have to be paid in cash, but royalties and governmental production shares can also be paid in the form of minerals mined.

The users of mineral resources are obliged to establish a rehabilitation fund, which will finance the restoration and reclamation of the affected site after the mining activities have ceased. However, in practice not all enterprises have established these funds.

Land taxes are based on the Decree on Land (1996. They are defined yearly according to the type of land use (agriculture, industry, transport, defence and other non-agricultural use). The Law on Taxes

and Other Obligatory Payments to the Budget (1995) defines separate payment rates for agricultural steppes and deserts. Both classes have 11 different subclasses, according to soil quality. Local authorities can change land taxes in their area by up to 20 per cent of the rates specified in the Law. Land taxes for residential (between 0.25 and 15 tenge/ha) and non-industrial areas in cities are classified according to the city. Land taxes for industrial land use are classified in 11 different classes according to the location of the land and other factors (ranging from 25 to 3,000 tenge/ha).

Excise duties

Differentiated excise duties for leaded and unleaded petrol have been in use since 1995. In 1998, payments from mobile pollution sources amounted to some 8.6 per cent of all collected pollution payments, some 200,000 thousand tenge in all.

Excise duties for imported fuel vary from year to year, but they do not differ according to the fuel quality. Excise duties for imported cars were introduced in 1998. There is also a car tax, differentiated according to the load volume for trucks, number of passengers for buses and engine size as well as age for passenger cars. However, the age differentiation follows a social rather than an environmental aspect, because new cars have to pay 5,000 tenge per year and cars more than 5 years old only 200 tenge. Only cars produced in the territory of the former Soviet Union are affected, cars produced elsewhere have a uniform tax of 5,000 tenge.

Other charges

The authorities of the Atyrau region, which is a centre for the oil and gas industry in Kazakhstan, have been imposing an experimental payment for thermal pollution since 1997. The payment has been introduced in order to reduce thermal losses from industrial enterprises, and it is charged per gigacalorie of thermal discharge. Enterprises in the region have, however, protested against the payment.

Planned developments of economic instruments

The MNREP plans to increase the use of economic instruments in environmental policy. The Ministry also plans to start emission trading inside Kazakhstan, as soon as the computerized registry of enterprise emissions is completed. Also, environmental insurance is mentioned in the Law on Environmental Protection, but not yet used for lack of implementing regulations.

As part of the new permitting strategy, the Ministry is striving to unify the charge levels of different regions. This means significant increases in charge levels regions that have imposed low pollution charges. The objective is to stimulate environmental investments and technological change in enterprises. The process has been ongoing since 1999.

The Ministry aims to change the system of economic and regulatory instruments so that instead of the current command-and-control approach, the relationship between enterprises and the Ministry would be more collaborative and consultative. The Ministry wants to establish a system of tax deductions according to which an enterprise does not have to pay all of its pollution charges if it invests the unpaid charges in environmental protection. Tax deductions would be based on an agreement of special nature use between the polluting enterprise and the Ministry. The agreement would list all of an enterprise's pollution charges, and the planned environmental investments. The Ministry would then check whether these investments were made.

Strategy 2030 on the use of natural resources and the protection of the environment foresees the development of a payment system for the use of groundwaters and for the discharge of waste water and irrigation water during 1999-2000. According to the Strategy, the Government also plans to distribute some of the pollution charges collected to the health-care system to compensate for health damage caused by pollution.

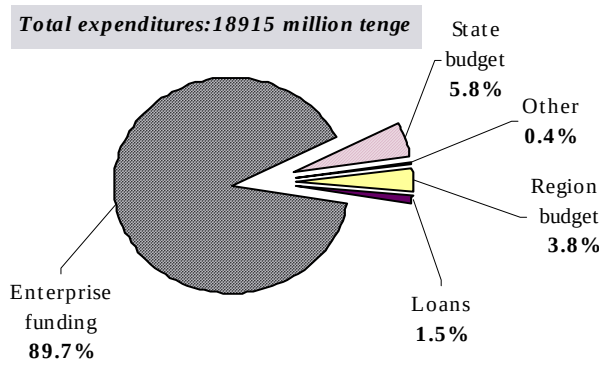
2.3 Environmental financing and expenditures

Sources of finances

Environmental financing comes from the State budget, regional environmental protection funds, foreign grants and loans, and enterprises' own funds. In 1999, a total of 18,915 million tenge (US$ 158 million) were used for environmental protection projects and activities. (Figure 2.2) Compared to the GDP of 1998 (US$ 22,300 million), this is some 0.7 per cent of GDP. The largest part, 16,871 million tenge or 89.7 per cent of the total expenditure was financed by enterprises' own funds. A total of 5.1 per cent (or

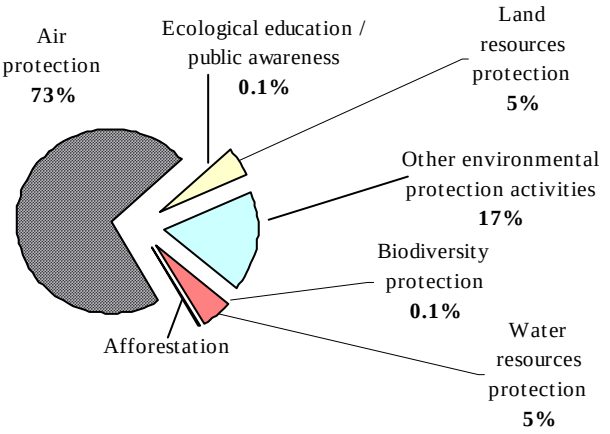
979 million tenge) was financed by the Republic's budget, and 3.3 per cent (or 642 million tenge) by regional funds. The rest was financed by loans and other sources.

Figure 2.2: Financing of environmental projects and activities, 1999



Source: MNREP.

Figure 2.3: Structure of environmental expenditures, 1999



Source: MNREP.

Environmental expenditure

In 1999, nearly 72 per cent of available funds were used for air protection (Figure 2.3). Other activities included land protection, water resources protection and non-specified environmental uses.

In 1999, most of the environmental investments and projects (63 per cent) were concentrated in the Atyrau *oblast*, a centre of the oil and gas industry. Environmental investments of enterprises to combat air pollution represented 97 per cent of all expenditures in Atyrau. The *oblasts* with the least environmental investments were Dzhambyl, North Kazakhstan and Akmola and the cities of Astana and Almaty.

Environmental protection funds

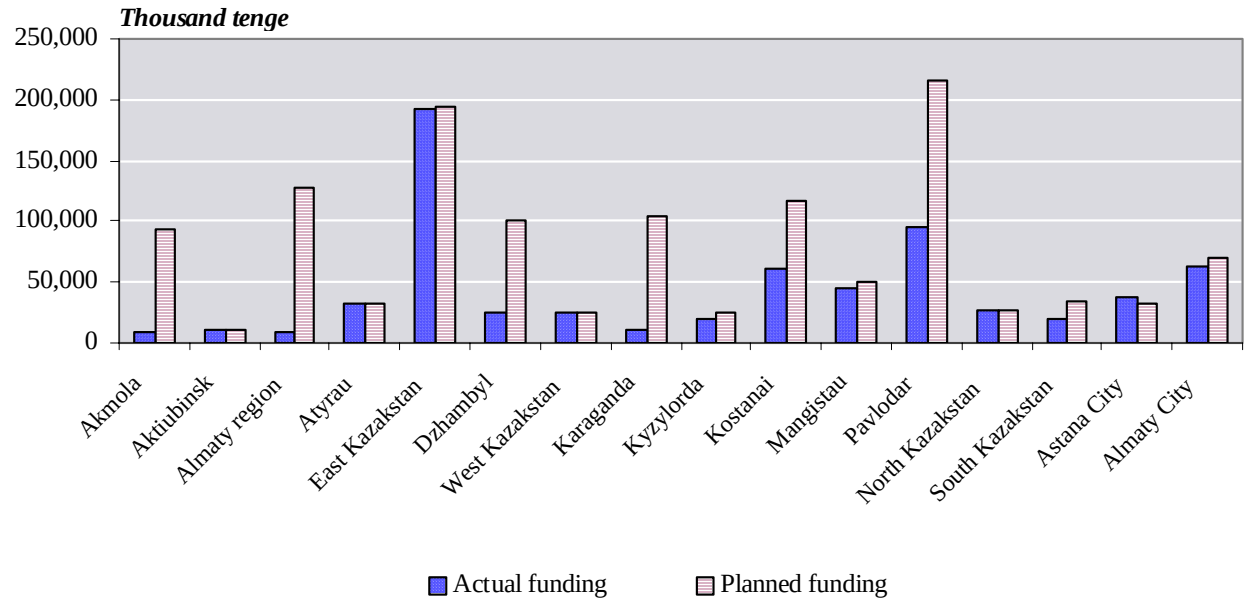
The Government Decree on the Creation of Nature Protection Funds (1993) established a system of environmental protection funds, which were consolidated into the State budget in 1994. In 1998, environmental protection funds were established again by a new Decree on the Creation of Environmental Protection Funds. In all, 16 regional and one national fund were created. At the end of 1999, the situation changed again, when the Law on the Republic's Budget for 1999 with Amendments and Supplements ordered that all extrabudgetary funds at national level should be closed. Therefore, there are currently 16 regional environmental funds (in Astana and Almaty, and in the 14 *oblasts*), but no national fund, and all national financing is via the State budget.

The division of environmental payments between the State and local budgets has been amended many times. Until 1997, local budgets received 85 per cent of the collected funds and the State budget 15 per cent. In 1997, the situation changed, so that 70 per cent of the collected payments were given to the local budgets and 30 per cent to the State budget. In 1999, it was ruled that 50 per cent of the collected charges should go to the State budget, and 50 per cent to the local budgets. For each local budget, it is half of the received environmental payments.

The share of the money collected in environmental pollution and nature use payments used for environmental protection has constantly shrunk. In 1997, some 36 per cent of collected payments were actually used for environmental protection, in 1998 this amount was only 25 per cent. In comparison, in 1997, this percentage was 93 per cent in the Russian Federation and in Poland, 114 per cent in Estonia and 46 per cent in Bulgaria.

The 16 regional and city funds administer pollution and nature use payments from enterprises. They calculate the charges for each enterprise, based on its permit and on the charge level. Regional funds also calculate nature protection expenditures for the coming year in their region, which in principle form the basis for the charge level of that year. The tax authorities assist the funds in actually collecting the payments from enterprises.

Figure 2.4: Planned vs. actual environmental expenditure in the regions, 1999



Source: MNREP.

The part of pollution and nature use payments going to regional funds has constantly decreased, mainly for two reasons. In addition to the shrinking share referred to above, the amount of pollution and nature use payments used by local administration for purposes other than environmental protection has increased. For example, in Almaty, in 1999, only 25 per cent of the pollution and nature use payments accruing to the city budget were actually planned to be transferred from the city budget to the city environmental protection fund. Planned and actual environmental expenditure in the regions (1999) is given in Figure 2.4. Some 91 per cent of the 25 per cent planned were actually delivered. As a result, the fund in fact received some 64 million tenge in 1999 instead of 180 million.

Some 3.3 per cent or 642 million tenge of the total funding of environmental projects and activities was financed from regional funds. Fund activities vary significantly in different regions, as the legislation does not contain mechanisms for distributing ecological funds between regions. Some, but not all, regions and cities have long-term environmental financing programmes. Regional fund directors are appointed by the Ministry according to the *akimats'* proposals. All financing is in the form of grants.

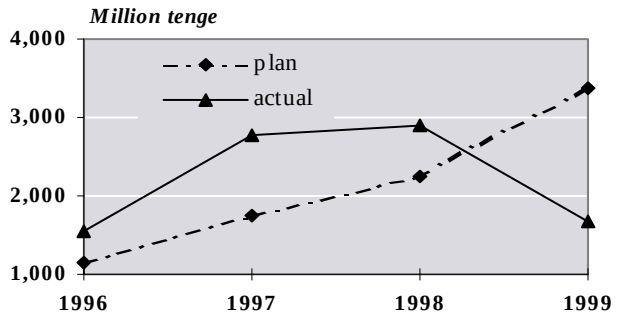
According to the statistics, most of the total regional financing is used for various ecological projects and programmes (21 per cent in 1999) and for the building and rehabilitation of environmental protection objects (21 per cent in 1999). For example, in Almaty, 31 per cent of fund financing was used for the "Taza aua-Zhanga-daua" programme, which aims to improve the city's environmental situation. Other major expenditure items include scientific research and cleaner technology development, financing of the protected area network and other, non-specified use. As the financing rarely materializes according to the initial plans (in some *akimats* regional funds actually received less than 10 per cent of the planned financing in 1999), planning is difficult. Some 20 per cent of financing is used to finance the material expenses of the regional environmental administration and the administrative costs of funds, although there is a great regional variation-in some regions almost 80 per cent of financing is used solely for these purposes.

Budgetary financing

As mentioned earlier, the separate national environmental protection fund was wound up at the end of 1999. Beginning in 2000, all funds are collected by the Ministry of State Revenue and go directly to the State budget. Environmental payments produce significant revenues for the State budget. In 1999, nearly 2,700 million tenge were collected in pollution payments, 8,350 million tenge in mineral resources payments and 8,600 million tenge in excise duties for petrol, diesel,

crude oil and condensates. Until 1999 collected pollution payments exceeded expectations every year. However, in 1999, the collected pollution payments amounted to less than 50 per cent of expectations (Figure 2.5). One reason for this decrease could be the resistance of enterprises to the rapidly increasing payments, which are used mainly for the Government's fiscal purposes.

Figure 2.5: Collected environmental payments, 1996-1999



Source: MNREP.

In 2000, the MoF plans to spend some 2,980 million tenge (US$ 21 million) on environment-related purposes. Of this amount, 33 per cent will be spent on environmental protection and 25 per cent on forest management. Other major expenditures include water management (11 per cent) and the financing of the hydro-meteorological service (13 per cent).

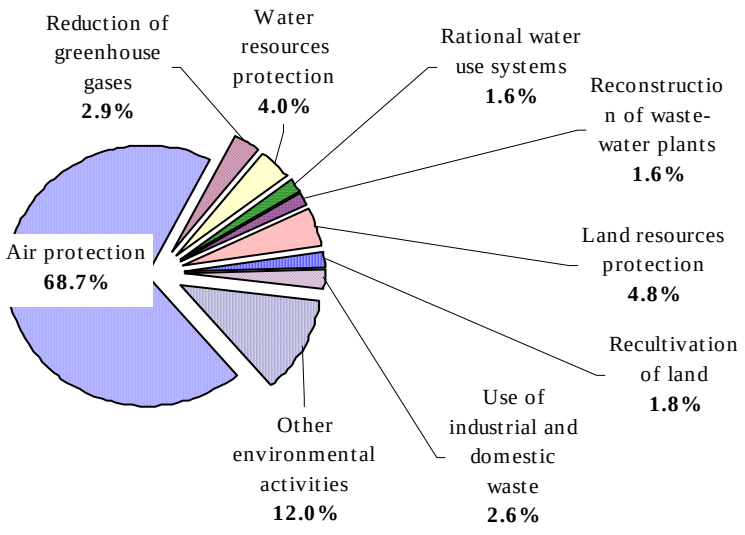
Over 50 per cent of the amount allocated to environmental protection is intended for the rehabilitation of the Mirgalimsai water reservoir. Some 20 per cent will be spent on the construction and maintenance of national environmental protection objects, and 11 per cent on financing protected territories. The MNREP and its regional branches will be financed to the tune of 150 million tenge (US$ 1 million, i.e. 15 per cent). Most of this money is dedicated to environmental monitoring (61 per cent).

Enterprise funds

Most of the enterprise financing of environmental protection in 1999 was directed to air protection (68 per cent, see Figure 2.6). The reconstruction of waste-water treatment plants, the protection of water and land resources, the reduction of greenhouse-gas emissions, the use of industrial wastes and other environmental activities were also financed.

Almost 12 billion tenge, or over 70 per cent of the total environmental financing by enterprises, was allocated to Atyrau. Also Mangistau (10 per cent of total financing) and Karaganda (6 per cent) attracted substantial enterprise funding. The Dzhambyl, Akmola and North Kazakhstan regions attracted the least amount from this source of finance.

Figure 2.6: Environmental expenditures of enterprises, 1999



Source: MNREP.

Subsidies and promotion of soft loans

The Law on Environmental Protection mentions environmental subsidies. However, it does not indicate which criteria the Government should use when deciding whether an enterprise deserves subsidies. In practice, there are no subsidies for ecological reasons.

One of the objectives of the MNREP in the long run is to create a 'green fund' which could allocate soft credits to enterprises for environmental investments. Currently, there are no soft credits, and as the banking system is not developed, it is difficult to obtain loans for environmental investments. There is a system of State guarantees, but only for State-owned enterprises.

2.4 Conclusions and recommendations

The percentage of pollution and nature use payments used for environmental protection has decreased constantly in Kazakhstan. According to MNREP statistics, it was less than 25 per cent in 1998. The practice of raising pollution payments and at the same time using the collected funds increasingly for fiscal purposes is alarming. It exacerbates the situation where enterprises have strong needs for environmental investments, but have to spend their scarce financial means on environmental payments to the Government – which does not finance the needed environmental protection expenditures.

The practice also creates disincentives for environmental and other authorities. For example, in some cities, enterprises are being placed within the city limits so that they can be charged for excess air emissions. As the excess emissions give 4-10 times more revenue for the authorities, it is profitable to increase pollution in already very polluted areas. On the whole, the impression that the Government "earns income" from environmental pollution for general revenue needs favours neither the creation of stable revenue collection mechanisms, nor environmental management.

There seems to be a discrepancy between the declarations of governmental priorities and actual governmental funding of environmental protection. The country's substantial environmental problems certainly demand equally substantial funds for their management and, it is hoped, solution. The international community is providing some of these funds, and will certainly continue to do so. However, national commitments to sustainable development require clearly visible national contributions. Government efforts in this area should be stepped up.

Recommendation 2.1:
Kazakhstan should make a conscious and clearly visible effort to contribute governmental funds to the management and solution of environmental problems, as a prerequisite for sustainable development. Environmental payments made to the State or regional budgets and/or environmental protection funds should actually be used for environmental protection projects and investments. If the levels of environmental payments exceed the needs of environmental expenditures, their rates should be reduced, and any resulting losses in public revenues should be made up by increases in other taxes. *See Recommendation 8.6.*

The ultimate purpose of the pollution payment system should be to increase enterprise investment in cleaner production technologies, in the interest of sustainable economic growth. High pollution payment levels provide strong incentives for technological change, but enterprises also need financial means in order to change their production processes. Most enterprises are working only at reduced capacity and face great economic difficulties. So they have few funds for investment. Further complications arise from the low development of the banking system, and the absence of State guarantees or soft loans for environmental purposes. Therefore, financing mechanisms for enterprises need to be developed. These mechanisms should be worked out together with the Ministry of Finance and the Ministry for State Revenue.

Recommendation 2.2:
A system of tax incentives, stimulating environmental protection expenditures by leaving part of due pollution payments in enterprises, should be established. In the longer run, part of the pollution payments could be used for facilitating soft loans for environmental investments, when the environmental situation is improving significantly.

Environmental fund expenditures and activities vary significantly in different regions of Kazakhstan, as the legislation does not contain any mechanisms for distributing ecological funds. Because Kazakhstan is a large country, and has different environmental conditions in different regions, it is natural that the environmental priorities vary. However, some of the projects

implemented by local funds do not comply with the environmental priorities of the country or of the region. This situation tends to increase regional disparities, the more so as no planning or other mechanism seems to be available for voluntary cooperation between regions.

In the absence of such a general mechanism, remedies could perhaps be found by changes in the management of regional and city environmental protection funds. One possibility may be to constitute 'fund committees', composed of representatives of different stakeholders, such as governmental institutions at all levels of administration, industry, scientists and other NGOs. Such committees could be asked to guide investment decisions, with due respect for projects that affect environmental conditions in more than one region. In the medium term, the desirable cooperation between regions and/or cities should be the subject of State regulation.

Recommendation 2.3:
Revising the management practices of environmental protection funds should improve the possibilities for reducing regional disparities in environmental conditions.

The new system for issuing environmental permits for enterprises has simplified the permitting process. The computerized registry of all enterprise emissions will in the future allow for a comprehensive picture of the country's pollution and enable a more effective use of environmental steering mechanisms. It will also allow for emission trading.

However, even in the new system, the current maximum permitted discharges allow increases in emissions without effective sanctions. MPEs of Kazakh enterprises need to be reduced in order to make the economic incentives more effective. But the basic problem of the prevailing system is its legislative basis. The permit and charge systems can be amended rapidly, but the legislative and normative bases cannot be reformed at the same pace. The basis for environmental norms is still the system of maximum permitted concentrations, sanitary zones and dispersion calculations, a complicated and expensive system that does not work optimally in a market economy. The only criterion for determining charges is the toxicity of substances to humans. There are no payments for instance for greenhouse gases or ozone-depleting substances. The health-based normative environmental criteria of the present system should be revised to include also technology-based criteria.

Recommendation 2.4:
The process of improving the environmental permitting and the environmental impact assessment systems should be continued so that the system can better address new conditions and needs. The most urgent need in this further revision would be to start incorporating technology-based criteria into permits. *See Recommendation 11.2.*

Chapter 3

INTERNATIONAL COOPERATION

3.1 General objectives for international cooperation

Kazakhstan is relatively active in international environmental cooperation. It participates in a number of international organizations and has ratified 12 international environmental agreements since 1993. Regional cooperation in Central Asia is deemed very important, especially for water management. It receives substantial international funds. Funding priorities are defined by the priorities of the NEAP.

The main objective in international environmental cooperation is to use international mechanisms and experience for the promotion of national environmental policy and legislation. The present national environmental legislation is often difficult to implement. Another problem is that international experience usually only reaches partners at national level, while managers at regional or local levels are hardly aware of the international environmental conventions and processes.

The United Nations Framework Convention on Climate Change, the Vienna Convention for the Protection of the Ozone Layer, the Convention on Biological Diversity and the Convention to Combat Desertification are among the international environmental conventions that Kazakhstan has ratified. National strategies have been or are being developed for each of these issues. This year Kazakhstan has already ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and is expected to ratify the ECE Aarhus Convention and the ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes. In a regional context, transboundary water issues are a top priority. The Ministry of Natural Resources and Environmental Protection (MNREP) is often challenged to convince other parts of the Government of the benefits of ratifying more international conventions. Lack of funding and of capacity to ensure effective follow-up is the main reason for non-ratification. The Ministry of Foreign Affairs has a unit dealing with environmental issues and is quite closely involved in determining the international environmental cooperation policy and in deciding on the ratification of conventions. Its international environmental cooperation priorities are: the rehabilitation of the Aral Sea; the rehabilitation of the Semipalatinsk region; the management of the water shortage in the region; the environmental protection of the Caspian Sea; climate change; and desertification.

The National Environmental Centre (NEC) includes a committee on environmental conventions, a committee on project preparation, and a committee on monitoring of environmental projects and programmes. Within the MNREP itself, there is no one dealing specifically with environmental conventions. The NEC has improved the Government's ability to advance the implementation of international environmental agreements. Before the setting-up of the NEC, the most important hurdles for the implementation of international conventions were insufficient knowledge of the conventions, the absence of an administrative structure for implementation, the absence of appropriate new legislation, a lack of policy support, and a corresponding lack of funding.

The committee on environmental conventions in the NEC has four subdivisions, each dealing with a specific set of issues (flora, fauna and desertification; transboundary issues; climate and ozone; the Aarhus Convention). Progress on the ratification and implementation of the conventions is being monitored closely. An analysis of all major multilateral environmental agreements has identified 18 conventions that are important for Kazakhstan but that it has not yet ratified, with 10 conventions or protocols having a high priority for ratification. The status of financing the implementation of the conventions is also closely monitored, and opportunities for international funding are identified.

The first two new directions for the NEC are to develop a national Agenda 21 and to establish a national committee on sustainable development. During the development and implementation of the NEAP, serious barriers to intersectoral cooperation were encountered. This is why it is now suggested to take the "Agenda 21 approach" with a focus on sustainable development instead of on the environment alone. The third new direction proposed is the development of a regional environmental action plan for Central Asia.

3.2 Regional cooperation in the framework of UNECE

Convention on Long-range Transboundary Air Pollution

Kazakhstan has not yet ratified the Convention on Long-range Transboundary Air Pollution, but is hoping to ratify it in 2000. It is not yet planning to ratify any of the Convention's protocols. Much of Central Asia's air pollution comes from sources in the Russian Federation and beyond. Kazakhstan and Uzbekistan are themselves also sources of transboundary air pollution in Central Asia. However, aggregate emissions and concentrations of most major pollutants in the region have dropped significantly since independence due to the closing-down of many companies.

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

Kazakhstan will most probably ratify the Convention on the Protection and Use of Transboundary Watercourses and International Lakes in 2000. The Convention is deemed very important for Kazakhstan and Central Asia as a whole. The other Central Asian countries have not yet ratified it.

Kazakhstan has scarce accessible water resources. Most water bodies suffer from serious environmental problems. Some of the most seriously polluted rivers are the Ural (phenols, petroleum by-products, boron), the Irtysch (ammonium nitrate, zinc, phenols) and the Nura (mercury). The main water polluters are industrial, mining, metal and refinery enterprises, and farms. Close to 50 per cent of the runoff of all rivers enters the country with transboundary rivers from China, Uzbekistan, Kyrgyzstan and the Russian Federation. There is an Interstate Council on Water for the 5 Central Asian republics which sets the water allocations each year. There are also general and annual agreements with each country on quantity control.

The NEAP identifies a number of priority projects on transboundary water issues, including the conclusion of agreements on the protection and use of joint water bodies (Ili and Irtysh rivers) and the establishment of interstate basin information centres. A framework agreement has been developed in cooperation with the French Government for technical assistance in solving some of the Irtysh river problems. A water quantity and quality monitoring station located at Boran, near the Chinese border, was in operation from 1938 until 1998, when it had to be shut down for lack of funds. There are no formal agreements with the Russian Federation for the Irtysh or with China for the Irtysh and the Ili on the use and development of the resources of these rivers.

Convention on Environmental Impact Assessment in a Transboundary Context (Espoo)
Convention on the Transboundary Effects of Industrial Accidents

Kazakhstan has not yet ratified these two conventions, although the MNREP aims to ratify all four ECE conventions in the future. For a description of the national ecological expertise procedures, see Chapter 1. For information on environmental management and management of dangerous or hazardous substances in industry, see Chapters 5 and 11.

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

Kazakhstan signed the Aarhus Convention in 1998 and has prepared all the documents for its ratification, which is expected in 2000. The NEC established a committee on the ratification and preparation of implementation of the Convention in January 2000. A national focal point was appointed, and priorities for implementation have been identified. Besides the NEC, the Information and Analytical Centre and the Committee on Environmental Protection in the MNREP will also be involved in implementation.

The NEC Committee on the Aarhus Convention has the following major aims: accede to the Convention in 2000; interact and cooperate with the Convention's secretariat; develop its data-collection

activities in the NEC; distribute environmental information as widely as possible; and interact with NGOs and the public as much as possible. Three national strategic documents have relevance to the implementation of the Convention. The 2030 Strategy, which has two priorities related to Aarhus principles, the programme for environmental education, which was prepared jointly with the Ministry of Education in 1999, and the plan to implement the Convention, developed by the MNREP in 2000.

Some of the problems in implementing the Convention are expected to be the lack of democratic tradition in the country, insufficient legislation, a lack of funding for NGOs, and problems with reaching the public at large and the local levels of environmental management. Representatives from the NEC and Kazakh NGOs participated in a joint UNECE, UNEP, OSCE workshop on the implementation of the Convention in Central Asia in Turkmenistan, in May 2000.

"Environment for Europe" process

In view of the stronger focus of this process on newly independent States (NIS), a high-level ministerial meeting will be held in Almaty, in October 2000, as a preparatory meeting for all NIS for the next "Environment for Europe" Conference in Kyiv in 2002. Ministers of environment and finance are expected to attend, as well as many international organizations and NGOs.

3.3 Bilateral cooperation

Kazakhstan has signed a number of bilateral environmental agreements. The agreements with its neighbouring countries, the Russian Federation, Kyrgyzstan, Turkmenistan, Uzbekistan and China, are the most important. Kazakhstan has also signed agreements with Azerbaijan, Germany, the United States, Israel, Mongolia, and Turkey. Most are of a more general cooperative nature, some are specific. For example, some agreements with the Russian Federation deal with the use of nuclear test sites and transboundary waters. Important bilateral cooperation is mentioned in various contexts throughout sections 3.4 to 3.6.

3.4 Regional cooperation

Cooperation in Central Asia

In 1995 the five Central Asian republics signed two regional declarations on environmental issues: the Issyk-Kul Declaration on Cooperation Among the Central Asian Republics, and the Nukus Declaration of the States of Central Asia and the International Community on the Sustainable Development of the Aral Sea Basin. The Issyk-Kul Declaration recognizes, *inter alia*, the common heritage and the similarities among the five republics, the need to make further development in the region sustainable, and the role of regional cooperation in preserving peace. 1997 saw the signature of the Almaty Declaration dealing with environmental security and aiming at harmonization of the NEAPs.

In March 1998, Kazakhstan, Kyrgyzstan and Uzbekistan signed the Agreement on Cooperation in the Field of the Environment and Rational Use of Natural Resources. A decision was made to cooperate on the protection of biodiversity in the West Tien Shan region.

In April 1998, the Joint Declaration of the Environmental Protection Ministers of the Central Asia Region was signed. It declares it necessary to:

- develop unified approaches to the creation and realization of national environmental policies
- continue the process of acceding to international nature protection conventions and UNECE programmes, as well as other global conventions and programmes
- develop a regional environmental action plan for the States of Central Asia
- encourage international organizations, donor States, and other interested parties to support the efforts of the States of Central Asia to resolve regional and global environmental problems with the maximum use of local specialists.

The five Central Asian Heads of State met in Bishkek in June 1999 to discuss the current status and the future prospects of multilateral cooperation and the economic revival of Central Asia. Also in 1999, a ministerial conference for Central Asia took the decision to develop a regional environmental action plan and establish a regional environmental centre for Central Asia in Almaty.

ESCAP organized a subregional meeting on strategic environmental management for Central Asia in Tehran in February 2000. It was followed by a meeting of experts on the development of regional environmental priorities for Central Asia in March 2000. This meeting identified a preliminary list of problems requiring regional

cooperation for their optimal solution. The regional problems were grouped into three blocks: the degradation of the ecosystem of the Aral Sea basin, the problems caused by oil and gas production and by the accumulation of waste, and problems within the jurisdiction of global conventions (climate change, ozone layer). Further steps for the development of the regional environmental action plan (REAP) were identified. UNEP, UNDP and other potential donors to the region and the REAP are currently assessing where and how they could assist.

Aral Sea cooperation

The interstate agreement of February 1992 between the Central Asian countries laid the foundation for regional cooperation in the form of the establishment of the Interstate Commission for Water Coordination (ICWC). In 1993 the International Fund of the Aral Sea (IFAS) and the Interstate Council on the Aral Sea Basin Problems (ICAS) were created. IFAS and ICAS were later (1997) merged into one institution under the name IFAS to coordinate, prepare, implement, monitor and manage the financial resources and programmes devoted to ecological, social and economic development in the Aral Sea region. The main role of IFAS is to mobilize the funds contributed by the five States, donor countries and international agencies for financing projects.

During the 1995 International Conference on Sustainable Development of the Aral Sea Basin, organized at Nukus, Uzbekistan, the five countries signed the Nukus Declaration. The Declaration expressed the need for an international convention on the sustainable development of the Aral Sea basin. This convention would incorporate water use and water-sharing arrangements, as well as update and harmonize environmental standards and the related legislation. A draft convention was developed and discussed during an OSCE seminar in 1996. However, the convention negotiations have come to a standstill since then.

In March 1998 Kazakhstan, Kyrgyzstan and Uzbekistan signed the Long-Term Water and Energy Agreement for the Syr-Darya River Basin. It includes provisions for Kazakhstan and Uzbekistan to share the purchase of summer hydropower from Kyrgyzstan, against payment in kind, in the form of the delivery of coal or gas, or in cash.

The Kazakh Government declared the Aral Sea region an environmental disaster zone and requested major assistance from the donor community. Phase I of the World Bank/UNDP/UNEP Aral Sea Programme started in 1994, with US$ 41 million. The regional Aral Sea Basin Capacity Development Programme started in 1999, with US$ 1.7 million. UNDP Kazakhstan has been working on projects in the region since 1994, providing immediate assistance to improve environmental and living conditions. The Aral Seashore Rehabilitation and Capacity Building Programme started in 1995 (US$ 1.2 million) and was completed by 1999. The project gave attention to small business development, general health, NGO and social development and water.

In 1997, the World Bank approved the Pilot Water Study Project (US$ 7 million) aimed at rapidly improving the water-supply system for the population of the Aral Sea basin by rehabilitating the water distribution networks in the two most affected district centres. The Kuwait Fund for Arab Economic Development provided a technical assistance grant for the project amounting to US$ 1.2 million. Two funding sources enable the implementation of the full-scale project in the Aral Sea region, Germany (with an initial DM 15 million grant) and Kuwait (a US$ 15 million loan). In addition, UNDP, in cooperation with the Danish International Development Agency, is preparing to contribute technical assistance.

UNDP is assisting the Aral Sea Region Development and Humanitarian Assistance Programme for 2 years with an annual amount of US$ 600,000 (including co-funding from Capacity 21, IFAS and World Bank). The Programme started in 1999 as a follow-up to the Aral Seashore Rehabilitation and Capacity Building Programme. It is joined with the Capacity Building of Water Users for Sustainable Development in the Aral Sea Basin (US$ 431,800). The projects undertake participatory capacity-building activities with local authorities and communities around the Kazakh shore of the Aral Sea. The assistance is targeted towards assisting the people most seriously affected, by alleviating poverty, improving drinking water quality and health, and supporting their self-sufficiency. The project thus concentrates on the most affected areas and supports environmental rehabilitation at the local level.

- EU/TACIS has provided a total of US$ 6.5 million for its Water Resources Management and Agriculture Production (WARMAP) in Central Asia and in the Aral Sea. The project was designed to provide the administrative and technical framework within which the Central Asian countries could develop programmes for the use, allocation and management of the water resources of the Aral Sea basin, and to assist in the establishment of the institutional structure required to implement the agreed water management. Phase I (US$ 6.5 million) and Phase II (2.5 million Euros) have been completed. The WARMAP II project is managed from Uzbekistan.

UNESCO provided equipment for the ecological monitoring of the Kazakh part of the Aral Sea region (US$ 300,000) in 1993. UNESCO has also established a Scientific Advisory Board for the Aral Sea Basin (SABAS) to provide independent advice on how to deal with the Aral Sea crisis.

The UNICEF Aral Sea Project for Environmental and Regional Assistance has organized a set of strategies for overcoming the worst effects of salination of the air, soil and water. The project has 5 components (mother and child health, nutrition, basic education, water and sanitation, advocacy).

In 1994, USAID signed a memorandum with the Kazakh Government on drinking-water-supply systems and awareness raising on environmental protection in the Aralsk and Kazalinsk rayons, amounting to US$ 4 million. France allocated US$ 4.3 million for drinking-water-supply systems in the Aral Sea basin. Several Japanese research and scientific institutes provided research into rice irrigation, water quality, and water-supply management.

Caspian Sea cooperation

The Caspian riparian States are Azerbaijan, the Islamic Republic of Iran, Kazakhstan, the Russian Federation and Turkmenistan. The Caspian Sea provides income from caviar exports and a major potential for hydrocarbon exploitation. It is heavily polluted by the inflowing rivers, as well as by oil-refining operations. Other major environmental issues are the steep decline in the sturgeon population due to overfishing, regulations of river and water pollution. (see Chapter 8 for details).

The main international effort to tackle the environmental problems of the Caspian Sea is currently the Caspian Environment Programme. The Programme is jointly funded by EU/TACIS and the GEF (with UNDP, the World Bank and UNEP as implementing agencies). The total funding involved for the 5 countries is about US$ 14 million (8 million from GEF and 6 million from TACIS) over a 4-year period that started in 1998. The main aim of the Programme is to ensure environmentally sustainable development and to improve the management of the natural resources of the Caspian region, including bioresources and surface waters. Kazakhstan is fully involved in the Programme.

Since 1995, UNEP has been supporting the development of a legal instrument for the protection of the Caspian Sea. The 4th Meeting of Experts on the Preparation of a Legal Instrument on the Protection of the Marine Environment of the Caspian Sea was held in February 2000 in Almaty together with the second meeting of the Caspian Environment Programme's Steering Committee. It is hoped that a respective framework convention can be finalized in 2001. It should eventually become the legal framework of the Caspian Environment Programme.

As part of this Programme, two of the so-called Caspian Regional Thematic Centres have been established in Kazakhstan. One, in Almaty, deals with water-level fluctuations and the other, in Atyrau, with biodiversity. The Centres are supposed to be region-wide, working for all five countries.

In addition, UNDP Kazakhstan is implementing the Kazakhstan Caspian Regional Development Programme (US$ 174,200), complemented with UNV support (US$ 420,000). This project focuses on SME development, as well as capacity building and information sharing within the oblast administration.

Nuclear issues

Kazkahstan is participating in a large number of international instruments concerning nuclear threats and protection against radioactive pollution. The most important instruments and measures in these regards are the following:

- In August 1963, USSR, USA and Great Britain signed the agreement on test stop of nuclear weapons in the atmosphere, outer space and under water, which came into effect on 10 Oct. 1963.

- Treaty on The "Non-Proliferation of Nuclear Weapons". Signed in London, Moscow and Washington on 1 July 1968. Entered into force on 5 March 1970.
- Agreement of 26 July 1994 between The Republic of Kazakhstan and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons. Entered into force on 11 August 1995.
- IAEA Joint Convention on the Safety of Spent Fuel Management and Radioactive Waste Management adopted on 5 September 1997. Kazakhstan signed on 25 March 1999 as the 39th Signatory.
- Cooperative Threat Reduction Agreement between United States and Kazakhstan, signed on 4 October 1995, would permanently close and seal the former Soviet Union's Degelen Mountain nuclear test tunnels.
- UN Resolution 52/169 M of 16 December 1997: The General Assembly recognises the seriousness of the situation in the Semipalatinsk region and calls on the international community to assist the Government of Kazakhstan in its efforts to meet the needs of those affected by the history of the Polygon.
- At the 53rd General Assembly on 23 September 1998, the Secretary-General presented his report on "International cooperation and coordination for the human and ecological rehabilitation and economic development of the Semipalatinsk region of Kazakhstan". A joint mission of the UN, the Government of Kazakhstan and other participants conducted between 15 and 30 June 1998 was charged with assessing impacts, problems and needs. Conclusion: Necessary support should be mobilised to perform priority projects in the fields of environment; health care and assistance for radiation victims; economic recovery and renewed opportunities; humanitarian assistance; and cross-sectoral information for risk reduction.
- The UNDP Semipalatinsk Relief and Rehabilitation Programme was endorsed at the Tokyo International Conference on Semipalatinsk, 6-7 September 1999, Tokyo, Japan.

3.5 Global cooperation

Implementation of Agenda 21

The NEAP was initiated in 1995 and finalized in 1997 with support from UNDP, the World Bank and EU/TACIS. A National Environmental Action Plan/Sustainable Development (NEAP/SD) Centre was established in Almaty with UNDP and World Bank support. The Centre coordinates the activities of the Government, local authorities, NGOs and international institutions for NEAP formulation and implementation. Two major donor conferences were held in Almaty in 1998, which discussed the most pressing environmental problems. As a result, a number of priority projects are now under consideration by major donors such as Japan, Germany, GEF, EU/TACIS and others.

A report on the implementation of Agenda 21 was submitted to the United Nations Commission on Sustainable Development in 1997. A national Agenda 21 will be ready for the Rio+10 Conference.

Climate change

Kazakhstan signed the United Nations Framework Convention on Climate Change in 1992 and ratified it in 1995. It signed the Kyoto Protocol in 1999 and is scheduled to ratify it in the year 2000. The Initial National Communication was prepared and presented to fifth conference on the Parties (with technical and financial support from the Netherlands Climate Change Studies Assistance Programme). Kazakhstan has made a voluntary commitment to reduce greenhouse gases (GHG) and is applying to become an Annex 1 country under the Convention and an Annex B country under the Kyoto Protocol. Work on a national climate change strategy started in 1995, but was not completed. It is currently being re-developed and should be ready for the sixth conference of the Parties in November 2000. An inter-agency commission of 7 government ministries and agencies was established to work on climate change policy.

An inventory of GHG sources was developed with 1990 as a base year. However, as Kazakhstan was still part of the USSR in 1990, a new inventory will

now be developed with 1992 as the base year. No macro-economic scenario has as yet been agreed.

USAID funded the Greenhouse Gas Emissions Reduction Initiative (GGERI) project, and is assisting in the setting-up of a Cooperation Centre on Climate Change. USAID is involved in preparing the analytical work and developing the institutional capacity. The centre is expected to develop national criteria and standards for joint implementation projects, and to appraise, review and approve such projects in the future, as well as to promote carbon trading.

A GEF PDF B grant (US$ 481,380) was provided in 1997 to prepare a GEF project on "Removing Barriers to Wind Power Production in Kazakhstan". Approval for a full-scale GEF project is dependent on governmental co-funding. Another GEF preparatory project on "Removing Barriers to Increased Hot Water and Heat Supply in Kazakhstan" (US$ 421,900) is expected to lead to a full-scale GEF project in the near future.

Protection of the ozone layer

Kazakhstan has the highest consumption of ozone-depleting substances (ODS) in Central Asia. 1,305 tonnes of ODS (including methyl bromide and HCFCs) were consumed in 1998, but no production takes place in the country. Imports originate mainly in the Russian Federation, China, India and Ukraine. The main sectors using ODS are refrigeration (51 per cent), solvents (22 per cent), fire fighting (13 per cent), and fumigation in agriculture (2.5 per cent). An inventory was prepared in 1998. It is hoped that ODS will be phased out in 2004. A preliminary strategy and action plan have been developed. A high-level official meeting was organized by UNEP in Almaty in April 2000 to address ODS problems in Central Asia and the Caucasus.

Kazakhstan ratified the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer in 1998. It has not yet ratified the Copenhagen amendments. A draft national programme on ozone depletion has been prepared (with a $40,000 GEF grant and technical assistance from UNEP and UNDP) and will be submitted to GEF. After ratification of the London amendments (expected in 2000), a GEF grant of US$ 4 million is expected. GEF has already provided US$ 154,000 through UNEP and US$ 189,000 through UNDP for the PDF B phase for both Kazakhstan and Tajikistan.

Transboundary movement of hazardous waste

Kazakhstan has not yet ratified the Basel Convention. The National Environmental Centre recently made preparations for ratification, but the Ministry of Finance has decided that the Convention is too expensive to be ratified.

Biodiversity protection and nature conservation

Kazakhstan's priorities for biodiversity protection are to implement the National Biodiversity Strategy and Action Plan (NBSAP), to promote the sustainable use of biodiversity, to become involved in genetic resource issues and biotechnology, to involve NGOs, to seek more funding for biodiversity protection, and to improve the related legislation.

Kazakhstan signed the Convention on Biological Diversity in 1992 and ratified it in 1994. The NBSAP was finalized with GEF support worth US$ 208,114 and approved by the Government in 1999. Seven projects of the highest priority were identified, of which two have received GEF funding and started implementation: conservation of the West Tien Shan region, and conservation of wetlands. The West Tien Shan project (US$ 10 million) is a regional project for Kazakhstan, Kyrgyzstan and Uzbekistan. A regional implementation unit was established in Tashkent, and each country has a national office. The objectives of the project are to protect the vulnerable and unique biodiversity, and strengthen national policies and institutional arrangements for biodiversity protection. Some income generation and public awareness raising will be extended to the local communities, and the protected areas network will be strengthened. TACIS may join in the near future with a two-year 1.5-million-euro project.

GEF spent US$ 147,200 on the PDF-B phase of the project on wetland conservation, for which a total of US$ 3-4 million is expected to be needed. Four wetlands have been selected for the preparation of pilot projects: the Ural delta, the Tengiz-Kurgaldzino system of lakes, the Alakol lakes and the Syr Darya delta. Kazakhstan has not yet ratified the Ramsar Convention on Wetlands of

International Importance Especially as Waterfowl Habitat, the Bonn Convention on the Conservation of Migratory Species of Wild Animals or the Agreement on the Conservation of African-Eurasian Migratory Waterbirds. Kazakhstan is, however, also involved in a transboundary project for the protection of the Siberian crane which is being carried out under the Bonn Convention on the Conservation of Migratory Species of Wild Animals.

Kazakhstan has not signed the Protocol on Biosafety, although the Ministry realizes that biodiversity protection will become increasingly important.

UNEP organized the preparatory meeting for the whole of central and eastern Europe for the fourth conference of the Parties of the Convention on Biological Diversity was in Almaty in 1997. A UNEP/IUCN workshop on the legal aspects of implementing biodiversity-related conventions (with financial support from the Netherlands), again for all central and east European countries, was held in Kokshetau in 1999.

Kazakhstan signed CITES in 1999 and ratified it in April 2000. Both a management and a scientific authority have been established within the MNREP, as stipulated in the Convention. Ways of tracking transboundary movements have been developed, and quotas for species that are being traded have been set. Kazakhstan participated in the conference of the Parties in April 2000 in Nairobi and is now looking for funding for training customs officers. Illegal transport is a problem for Kazakhstan and the MNREP would like to introduce a system in which every export of a species has to be reported to the management authority. Kazakhstan ratified the Convention on Protection of World Cultural and Natural Heritage in 1994 but has not so far identified any environmental sites.

Desertification

Kazakhstan ratified the Convention to Combat Desertification in 1997 and is developing a national action plan (the first two versions were rejected by the Government). UNDP/ Office to Combat Desertification and Drought (UNSO) provides US$ 90,000 to support the work. For details, see Chapter 12.

3.6 International funding

Bilateral sources

United States of America. USAID carries out its environmental activities in Central Asia under the Environmental Policies and Institutions for Central Asia (EPIC) programme, focusing on water and energy management, the latter especially in relation to global climate change. The work in the domain of water assists the Central Asian countries in developing policies and institutions to manage their international river basins cooperatively, to develop market systems for the maintenance and operation of water and energy facilities, and to address the legacy of environmental disasters. It has included projects on water user group training, transboundary water issues, water modelling and policy work. In this framework, USAID assisted Kazakhstan, Uzbekistan, Kyrgyzstan and Tajikistan in their discussions on agreements on water in the Syr Darya basin given the competing uses for hydro energy and irrigation.

The climate change work carried out by USAID in Central Asia has mostly focused on Kazakhstan. This includes the Greenhouse Gas Emissions Reduction Initiative (GGERI), which will give rise to a climate change centre in Astana (see above). Furthermore, USAID is carrying out a biodiversity assessment in every Central Asian country and it supports ECOLINK, a small grants programme for climate change, water and cleaner production activities.

A USAID environment and energy strategy for 2000-2004 is currently being developed, and new activities for the Central Asian countries will start in the summer of 2000. They will be mostly focused on implementing models of integrated natural resources management, increasing natural resources management capacity, improvements to the policy and regulatory framework, and increased public support for better natural resources management.

Germany. The German Agency for Technical Cooperation (GTZ) focuses on private sector development in Kazakhstan. It has so far been involved in two environmental projects, namely a study in 1992-1993 on Semipalatinsk and a new project currently being developed on a

metallurgical complex in Ust-Karmenogorsk. The latter will include the cleaning-up of groundwater contaminated by hazardous waste stored in tailing ponds and lakes. GTZ also implemented a project on waste-water treatment and water supply in the City of Almaty. The German Government is also implementing the "Reduction in drinking water consumption and losses in the municipal sector in Almaty city" project (US$ 1.5 million).

Japan. Japan has carried out an urban waste reduction project in Almaty. Other projects with an environmental component are projects on the "Urgent establishment of national basic geographic data in the Southern Area" and on "Technical cooperation for the continued improvement of the monitoring system for earthquake preparedness and risk assessment in the region of Almaty". A Japanese expert was on loan to the MNREP during 1999.

United Kingdom. The United Kingdom has supported the development of a sustainable land-use strategy for the Semipalatinsk area (GB£ 500,000) and is planning a new project on river basin management, including the development of a clean-up plan for the Nura river. The United Kingdom also runs a small grants programme of GB£ 50,000 a year from the Know-How Fund.

Multilateral sources

The total recorded disbursement of technical and financial assistance (ODA) to Kazakhstan in 1998 amounted to US$ 797.9 million. This represents an increase of 21.4 per cent over 1997 and can mostly be attributed to the fact that, by 1998, assistance to project preparation was largely completed and project implementation started. In 1998, the Government made its first use of the Extended Fund Facility (EFF) from the IMF (first disbursement of US$ 217 million) as well as the World Bank and Asian Development Bank pension reform loans (US$ 300 and 100 million, respectively). More than 80 per cent of the total assistance came from multilateral sources. The year 1998 also saw a significant increase in assistance from the United Nations as a whole. However, in 1999 the total amount of United Nations grants decreased by 20 per cent.

UNDP. The programme in Kazakhstan during the past 5 years focused on social development, environment and governance. In 1995, UNDP supported the development of the NEAP (US$ 50,000). In 1997, the "Rolling Framework Environmental Programme for Sustainable Development of the Republic of Kazakhstan" continued the work (US$ 574,000). A National Environmental Centre (NEC) was set up in the MNREP. In 1998, the "Programme for Implementation of the 1998-2000 Strategic Plan Ecology and Natural Resources" (US$ 350,000) followed, but the Government has not been able to contribute US$ 7.5 million as had been planned. A part of the UNDP financial support for the running of the NEC will be phased out during 2000. It is expected that the activities of the NEC will be shifted to the Ministry. UNDP has also provided support for the establishment of the new regional environmental centre for Central Asia.

In addition, UNDP has been assisting selected environmental projects in the Semipalatinsk, Aral Sea basin and Caspian coastal oblasts. UNDP also administers six GEF projects in Kazakhstan (see above). Furthermore, UNDP funds a small grant programme (US$ 650,000), targeting the marginalized population, primarily rural households and communities.

In 1999, funds released for technical assistance from UNDP decreased by 31 per cent compared to 1998. A new framework for cooperation on sustainable development 2000-2004 is currently being prepared. The ongoing projects will be linked to the new programme, or they will be supported till their envisaged termination. The focus of the new environmental programme will be on institutional strengthening centred on the MNREP, as well as on the promotion of cross-sectoral cooperation. The total UNDP budget for the next 5 years will be US$ 2 million, of which US$ 150,000 a year will be available for environmental issues.

EU TACIS. A Partnership and Cooperation Agreement (PCA) between Kazakhstan and the European Union was signed in January 1995. The PCA provides the framework for political, commercial, economic and cultural cooperation. In principle, TACIS funds environmental projects in Kazakhstan only through the TACIS Interstate Environmental Programme . The Indicative and Action Programmes for Kazakhstan (developed in cooperation with the Government) have so far not included environment as a priority. Priorities for 1998-1999 included agriculture, SME development, public administration and transport. Nevertheless, TACIS will fund an air pollution combat project (1 million Euros) addressing the transport sector in Almaty, starting in September 2000. The new Indicative Programme for Kazakhstan for

2000-2003 is being developed and includes three priority areas: (a) institutional, legal and administrative reform, (b) the development of the private sector and assistance for economic development, and (c) the promotion of environmental protection and management of natural resources.

Within the structure of the Interstate Environmental Programme, TACIS has assisted Kazakhstan in the development of the NEAP, training local experts in project preparation, preparing pre-feasibility projects (a project for the Astana water supply will now be financed by EBRD), and awareness-raising activities. As a follow-up to the NEAP, TACIS will most probably fund further activities over the next two years, with a focus on the water sector.

TACIS is also funding and supporting the setting-up of the regional environmental centre for Central Asia (CA/REC). Furthermore, TACIS is a major partner in the Caspian Environment Programme (see above) and has carried out two phases of the "Water Resources Management and Agricultural Production (WARMAP) in the Aral Sea Basin" project since 1995 (see above).

Under the so-called BISTRO project, run by the Kazakh TACIS office, study and training activities are funded up to a maximum of 100,000 Euros. Currently some environmental studies are being carried out, notably on the performance of the State Environmental Protection Fund and sources of finance for environmental investments in Kazakhstan. Although the State Environmental Protection Fund has been abolished recently, the study will still go ahead and will make recommendations on the need and role for the fund. The studies are expected to be finished by the end of the summer of 2000.

World Bank. Kazakhstan became a member of the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the Multilateral Investment Guarantee Agency (MIGA) and the International Centre for Settlement of Investment Disputes (ICSID) in July 1992 and of the International Finance Corporation (IFC) in 1993. The World Bank Group is the largest source of official external development funding to Kazakhstan. By April 2000, the World Bank had issued a total of US$ 1,819.1 million in loans. Initial lending focused on supporting Government efforts to design and implement structural reforms in key areas such as privatization, enterprises, the financial sector and social security. Other sectors receiving attention include road transport, oil fields, health and electricity transmission.

In environmental protection, the Irrigation and Drainage Project (US$ 80 million loan over 6 years) is being carried out. The project aims to rehabilitate the irrigation and drainage infrastructure, covering some 40,000 hectares of on-farm irrigation as well as some inter-farm works, promote the development of privatized farms through pilot initiatives for farmer training and information, and strengthen the environmental sensitivity of the Ministry of Agriculture and other agencies.

The World Bank has also been involved in the Aral Sea Basin Programme since 1994. Furthermore, the Bank has been supporting national initiatives for Northern Aral Sea management (Syr-Darya Control and Northern Aral Sea Project, US$ 50 million), the protection of biodiversity in the West Tien Shan Range (Central Asia Transboundary Biodiversity Project, see above), and the development of the NEAP.

As a follow-up to the implementation of the Aral Sea Programme, a dyke investment project aiming at the environmental restoration of the Syr Darya area is planned for 2001 (US$ 50-80 million). An environmental impact assessment will be carried out before the project starts. A preliminary environmental management plan will be developed. This project should ideally be complemented by technical assistance from other donors.

Among its high priorities the Government places the northeast region, where economic development is facing serious constraints due to a variety of problems related to water resources, water supply, environment and urban/industrial pollution. Assistance is being sought from donors and international financing institutions to implement a region-wide programme. The World Bank is considering an adjustable programme loan, estimated at US$ 200-250 million (Northern Environment Management and Rehabilitation Project). The Project will cover the basins of the Irtysh, Nura and Ishim rivers, and is expected to help establish the long-term institutional and policy structures necessary for controlling the environmental problems. The specific components are the clean-up of toxic waste, pollution control, the provision of a sustainable water supply source for Astana and Karaganda, and the rehabilitation of water and sewerage systems in the major

northeastern industrial cities. Currently, US$ 600,000 from a Japanese grant is being spent on a feasibility study for a potential environmental management and rehabilitation project to clean up the mercury contamination in the Nura river.

The Atyrau Pilot Water Supply Project aims to strengthen the capacity of Vodocanal in the City of Atyrau to provide reliable and safe drinking water and the disposal of sewerage in an environmentally responsible, financially efficient and sustainable manner. The US$ 16.5 million loan was approved in 1999. A new grant for dry-land management (US$ 5 to 6 million), to rehabilitate abandoned agricultural land, is currently under discussion.

The World Bank has also played a role in helping the Kazakh Government coordinate external assistance to Kazakhstan through Consultative Group meetings. Four such meetings have been held since 1992, mobilizing nearly US$ 4 billion in the form of official development assistance.

European Bank for Reconstruction and Development. EBRD opened an office in Kazakhstan in 1993. Up to now, 605 million dollars have been allocated in loans and grants. 70 per cent goes to private sector development, 30 per cent to the public sector. Projects include the Aktau port rehabilitation, SME development, and the Karaganda power project. Apart from the direct financing of projects, EBRD has provided 26 million Euros in technical cooperation grants. No environmental projects as such have been carried out so far, although EBRD environmental standards have to be met for every loan or grant.

Asian Development Bank. Kazakhstan joined the Asian Development Bank (ADB) in 1994. By 31 December 1999, cumulative ADB lending to Kazakhstan had amounted to US$ 415 million. 33.7 per cent was disbursed to the agricultural and natural resources sector. In addition, 29 technical assistance grants, amounting to US$ 15.3 million, have been approved for capacity building, institutional strengthening and project preparation. The main objectives of the Country Operational Strategy are to: (a) encourage the transition to a market economy by supporting the Government's reform agenda, encouraging institutional change and strengthening social security, (b) promote the rehabilitation of the environmental resource base of the country, (c) strengthen the long-term potential for sustainable growth by investing in physical infrastructure and in human development, and (d) encourage the creation of a new output structure and new production capacity through private sector investment.

ADB is currently dealing with environmental issues in Kazakhstan through a US$ 800,000 technical assistance grant (from Finland), approved in December 1999, to strengthen environmental management in the MNREP. In terms of lending operations, a request has been made to tackle the locust problem (see Chapter 12). An environmental impact assessment will have to be carried out for this project in view of the impact of the chemicals on the environment before the US$ 10 million loan can be disbursed later in 2000. Within the next 2 or 3 years, a loan will probably be issued specifically for the improvement of environmental management. The technical assistance project which is currently being carried out, together with a possible second technical assistance grant, is designed to identify specific uses for the loan.

In 1997, a US$ 45 million Water Resources and Land Improvement Project loan was approved for the south of Kazakhstan. The project supports the Government's privatization of agricultural farms, by transferring the management of rehabilitated irrigation systems to Water User Associations.

3.7 Conclusions and recommendations

Kazakhstan has acceded to a number of international and regional environmental agreements and is actively developing its international environmental cooperation. To meet the requirements of the ratified conventions, policy and action plans are being developed and foreign assistance has been sought for programme formulation and implementation. The harmonization of national environmental legislation with international norms and standards and the implementation of multilateral environmental agreements are in the interest of both Kazakhstan and the international community.

Implementing these conventions and complying with them has not been a priority for all institutions concerned. An analysis of what needs to be implemented will provide better identified goals and will ultimately provide a stronger commitment from the institutions involved. National environmental legislation is often not yet in conformity with international norms and concepts, sometimes unpractical or unrealistic, and often neither implemented nor enforced. The legislation should be reviewed and an assessment should be made on how it can be made more practical, better

enforced and more in line with widely used modern concepts. Policies and laws should focus on achievable objectives instead of on elaborate programmes that merely exist on paper, are unrealistic or too dependent on international funding.

Recommendation 3.1:
National environmental legislation should take international norms and standards into account and should be both enforceable and strictly enforced. True implementation, compliance and enforcement of environmental norms and action plans following existing international commitments should be a major priority in Kazakhstan's environmental policy .See Recommendation 1.1.

Regional cooperation in Central Asia is important, as the countries share many common physical, social, economic and historical problems. The five republics have already signed a number of agreements and declarations on environmental issues. However, it is questionable how much impact and commitment these agreements really enjoy. Most of the initiatives seek international funding or are only implemented, where immediate economic or security interests are at stake. The regional agreements on transboundary watercourses mostly concern the quantity and allocations of water between the countries. There are virtually no agreements on the quality of the shared watercourses, joint monitoring, or joint control over polluting activities. Kazakhstan is aiming to ratify the ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes this year. Unfortunately, the other Central Asian republics have not yet shown a clear interest in ratification. Kazakhstan's ratification should encourage the others to follow suit, because the Convention could be a useful tool in solving several of the transboundary water problems in the region.

Most regional cooperation currently takes a fragmented look at environmental problems. Issues being brought forward in the process of developing the new regional environmental action plan include land degradation, water pollution, air pollution, etc. Instead, it would be preferable to take a more integrated approach, looking for instance at land and water management, the energy sector or the industry sector, or at cross-cutting issues such as environmental inspection, environmental law-making, etc. Such an approach might also receive more interest from foreign donors.

Recommendation 3.2:
Regional cooperation in Central Asia, especially on transboundary waters, should be strengthened and focused more on environmental protection and the rational use of natural resources instead of solely looking at pressing economic interests. In the development of the regional environmental action plan, a more integrated approach to the regional problems should be considered.

Through the setting-up and work of the National Environmental Centre, Kazakhstan seems to have a well developed system for preparing ratification and monitoring the implementation of international environmental conventions. Also, the various environmental projects carried out with international and national funding are being monitored and checked to be in line with 'Strategy 2030' and the NEAP. The NEC seems to have a good overview of the amounts of money spent on the different priorities. Funding to keep the NEC in existence in its current form seems to be running out. However, the activities initiated by the NEC and the expertise built up within its framework must be preserved. The capacity of the current NEC should be integrated into the Ministry of Natural Resources and Environmental Protection. In international environmental cooperation especially, the Ministry still has very little capacity and much can be learnt from the experiences of the NEC in this respect.

International environmental cooperation does not seem to be among Kazakhstan's top priorities. Among many decision makers as well as among the public, awareness of environmental issues and international environmental cooperation are still underdeveloped. The MNREP often has a hard time convincing other parts of the Government to ratify further international environmental conventions. Those at the regional and local levels have little awareness of the various international environmental conventions and processes. Once awareness is raised with special, tailored programmes, the integration of international environmental norms, contained in the conventions that Kazakhstan has ratified, into national socio-economic policies and legislation will be facilitated. There is a need for capacity building in the MNREP on international environmental regimes. The training should most profitably be aimed at middle-management staff.

Kazakhstan is a party to a number of important international conventions. This year it plans to ratify the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, and the Kyoto Protocol to the United Nations Framework Convention on Climate Change. At the same time, preparations have not been finished for the ratification of other important conventions, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Convention on Environmental Impact Assessment in a Transboundary Context, the Convention on the Transboundary Effects of Industrial Accidents and the Convention on Long-range Transboundary Air Pollution. Furthermore, in the area of nature protection, Kazakhstan has not yet ratified the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat nor the Bonn Convention on the Conservation of Migratory Species of Wild Animals.

Recommendation 3.3:

The capacity and experience of the National Environmental Centre should be sustained and integrated into the Ministry of Natural Resources and Environmental Protection. Awareness of international environmental conventions and policies and their social and economic importance at both the national and the local levels should be raised with special training and educational programmes targeting all levels of government as well as the public. Kazakhstan should work towards the ratification of all major international environmental conventions in accordance with its analysis of the importance of these conventions for the country.

PART II: MANAGEMENT OF POLLUTION AND OF NATURAL RESOURCES

Chapter 4

AIR MANAGEMENT

4.1 State and determinants of air pollution

Air emissions

Since 1990 air emissions in Kazakhstan have decreased overall by 50 per cent. The main reason for this development was the general recession, following the disintegration of the Soviet Union in 1990, resulting in a sharp decrease in production volume (in 1995 GDP amounted to only 45 per cent of that in 1990). Emissions of the main pollutants from stationary sources have decreased by 50.5 per cent and from mobile sources by 44.5 per cent. SO_2 emissions from stationary sources decreased by 33 per cent, NO_x by 71 per cent, CO by 58 per cent and dust by 54 per cent (see Table 4.1).

Table 4.1: Trends in emissions of selected pollutants, 1990-1998

1000 t

		1990	1992	1993	1994	1995	1997	1998
All pollutants	**Total**	**6,741**	**..**	**5,752**	**4,464**	**4,097**	**3,546**	**..**
	Stationary sources	4,700	4,062	3,791	3,261	3,097	2,436	2,308
	Mobile sources	2,041 a/	..	1,961	1,203	997	1,110 b/	..
of which:								
SO_x	**Total**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
	Stationary sources	1,480.0	1,422.2	1,468.3	1,134.6	1,132.9	987.1	983.3
	Mobile sources	..	..	..	..	..	..	..
NO_x	**Total**	**738.0**	**..**	**..**	**353.5**	**..**	**..**	**..**
	Stationary sources	552.0	310.3	334.5	240.5	233.4	155.3	159.5
	Mobile sources	186.0	..	..	113.0	..	..	..
Dust	**Total**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
	Stationary sources	1500.0 c/	1,402.6	1,375.6	1,028.8	1,085.1	688.4	687.4
	Mobile sources	..	..	..	..	..	..	..
CO	**Total**	**2158.0**	**..**	**..**	**1,262.0**	**..**	**..**	**..**
	Stationary sources	870.0	687.1	555.7	494.0	446.0	408.7	360.5
	Mobile sources	1288.0	..	..	768.0	..	..	..
Pb	**Total**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
	Stationary sources	..	..	..	..	..	..	..
	Mobile sources	0.265	0.250	0.245	0.210	0.195	0.165 b/	..

Sources: Statistical Yearbook 1999; MNREP; GHG Emission inventory; Report on lead pollution in Kazakhstan.

a/ Data refer to 1991.
b/ Data refer to 1996.
c/ Author's assessment.

Apart from the lower energy demand and the decrease in overall production, part of the emission reduction was also due to abatement measures, which have been introduced step by step since 1985. In 1985 average abatement efficiency was 82 per cent, in 1990 86 per cent and in 1993 88 per cent. No further abatement efficiency increase has been achieved since (Table 4.2).

Table 4.2: Generation, abatement and emission of pollutants from stationary sources, 1985-1998

	1985		1990		1993		1995		1998	
	10^6 tonnes	%	10^6 tonnes	%	10^6 tonnes	%	10^6 tonnes	%	10^6 tonnes	%
Generated	34.0	*100*	33.9	*100*	30.9	*100*	25.8	*100*	19.1	*100*
Abated	27.9	*82*	29.2	*86*	27.1	*88*	22.7	*88*	16.8	*88*
Emitted into the air	6.1	*18*	4.7	*14*	3.8	*12*	3.1	*12*	2.3	*12*

Sources: Statistical Yearbook 1999; MNREP.

According to the structure of the Kazakh economy sector, significant emissions of heavy metals may be assumed to come from the ferrous and non-ferrous metallurgy and also from energy production, which uses mainly domestic coal with an ash content of up to 55 per cent. At the same time, large emissions of organic matter may be assumed to come from the extraction and processing of crude oil, the chemical industry and the mining-metallurgy sector, where sinter plants in particular are one of the largest sources of persistent organic pollutant emissions (dioxins, PCBs and PAHs).

Lead emissions from mobile sources have decreased by 38 per cent, a reduction that is attributed to reduction in traffic volume and also to the step-by-step introduction of unleaded petrol.

Table 4.3: Spatial distribution of emissions from stationary sources in Kazakhstan, 1999

	%	kg/capita	tonne/km^2
Total	**100.0**	**154.0**	**0.86**
Akmolinskaja oblast	2.6	71.4	407.72
Aktyubinskaja oblast	1.0	34.0	77.32
Almatinskaja oblast	2.5	37.6	261.71
Atyrauskaja oblast	**7.6**	**397.7**	**1,473.01**
East Kazakhstan oblas	**7.7**	**116.1**	**628.08**
Zsambylskaja oblast	0.5	12.0	81.52
West Kazakhstan oblast	1.0	36.7	149.85
Karagadskaja oblast	**45.5**	**742.4**	**2,452.03**
Kyzylordinskaja oblast	2.4	91.9	242.14
Kostanajskaja oblast	2.4	53.5	279.03
Mangistauskaja oblast	2.2	161.3	308.01
Pavlodarskaja oblast	**18.9**	**539.0**	**3,486.80**
North Kazakhstan oblast	2.6	83.0	616.37
South Kazakhstan oblast	0.7	7.9	132.57
Almaty City	0.6	11.7	43 846. 66
Astana City	2.0	144.0	152,746.66

Sources: MNREP; Statistical Yearbook 1999.

Emissions of greenhouse gases were estimated for 1990 and 1994. They decreased on average by 35 per cent during this period (Table 4.3).

Emissions of NOx reported in Table 4.1 are lower than those in Table 4.3. This is due to different estimation methods. It may be assumed that the method used for estimating greenhouse gases is more realistic. On the other hand, NMVOC emissions reported in Table 4.3 are probably underestimated, as solvent use, one of the most significant sectors, was not considered.

In general, reported emissions may be underestimated as they are calculated by the bottom-up method, based on the yearly emission reporting that operators of emission sources are obliged to provide to the authorities. It may be assumed that no emissions from diffuse sources are considered.

As a Party to the Montreal Protocol on Substances that Deplete the Ozone Layer, Kazakhstan is bound to phase out CFC consumption and later on HCFC consumption. In 1998 a total consumption of 1304.9 tonnes of ODS was reported. Until the definitive ODS phase-out in the year 2004, a further consumption of 3441.4 tonnes is expected.

Kazakhstan's per capita emissions are in general higher than those in other European countries (Figure 4.1). Its SO_x per capita emissions are 46 per cent over the OECD average, and slightly higher than those of Slovenia, Poland or Hungary. Similarly, its CO_2 per capita emissions are 10 per cent over the OECD average. Its NO_x emissions are 40 per cent below the OECD average, which may reflect some underestimation.

54 per cent of sulphur deposition, 81 per cent of oxidized nitrogen and 49 per cent of reduced nitrogen compound deposition are of transboundary

Figure 4.1: Emissions of CO_2, 1996

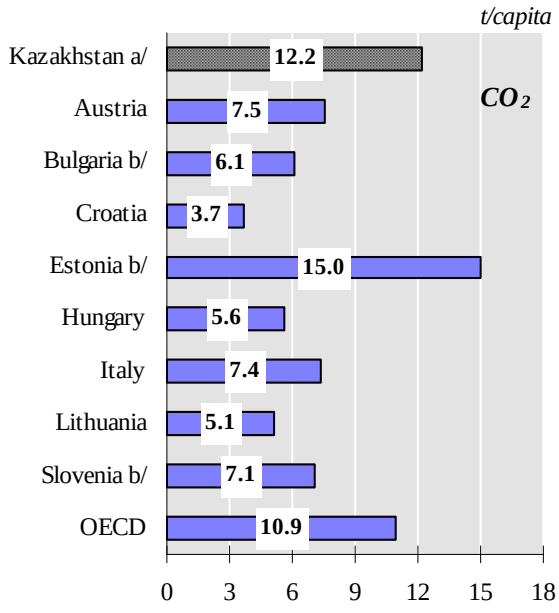


Figure 4.1: Emissions of NO_x, 1996

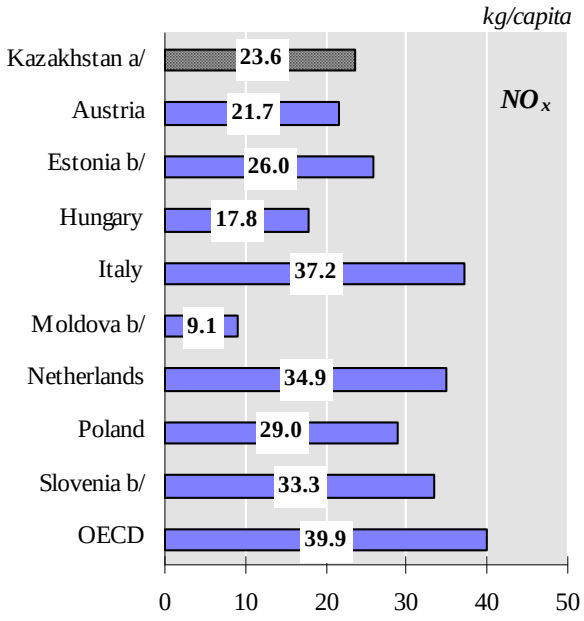
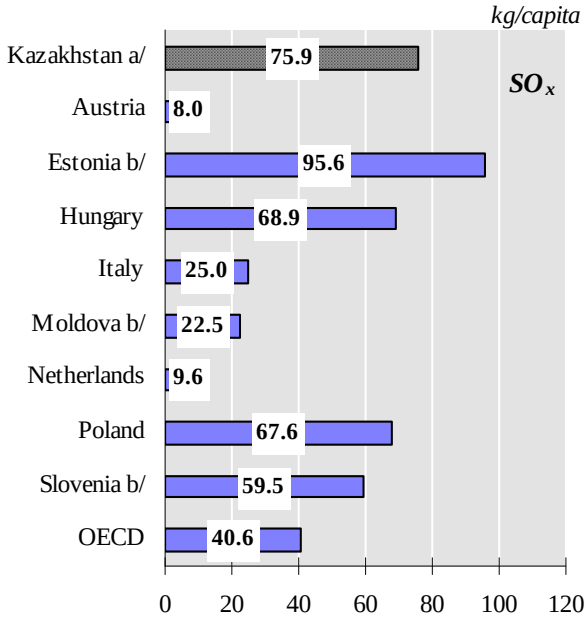


Figure 4.1: Emissions of SO_x, 1996



Sources: MNREP, 1999; OECD, Environmental data, Compendium 1997.

a/ Data refer to 1994.

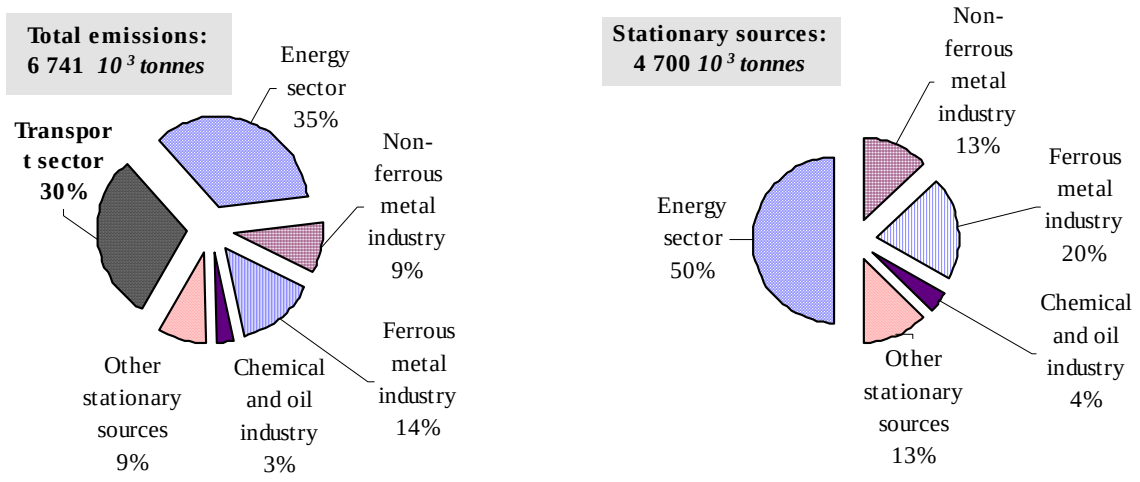
origin. The main contributions come from the Russian Federation (28 per cent), Uzbekistan (10 per cent) and Ukraine (8 per cent). Western Europe, Southeast Asia, Poland, Kyrgyzstan and Belarus contribute 3, 1, 2, 1 and 1 per cent respectively.

Sectoral pressures and underlying factors

Kazakhstan is remarkably rich in natural resources, which dictates the structure of industrial production. The mining-metallurgy sector and the primary processing of raw materials are the most important, with a large energy sector supporting their high energy demand.

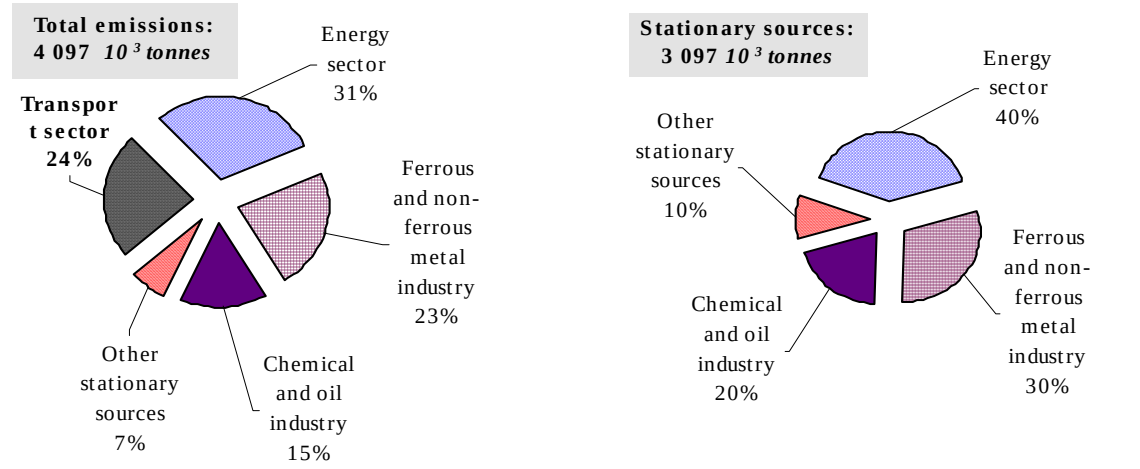
In 1990, the energy sector contributed 50 per cent to stationary source emissions, non-ferrous metallurgy 13 per cent, ferrous metallurgy 20 per cent, and the chemical and crude oil industry 4 per cent. In 1995, the energy sector contributed 40 per cent, ferrous and non-ferrous metallurgy 30 per cent, and the chemical and crude oil industry 20 per cent (Figures 4.2 and 4.3). An overview of different industrial branches and their share of total production volume is shown in Table 4.4.

Figure 4.2: Emissions by sector, 1990



Source: MNREP.

Figure 4.3: Emissions by sectors, 1995



Source: MNREP.

Table 4.4: Characteristic of different branches of industry

Branches of industry	Plants		Share of industrial output	Share of staff in industry
	Large	Medium		
	Number		*%*	*%*
Coal industry	62	50	2.2	3.2
Oil producing industry	47	25	21.1	4.4
Gas industry	3	2	1.7	…
Mining of iron ores	46	6	1.1	…
Ferrous metallurgy	2	2	6.3	9.4
Non-ferrous metallurgy	62	48	16.1	10.9
Other mining	164	44	0.9	2.2
Oil refining industry	13	6	2.8	1.5
Chemical industry	518	56	3.7	9.6
Building materials	808	..	2.2	5.1
Other non-metallic mining	470	108	1.0	2.9
Food industry	6,674	390	15.4	9.4
Others	6,408	623	9.2	31.2

Source: MNREP.

In 1990, 30 per cent of total emissions were traffic-related, while traffic contributed 24 per cent to the total in 1995. However, the decrease in total emissions during this period was 39 per cent (49 per cent from traffic and 34 per cent from stationary sources). This indicates that the main environmental pressure came from energy, mining-metallurgy, the crude oil and chemical industry and traffic before as well as during the economic recession. A similar trend may be expected in the future. The number of registered passenger cars increased by 17 per cent compared to 1990, and the number of trucks decreased by 40 per cent (Table 4.9). It should be borne in mind, however, that traffic-related emissions are mostly concentrated in large cities, where they may account for up to 90 per cent of total emissions.

There is no car production in Kazakhstan and all vehicles are imported. At present there is no import restriction that relates to the age or technical properties of vehicles. More than 80 per cent of the vehicles are estimated to be more than 10 years old and 60 per cent more than 5 years old. 20 per cent of the buses are more than 13 years old. Most of the older cars were produced in the former Soviet Union. In recent years imports have come from western Europe as well as Japan and the Republic of Korea. These cars are usually equipped with catalytic converters but due to the poor quality of fuel, they are mostly removed before being imported to Kazakhstan. Even if 80 per cent of petrol produced is lead-free, the illegal addition of lead-containing additives (in order to increase the octane number and at the same time the petrol price) means that the fuel being sold has a different quality from that being produced. Despite a yearly inspection, the technical conditions of vehicles are mostly unsatisfactory. In the eighties a large share of vehicles, mostly in the public transport sector, used natural gas or propane-butane as fuel. After the disintegration of the Soviet Union, the supply of these fuels became a problem and vehicles had to be adapted to other fuels. At present only 1 per cent of vehicles uses natural gas.

Kazakhstan's main air polluting branch of industry is power and heat production. The electricity sector is based on coal (80 per cent of energy demand in industry and 40-50 per cent in the municipal sector is supplied from coal). The rest is supplied from hydropower, fuel oil, gas and nuclear power (discontinued in January 1999). Domestic coal is used and it is characterized by a low sulphur content (0.5-0.9 per cent) and an extremely high ash content, in the range of 30-55 per cent. The fact that the Kazakh electricity sector includes mainly large units allows for a more cost-effective introduction of primary as well as secondary abatement measures. The use of accompanying gas from crude oil extraction and coal mining, which is flared at present (up to 740 million m^3 yearly)

contributing much air pollution, is also envisaged. The Strategy, adopted under the United Nations Framework Convention on Climate Change, supports the general Strategy 2030. For further details see Chapter 13.

Significant environment pressure originates in the mining-metallurgy sector. At present mining and ore processing dominate this sector. To introduce modern, efficient and at the same time more environmentally friendly technologies into this sector requires enormous financial resources. Moreover, means of abating the dangerous VOC and POP emissions as well as gaseous inorganic pollutants generated by the ore-processing plants (sintering, agglomeration,…) are in general scarce. Strategy 2030 drawn up for the mining-metallurgy sector should be adopted by July 2000. The first priority is the recovery of the sector, which has suffered a production decrease of about 20-30 per cent in recent years. Projects for the modernization of particular plants have also been prepared. However, their implementation is dependent on the availability of financial resources.

Environmental pressure from the chemical industry has dropped in the past years as a consequence of a decrease in production of about 80 per cent. However, production is intended to increase again. Production is mainly of base chemicals such as chlorine, chromium oxide, phosphorus compounds, fertilizers, polystyrene, polypropylene and man-made fibres. The consequence is pollution of the ambient air with several toxic chemicals such as mercury, phenol, formaldehyde, ammonium, HF, CS_2.

Environmental pressure from the extraction and processing of crude oil as well as from the oil refineries and petrochemical industry is also significant and may be even larger in the future, as this sector is still growing. Outdated technologies and previous mismanagement are the typical constraint. Emissions of VOC, NOx, SO_2, CO and GHG heavily pollute the vicinity of the plants. Only one of the refineries has a sulphur recovery plant. On the other hand, the largest share of investments, both foreign and national, is flowing into this sector. Unfortunately, there are no efficient legislative tools to enforce the introduction of an environmental management system and best available technologies (BAT) on plant level. Likewise, no tools are available to prevent the import of outdated technologies, which are forbidden in countries with BAT-based emission limits.

Urban air quality

Despite the fact that emissions have decreased in recent years, air quality in the most polluted cities has not improved remarkably. Both industry, often without the required protective sanitary zones, and traffic are concentrated in few cities and contribute together to their air pollution. Table 4.5 shows the spatial distribution of stationary source emissions. It is evident that the heaviest burden falls on the Karaganda *oblast*, where 45.47 per cent of stationary source emissions are released, followed by the Pavlodar *oblast* with 18.8 per cent, and the East Kazakhstan and Atyrau *oblasts* with 7.7 per cent.

The four basic pollutants (SO_2, CO, NO_2 and dust) are monitored, as are some site-specific pollutants such as heavy metals, HF, HCl, NH_3, arsine, phenol, formaldehyde and chlorine. There are no ground-level ozone monitoring data available. Data on lead and other heavy metals as well as benzo(a)pyrene, which were monitored regularly in the past, are scarce at present. No information on PM 10 or PM 2.5 is available.

Table 4.5: Greenhouse gas emissions, 1990 and 1994

1000 tonnes

	CO_2	CH_4	N_2O	NOx	CO	NMVOC
1990	275,140	2,241	109	738	2,158	542
1994	182,266	1,821	72	525	1,262	334

Source: Kazakhstan's Greenhouse Gas Emissions and Sinks Inventory, 1990 and 1994.

Table 4.6: Air pollution in the cities of Kazakhstan according to IZA5 indexes*, 1987-1997

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Akmola	1.9	3.2	3.0	2.8	**5.9**	2.5	2.7	2.4	2.3	3.3	0.4
Kokshetau	..	..	..	..	1.7	1.2	1.4	1.7	..	..	..
Kostanai	**5.4**	**12.6**	**8.7**	4.2	**5.1**	2.9	2.9	2.9	1.9	3.6	3.9
Pavlodar	**10.9**	**8.6**	**13.8**	3.9	**10.4**	2.9	2.2	2.4	2.1	2.8	1.7
Petropavlovsk	4.6	11.0	4.6	**7.3**	**8.6**	**7.3**	**6.5**	5.4	**3.9**	**5.1**	5.0
Ekibastuz	2.4	3.9	3.0	3.6	**5.0**	2.5	2.5	2.9	2.1	1.3	1.2
Aktau	..	3.4	**7.1**	**9.1**	**9.7**	**8.5**	**7.4**	**6.8**	**7.6**	**10.3**	**9.8**
Aktobe	**5.6**	**10.6**	**17.1**	**7.9**	**7.8**	**9.6**	**9.3**	**8.7**	**8.6**	**10.7**	**12.8**
Atyrau	**5.1**	**8.7**	2.9	3.3	4.6	2.2	2.2	2.5	1.0	2.4	1.9
Uralsk	4.1	3.2	**5.6**	2.4	2.2	1.9	2.0	1.7	2.5	2.2	2.2
Balkhash	**7.7**	**12.1**	**16.9**	**18.4**	**7.4**	4.1	3.7	3.8	3.6	2.6	2.3
Zheskhasan	**7.4**	**6.3**	**8.8**	**6.7**	**20.8**	**12.6**	**14.7**	**8.4**	4.9	**6.2**	4.4
Karaganda	**11.4**	**9.5**	**20.4**	**7.6**	**8.2**	**8.5**	**7.1**	**6.8**	4.4	2.3	2.5
Temptau	**15.5**	**14.3**	**27.5**	**13.9**	**30.9**	**12.4**	**13.8**	**12.8**	**6.1**	**7.7**	**8.6**
Zyryanovsk	**72.3**	**30.4**	**30.6**	**20.9**	**42.0**	**11.8**	**9.5**	**7.9**	**6.1**	**11.0**	**10.5**
Leninogorsk	**20.4**	**20.8**	**18.2**	**36.2**	**24.2**	**30.1**	**20.1**	**26.8**	**16.4**	**22.0**	**22.8**
Cemipalatinsk	4.6	**5.3**	4.3	**9.5**	**25.3**	4.5	4.6	4.9	**6.3**	4.9	4.7
Ust-Kamenogorsk	**31.1**	**27.0**	**17.6**	**21.8**	**31.3**	**14.2**	**13.0**	**9.0**	**8.6**	**13.0**	**14.8**
Almaty	**35.3**	**32.4**	**54.2**	**19.4**	**51.2**	**15.0**	**16.8**	**16.7**	**16.7**	**15.9**	**12.5**
Kaptchagay	2.7	2.2	1.3	1.2	1.0	1.1	1.4	1.5	1.7	..	..
Taraz	**74.9**	**45.7**	**42.1**	**14.7**	**29.1**	**6.2**	4.8	**7.7**	4.5	**6.4**	**7.2**
Shymkent	**15.5**	**14.3**	**27.5**	**13.9**	**30.9**	**12.4**	**13.8**	**12.8**	**6.1**	**7.7**	**8.6**

Source: MNREP.

* IZA5 indexes record the exceedance of maximum permissible concentration (MPCs) of 5 representative pollutants, considering their toxicity classes. The air is considered polluted if this index is higher than 5.

Air quality is assessed according to the so-called IZA5 indexes, which record the exceeding of maximum permissible concentrations (MPCs) of five representative pollutants, together with their toxicity classes. The air is considered polluted, if this index is higher than 5. As shown in table 4.6, air quality has improved slightly in recent years, but still needs to be improved in most cities. Moreover, due to a lack of money monitoring has suffered some inconsistency over the past years, reducing the number of monitoring sites as well as the number of monitored pollutants. The indexes are therefore not always calculated from the same set of pollutants, and this may result in inconsistency. For example, if in Almaty benzo(a)pyrene, also in the highest toxicity class, was included in calculations of the IZA5 index, it would amount to 54. When benzo(a)pyrene was no longer measured, the value of the index fell, but this does not necessarily mean that air quality in fact improved.

Leninogorsk and Ust-Kamenogorsk, where large non-ferrous metallurgy plants and coal-fired power plants are located, are the cities with the highest concentrations of pollutants. The concentration of phenol was about 0.011 mg/m^3, formaldehyde 0.02 mg/m^3, SO_2 0.174 mg/m^3, NOx 0.08 mg/m^3 and CO 3 mg/m^3. However, despite the fact that emissions of arsine and lead have increased in the past years, their ambient concentration is no longer monitored due to a lack of funds.

In Shimkent, 73 per cent of emissions originate from traffic and the rest from large coal-fired power plants, non-ferrous metallurgy, cement and petrochemical production. In 1998 they exceeded MPCs for NO_2 6.4-fold, for CO 3.4-fold, for

ammonia 2.7-fold and for dust 2.6-fold. Extreme air pollution by xylol (66.5 MPC), hydrocarbons (47.7 MPC) as well as toluene, H_2S and benzene was measured occasionally. A chemical plant producing phosphor compounds, currently out of operation, used to pollute the air in Shimkent with HF, H_2S, SO_2, NOx and phosphorous compounds.

Air pollution in Aktau and Atyrau is caused by the extraction and processing of crude oil with consequent high concentrations of SO_2, NOx, CO and toxic hydrocarbons (see also Chapter 9).

90 per cent of air pollution in Almaty comes from traffic. Emissions from stationary sources have decreased in the past years by 67 per cent and traffic-related emissions increased by 6 per cent. High concentrations of most of the pollutants have been and are still measured. In 1999 the dust concentration was 1.3 times the MPC, the formaldehyde concentration 1.3-3.3 times the MPC, NO_2 1.3-1.8 times the MPC. The physical location of Almaty behind a mountain range with nearly no wind (wind speed under 1 m/s 71 per cent of the time in summer and 79 per cent in winter) worsens the situation. Moreover, often inversion and the release of a large part of the emissions close to the ground lead to very poor dispersion of pollutants and insufficient self-cleaning of the ambient air.

4.2 Policy objectives and management practices

Objectives and legislation

Strategy 2030 also has an environmental element, the main objective of which is to slow down the environmental deterioration. The priorities are to create an effective regulation system for nature use and environment protection, to establish a base for the balanced use of natural resources and to raise overall environmental awareness. Within this Strategy the *Environment and natural resources* part was prepared by MNREP and approved by the President in 1998. There is no particular air protection strategy available. Air protection is also included in the National Environmental Action Plan for Sustainable Development (NEAP/SD), which identified air pollution in urban areas as a priority problem in Kazakhstan.

In 1996 the Concept of the Environmental Safety of the Republic of Kazakhstan was adopted and in 1997 the Law on Environmental Protection. General provisions of air management are included in this Law. However, the Law on the Protection of Atmospheric Air of 1981 is still in force and so are different regulations and standards governing the enforcement of the Law on the Protection of Atmospheric Air. Virtually all air protection management is conducted according to legal documents from the Soviet era. The most important documents are:

- The categorization of air pollution sources
- The method for establishing dispersion models and calculating polluting matter concentration on the border of sanitary zones
- The method for establishing the MPE project
- The maximum permitted concentrations of polluting matter in ambient air
- The method for setting fees for environmental pollution (1996)
- The Law on Ecological Expertise (1997)
- Instructions for the standardization of emissions into the atmosphere and water
- Instructions for environmental impact assessment
- The ministerial decree on a single information system for the environment and natural resources (not yet in force)
- Instructions for licensing experts conducting environmental expertise (not yet in force)
- The issue of permits for special nature use (2000)

These legal instruments are supported by a comprehensive set of national standards (GOST) from the Soviet era. In addition, relevant international legal instruments are in force, or their ratification is being prepared (see Chapter 3).

Institutional framework

At present, the following institutions have air quality management tasks and responsibilities:

- The Ministry of Nature Resources and Environmental Protection (MNREP) Committee for Environmental Protection: the development of air protection strategies, policies and legal instruments; the setting of maximum permitted emissions (MPEs); the administrative supervision of the implementing institutions; responsibility for monitoring and reporting at national level; ecological expertise for projects of national importance; the organization of ecological training and education; responsibility for international treaties and their implementation into the national policy and legal system

- The MNREP Department of Central State Inspection: Supervises inspection control over the compliance of the polluting sources with air protection legislation; supervises the implementation of protective measures and emission limits as specified in the MPC projects
- The MNREP Kazhydromet: The monitoring of air quality, atmospheric precipitation, hydrological and meteorological data, radiation monitoring as well as scientific support, in particular for dispersion modelling and maintaining appropriate monitoring databases
- The regional *oblasts* and city (14+2) executive bodies (*akimats*): Enforce environmental legislation at the local level, draw up local environmental action plans, conduct the State inspection at local level and supervise
- compliance with environmental protection legislation in the region and report violations to the responsible bodies; conduct environmental expertise in the framework of their competency; carry out environmental monitoring including emission measurement; issue the yearly permits to discharge emissions and wastes and collect the respective fees; cooperate with citizens and environmental NGOs.
- The Ministry of Health: Defines MPCs and the protective sanitary zones around the industrial plants on the basis of health effects; assesses emission sources and their physically hazardous effects; supervises the application of sanitary rules
- The Ministry of Internal Affairs: Monitors the emissions of polluting substances by motor transport and controls the activities of the traffic police

Kazakhstan has a decentralized air protection management system with local authorities playing the key role in enforcing legislation. The *oblast* and city environmental protection departments used to fulfil similar tasks during the Soviet era, using almost the same legislation. Likewise, in the past as today much emphasis is put on inspection and on fees and penalties. Besides environmental inspection, industry is the subject of several other inspections (technical, epidemiological, urban planning, veterinary, water), some of them overlapping. Some thought is being given to integrating at least part of these inspections. Further overlapping is found in the competences of different sectors. Therefore, in 1999 MNREP and the Agency on Health Affairs adopted a document which clearly states their competences in respect of environmental protection. Similar documents will be prepared for other sectors.

MNREP as well as the *oblast* and city environmental protection departments and Kazhydromet are fully financed from the State budget. However, in recent years the insufficient State budget was partly supplemented from the local environmental funds. These funds may be used for capital and operating costs but not for salaries. For example, in the Astana city environmental protection department a modern laboratory was built and equipped from this fund. In general, the lack of financial resources is a serious problem in implementing and enforcing the legislation.

Air quality management and monitoring

Air quality management is based on air quality standards, the so-called maximum permitted concentrations (MPCs), inherited from the Soviet era. The MPC is determined for about 1,500 substances (20-minute as well as daily averages). MPCs are in general more stringent than the WHO or EU standards (Table 4.7). The comparison is complicated, because MPCs are not set on an annual basis. As few of the substances are monitored, the effect of this instrument is questionable.

The system of National Standards (GOST) from the Soviet era still plays an important role in air management of Kazakhstan. GOST standards regulate, for example, fuel quality, the concentration of pollutants in motor vehicle exhaust gases, methods for determining the MPC of different pollutants, dispersion modelling and also parts of the EIA procedure. GOST standards are usually associated with a network of laboratories equipped to supervise compliance. GOST-standard laboratories also play a key role in the accreditation procedure for other laboratories. For example, all equipment purchased for the new environmental laboratories of the city department in Astana is being tested in a GOST-standard laboratory as part of the accreditation procedure. Only accredited laboratories may provide data for the purpose of State administration.

The State agency Kazhydromet is responsible for air quality monitoring in the whole country. The air-quality-monitoring network comprises at present 51 sites, located in the 19 most polluted

Table 4.7: Comparison of selected Kazakh air-quality standards with recommended WHO guiding values and present and future EU standards

Substance	Kazakhstan MPC a/ mg/m^3		WHO guiding value / averaging time	EU standards / averaging time	
	20 min	*24h*		Present	According to IPPC Directive b/
Carbon monoxide	5.00	3.00	60 mg/m^3, 30min 10 mg/m^3, 8h		
Sulphur dioxide	0.50	0.05	0.5 mg/m^3, 10 min 0.125 mg/m^3, 24 h 0.05 mg/m^3, annual	0.08 mg/m^3, annual, c/ median value if BS>40 and 0.12 mg/m^3, annual, median value if BS ≤ 40	0.125 mg/m^3, 24 h, d/ exceeded not more than 3 times annually to protect human health; 0.020 mg/m^3, annual and e/ in winter to protect ecosystems
Nitrogen dioxide	0.085	0.04	0.2 mg/m^3, 1 h 0.04 mg/m^3, annual	0.2 mg/m^3, annual, exceeded not more than 2% time	0.2 mg/m^3, 1 h, f/ exceeded not more than 8 times annually (50% margin of tolerance) 0.04 mg/m^3, annual (50% margin of tolerance) both to protect human health; 0.03 mg/m^3, annual, as $NO + NO_2$ to protect vegetation
Particulate matter		0.05	0.06-0.09 mg/m^3	0.08 mg/m^3, annual median value 0.13 mg/m^3, winter median value 0.25 mg/m^3, maximum value not to be exceeded more than 3 times annually	0.05 mg/m^3, 24 h (50% margin of tolerance to protect human health) 0.03 mg/m^3, annual (50% margin of tolerance to protect human health)
Lead		0.0003	0.0005 mg/m^3, annual	0.0002 mg/m^3, annual	0.0005 mg/m^3, annual (100% margin of tolerance)

Sources: MNREP; WHO Air Quality Guidelines for Europe and EU Directive 96/61 on IPPC.

a/ MPC maximum permissible concentration

b/ IPPC: Integrated Prevention and Pollution Control.

cities. There are analytical laboratories in each of the cities. Monitoring is done using old-fashioned technical equipment and GOST. However, since 1995 a new progressive sampling method, using sampling tubes with the appropriate solid sorbent, is used at all monitoring sites. The pollutant concentrations are analysed in the chemical laboratories using the following analytical methods:

sulphur dioxide, chlorine, formaldehyde and the nitrogen oxides (spectrophotometry); carbon monoxide (gas analyser); chloroprene, xylene and aromatic hydrocarbons (gas-chromatography); dust (gravimetry), heavy metals (atomic absorption). The laboratory in Almaty, responsible for the methodological guidance of all other laboratories (according to a methodology document from 1991), regularly conducts inter-laboratory testing in the framework of internal QA/QC. All laboratories and their equipment are inspected yearly by a GOST-standard laboratory.

The number of sites for air quality control was decided on the basis of several criteria, mostly according to the size of the population of the city and the specific air emission burden. They are located in order to characterize air pollution by different sources, e.g. industry, traffic or domestic heating. Usually, four samples are taken a day. The sites are placed at a 0.5-5.0 km distance from each other; the samples are taken 1.5-3.5 m from the ground during 20-30 minutes and brought to the laboratories.

There is one background-monitoring site located in the rural area in Borovoe, which is included in the global UNEP network.

The monitoring programme suffered from a lack of resources to maintain and run the sites and laboratories mainly in the period 1997-1999. The number of sites was reduced (for example, in Almaty of the 13 sites only 2 were functioning in 1999, and at present 5 should be in operation) as was the number of monitored pollutants or number of samples taken during 24 hours. As the ambient concentration of pollutants is essential for air quality management in Kazakhstan, in some cities the monitoring network was supported from city budgets, if the regular State budget was insufficient. The creation of a parallel air-quality monitoring system, operated by the city environmental protection departments and based on modern continuous analysers, is also planned.

Management of emission sources

Standards for stationary air pollution sources are also based on MPCs. According to present legislation, all enterprises that generate air pollution have to get yearly emission permits from the *oblast* or city authorities. The emission permit is based on the confirmed MPE project. The MPE projects are prepared by the companies (usually in collaboration with an expert institution) and presented to the authorities for State examination and confirmation. For each source the mass flow (g/s) of a particular pollutant is limited. It is defined as the maximum emission that (under the least favourable dispersion conditions) will not cause any excess of the MPC close to the ground (1.5 m above ground) on the edge of the protective sanitary zone. Also the maximum yearly emission is limited, based on the permitted mass flow and average operating hours. MPE projects contain much technical information about the production technology as well as the abatement techniques used, and are to be updated every 5 years. Within this procedure the local authorities play an important role and may set certain technical conditions to reduce emissions, if the MPCs are not met. Sometimes, if the air pollution source cannot meet the MPCs within the existing technical conditions, the sanitary zone may be extended (this is within the competence of the Ministry of Health), or the stack may be raised to improve the dilution of pollutants. All MPE projects are available at the *oblast* or city environmental protection department and may also be used for local strategic planning.

The methodological documents used for MPE projects are based on dispersion modelling. They need a comprehensive set of meteorological input data as well as data on ambient air concentrations (for calibration purposes). These monitoring data are therefore essential for the application of the air protection legislation.

All enterprises are responsible for their own emission monitoring, using both emission measurements and mass balance calculations. They are obliged to keep records and to report on quarterly and yearly bases to the authorities and the statistical office.

The State Inspectorate is responsible for controlling the air pollution sources and their compliance with the respective MPE projects and emission permits. It also reviews the emission measurements and the mass balance calculations. If it discovers violations, penalties may be imposed. The inspection is conducted at least once a year, depending on the size and importance of the plant. The authorities conduct their own measurements and compare results. In the event of non-compliance, the authorities may require some reparation measures to be taken and the State Inspectorate later verifies if the measures have indeed been introduced.

Economic instruments and cleaner technologies

Fees are to be paid by operators of air pollution sources for the emissions within the limit as well as for those exceeding the limit, which may be up to ten times higher.

The amount of fees to be paid is set on a yearly basis by the respective *akims* (and approved by MNREP) and may vary from *oblast* to *oblast*. They are set according to a methodological document from 1996. On the basis of the emission reduction plans of the respective *oblast*/city, drawn up together with the main air pollution sources, so-called normative emissions are set. This amount is the basis for calculating fees. The fees are to be paid in advance on a quarterly basis and are cleared by the end of the year. They are paid to the local environmental protection funds. They should be used, among other things, for facilitating the introduction of energy conservation and cleaner technologies. Until 1 June 1999 only activities connected with environmental protection could be financed from these payments.

The emission limits determined in accordance with the above methodology do not correspond to the BAT-based limits used in most European countries. If the enterprise is not able to meet the determined emission limit because of the technology it uses, it may continue to operate but has to pay multiple fees.

Currently industry is working at 20-80 per cent of its capacity, but it is expected to recover and even grow in the future. The introduction of cleaner technologies is also hampered under the poor economic conditions. There are no incentives in the present legislation to encourage the introduction of cleaner technologies in new or reconstructed enterprises. Likewise, there are no tools for stimulating or enforcing primary or secondary measures for air pollution abatement in industry.

Environmental objectives of urban transport policy and infrastructure development

Urban air pollution is considered to be one of Kazakhstan's priority environmental problems and its improvement one of the main objectives. Measures are being taken at national level, but the local executive bodies-city/*oblast akimats*, together with the local representative bodies-*maslikhats*, play the key roles in urban transport policy and infrastructure development.

At the national level the Vehicle Transport Committee under the Ministry of Transport and Communication is responsible for regulations and the setting of standards in the transport sector. The implementation of these documents is in the hands of traffic police. Most (about 80 per cent) of the road transport is already in private hands. The composition of the vehicle stock is in Table 4.8.

Table 4.8: Petrol consumption in the transport sector, 1992-1996

1 000 tonnes

1992	1993	1994	1995	1996
833	405	404	767	363

Source: Programme on Phasing out Leaded Petrol in Azerbaijan, Kazakhstan and Uzbekistan.

The State control of air-polluting vehicle emissions is based on national standards (GOST), limiting the maximum content of CO and VOC in the exhaust gases of petrol-driven passenger cars, and the soot content in diesel. The standard also defines the estimation methods, using continuous IR spectroscopy for the CO and VOC measurement. At present, only CO concentration and soot are measured. The exhaust gas control is obligatory once a year and shown by a sticker on the screen. It is intended to extend the yearly control of exhaust gases also to an obligatory control after every 10,000 km. Spot checks are also carried out. They show that the emissions of about 80 per cent of cars are 2-3 times higher than the standard.

GOST standards also regulate the composition and properties of petrol and diesel. In terms of air pollution, the regulation of the sulphur content in diesel fuel is important (0.2-0.5 per cent). There is leaded (0.17 and 0.37 g Pb/l), as well as unleaded (0.013 g Pb/l) petrol available on the market. Kazakhstan has a large car-fuel-producing capacity of its own and could be self-sufficient in the future. Two relatively modern refineries in Pavlodar and Shimkent produce only unleaded petrol and the over than 50-year-old refinery in Atyrau produces only leaded petrol. Some high-octane leaded petrol is also imported. The share of unleaded petrol in total production is about 80 per cent. Most of this petrol is relatively low-octane. As the demand for high-octane petrol increases, additives are added illegally to the cheap low-octane petrol, which is then sold at a much higher price (the price difference is up to 10 tenge/l). In Almaty, where selling leaded petrol is prohibited, illegal sales of about 100,000 tonnes of leaded petrol (with lead

Table 4.9 : Registered motor vehicles, 1990-1998

Thousand

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Number of vehicles	1,364	1,394	1,460	1,492	1,496	1,492	1,409	1,333	1,285
of which:									
Passenger cars	810	849	916	956	992	1,034	997	973	971
Trucks	377	372	376	375	353	319	295	257	223
Buses	54	54	55	56	55	54	49	46	44
Special cars	122	119	113	105	96	85	68	57	47

Sources: Statistical Yearbook; MNREP report.

content up to 1 g/l) were reported in 1997. The local authorities conduct extended inspections of fuel quality at petrol stations and penalties of about 7,000 tenge/t of leaded petrol sold may be imposed. Petrol consumption trends figure in Table 4.9

A National Programme to Phase out Leaded Petrol in Azerbaijan, Kazakhstan and Uzbekistan was established in 1998 with the support of Denmark. Fuel and car tax exists – see Chapter 2 for descriptions.

Strategy 2030 is transposed into local strategies for air quality improvement, drawn up by the local authorities. Almaty has a comprehensive programme to mitigate the adverse effects of traffic. It comprises:

- Vehicle stock improvement
- Fuel quality control
- Optimizing traffic management and public transport
- Raising public awareness

Since mid-eighties only unleaded petrol may be sold in Almaty. However, over the past years there have been extensive violations of this regulation, as mentioned above.

In the 1979-1987 period the whole public transport system used LPG. After the disintegration of the Soviet Union the supply of these fuels became a problem and vehicles had to be adapted to other fuels. One stationary and 30 mobile LPG stations have been established and 2 stations for liquid natural-gas supply to facilitate their use again.

Since 1999 the majority of public transport has been in private hands, but is organized by the city authorities. The vehicles used to be inspected 3 times per year. In 1999, 207 diesel-fuelled buses were equipped with so-called “neutralizers” to lower emissions by 80 per cent. More buses are to be equipped in the next few years. Research is going on to lower the emissions from petrol-fuelled vehicles also.

Almaty also has an electro-transport development strategy. This concerns new trolley-bus lines and a metro, on which construction was started in the Soviet era. Since 1994, due to a lack of money, only the funds necessary for the conservation and safekeeping of this structure are available from the State budget. Conservation costs are assessed to be 5 billion tenge, liquidation costs 15.8 billion tenge and the cost of finishing the metro 48 billion tenge.

Transit through the city is also regulated, with established transit routes. An infrastructure for trucks was established on the outskirts of Almaty, in order to encourage them to use these routes rather than enter the city. Similar strategies are included in the General Development Plan of Astana, where transit transport by-passing, a switch to gaseous fuels, the electrification of public transport and a ban on leaded fuels are the main objectives.

4.3 Conclusions and recommendations

Although emissions in Kazakhstan have decreased in recent years, air quality in the most polluted cities has not improved remarkably. Lower energy demand and a drop in overall production, together with abatement measures introduced step by step after 1985, were the main reasons for this development. Kazakhstan has a long-term development strategy to the year 2030, which is being transposed into the strategies of different sectors. At present, 70 per cent of the economy is connected to natural resources. The remarkable wealth of natural resources is also the base for future development, with more emphasis on the finalization of the production. The recovery and further development of mining-metallurgy and

especially of the crude oil extraction and processing sectors are the key elements. However, the need for sustainability should be recognized by favouring the introduction of cleaner technologies, in order to prevent a simple resumption of old pollution patterns.

Kazakhstan adopted its National Environmental Action Plan for Sustainable Development, which became part of Strategy 2030. The main issues and problems in air protection management were identified and a prioritized action plan was established. The envisaged priorities point in the right direction. They should therefore be maintained and implemented. See Recommendation 1.2.

The present legal system of air protection is still based on that inherited from the Soviet era. There are MPCs for about 1500 substances, 20-minute and daily average values, but no yearly averages. Kazakh MPCs are often more stringent than WHO guiding values or EU standards, but action follows only rarely even if they substantially and permanently exceeded. Moreover, only few of the 1500 pollutants were or are actually monitored. Emission limits for stationary air pollution sources are based on MPCs, set with the help of dispersion modelling for each source. Emission measurement capacity too is available in both State authorities and the private sector.

The air protection management system is decentralized and the local authorities play an important role. The emphasis is put on inspection, rather than on the implementation of efficient air quality management tools. No legal instruments secure the implementation of BAT or even BATNEEC in new or reconstructed sources. Furthermore, no tool is available to enforce the use of primary and secondary measures to abate air emissions. Box 4.1 provides a synoptic overview of the broad features of technology-based air protection management.

This Kazakh system differs in its main features from that of most European countries. As a first step towards harmonization and modernization, emphasis should be put on adopting realistic MPCs (calculated also on an annual basis) for a reduced number of pollutants, and at the same time on securing the proper monitoring of these pollutants. Furthermore, technology-based emission limits should be set for new or reconstructed sources, in order to prevent air quality deterioration

Box 4.1: Technology-based emission limits

Existing sources	• Emission limits are to be set case by case according to the existing technologies, requiring only measures such as good environmental management practices, without the need for additional costs. Sufficient time, e.g. 15 years, should be given for existing sources to comply with emission limits for new sources
New sources	• Emission limits should be set strictly according to best available technologies

INCENTIVES TO SUPPORT THE APPLICATION OF TECHNOLOGY-BASED EMISSION LIMITS

- The introduction of the *bubble principle* for existing sources during the transition period. This would allow emissions to be reduced where it is most convenient and cost-effective for the plant, provided that the agreed total emission cut was achieved.
- Setting uniform emission fees in the whole country, with the possibility for local authorities of imposing only a percentage of the fees (or even nothing) should the plant show evidence of investments into cleaner technologies or abatement techniques. Environmental investments should be promoted by gradually increasing the percentage to be paid if no environmental investments are made.

ADVANTAGES OF THE TECHNOLOGY-BASED EMISSION LIMITS

- Provides for the same technical level throughout the country
- Provides guidance to the local environmental protection authorities
- Independence of the outdated MPCs, being within the competence of the Ministry of Health
- Protection against imports of outdated technologies banned in countries with BAT-based emission limits
- Enough flexibility for the local authorities to reflect the local peculiarities
- Transparent conditions for potential investors
- Best available technologies are generally more efficient, so they can improve industry's competitive position on the international markets

DISADVANTAGES OF THE PRESENT MPC-BASED SYSTEM

- Local authorities need to evaluate the technical properties of the same technologies case by case
- Ability to comply with MPC by raising the stack or extending the diameter of the protective sanitary zone, without lowering the actual emissions
- Obscure conditions for the investors, as emission permits have to be issued every year and the charges may be different.

accompanying economic growth. Also, in the future, significant pressure may be expected from the energy, mining-metallurgy, crude oil and chemical sectors as well as traffic.

Recommendation 4.1:
Short-term and annual maximum permitted concentrations for a reduced number of pollutants should be adopted and harmonized with World Health Organization guiding values. Technology-based emission limits for new and reconstructed sources should be incorporated into the air protection legislation. For existing sources, sufficient time should be given for complying with those emission limits.

National standards (GOST) support the enforcement of the air protection legislation, setting technical parameters together with their control methods, accompanied by laboratories equipped to use them. These laboratories are also playing an important role in the accreditation of laboratories providing environmental data. Even if the methods used have become obsolete, and financial funds have been lacking in recent years, the whole system seems to maintain a sufficient level of good laboratory practice throughout the country.

Kazhydromet is responsible for air-quality monitoring and the monitoring of meteorological data, both essential for MPC-based air protection legislation, since they are needed for dispersion modelling and model calibrations as well as the assessment of air quality. The monitoring programmes have a relatively long tradition, but in recent years have suffered from a lack of resources to maintain and run the sites and laboratories. Moreover, both methods and equipment have become obsolete. Efforts were made to improve the sampling methods, and liquid sampling has been replaced by sorbent-tube sampling recently.

In the past years the lack of funds for air quality monitoring was partly compensated by the city/*oblast* authorities, which recognized the importance of air-quality data for air-quality management. In some cities projects do exist for establishing a parallel air-quality monitoring system, using modern continuous monitoring devices. However, it should be borne in mind that these systems require extensive operating costs in the future and that the lifetime of analysers is limited. The development of a truly satisfactory monitoring programme can wait for more favourable economic conditions, but a sufficiently homogeneous programme has to be defined and maintained.

Recommendation 4.2:
The air-quality and meteorological monitoring programmes should at least return to 1990 levels of performance in order to be useful for minimum air management purposes. In order to prepare for future requirements of air management, a new monitoring strategy adapted to both national and local needs should be developed together with the adoption of revised ambient air quality standards. See Recommendation 14.6.

Kazakhstan's main air polluting branch of industry is power and heat production, based on use of domestic coal with an extremely high ash content. A vast part of the energy is produced in large power plants with an installed capacity of up to 4,000 MW, which allows for the more cost-effective introduction of primary as well as secondary abatement measures.

Recommendation 4.3:
Financial means available for reducing air pollution should preferably be allocated to the heavily polluting energy sector, where good opportunities for cost-effective emission reduction exist through the introduction of cleaner technologies and/or the use of cleaner fuels. See Recommendation 13.2.

Kazakhstan has a large vehicle-fuel production capacity of its own and 80 per cent of the petrol produced is lead-free. Due to the illegal adding of lead-containing additives, the fuel sold may contain up to 1g of lead a litre. The extensive inspection of sold fuels and the imposition of penalties for violations seem inadequate to prevent these practices. The National Programme on Phasing out Leaded Petrol in Azerbaijan, Kazakhstan and Uzbekistan also envisages other measures, first of all a change in the fuel quality standards.

Recommendation 4.4:
Both legislative measures and economic incentives should promote a phase-out of leaded petrol and of illegal leading of unleaded petrol. See Recommendation 14.5.

About 60 to 90 per cent of air emissions in the cities of Kazakhstan are traffic-related. An improvement could be achieved by the gradual replacement of the vehicle fleet by cars equipped with three-way catalysers. As Kazakhstan has no

passenger car production, import regulations could support this process.

Recommendation 4.5:
A regulation of technical parameters aiming at air protection for cars should be introduced. Car taxes or import duties should be relatively lower for vehicles with functioning technical parameters reducing air emissions. Effective car inspections should be enforced that control the functioning of the regulated technical parameters.

Chapter 5

MUNICIPAL AND INDUSTRIAL WASTE MANAGEMENT IN THE EASTERN OBLASTS

5.1 General characteristics of waste flows

Structure and recent development of industry

Kazakhstan's industry is based on the use of its rich natural resources. Industry is a major economic sector, contributing more than 20 per cent to GDP (23.5 per cent in 1995 and 22.5 per cent in 1999). The main industrial sectors are mining, oil production and refineries, the gas and coal industries, ferrous and non-ferrous metallurgy, the chemical and petrochemical industry, the building materials industry and light industry. Some characteristics of these industrial sectors are also presented in Chapter 11.

Overall industrial production was reduced during 1991-1996. Many chemical plants were closed because of a lack of raw materials or market loss. A slight increase and stabilization in overall industrial output took place during 1996/7, but in 1998 industrial output decreased again by 2.4 per cent. Average overall capacity utilization in industry was 45 per cent in 1998. For the mining industry, this Figure was 68.2 per cent, for the oil and gas industries 70.8 per cent, for refineries 43.7 per cent, and the chemical, engineering, pulp and paper industries worked at less than 10 per cent of their capacities.

Most of the enterprises have outdated and worn-out equipment. According to the statistics, the decline in industrial output did not result in a decrease in the generation of industrial wastes. This can be explained by an improved statistical reporting system, as the number of responding enterprises has increased, particularly as concerns the generation of hazardous industrial wastes. However, the main problem for waste management and waste statistics is the amount of accumulated industrial wastes stored at industrial sites.

The eastern *oblasts* are highly developed industrial regions where most of Kazakhstan's industrial enterprises and many of its natural resources are located. Among the six *oblasts* that have been identified as environmental "hot spots", there are three eastern *oblasts*: East Kazakhstan, Karaganda and Pavlodar. The main problems in these regions are the generation and accumulation of industrial wastes. The NEAP classifies the region, including the Akmola *oblast*, as priority activity zone B (see Figure 2.1).

Classification of industrial wastes

The governmental industrial research union "Kazmekhanobre" developed a classifier of hazardous industrial wastes in 1996. The purposes of the classification system are:

- To develop a State certification system for hazardous wastes according to existing international rules, norms and standards
- To improve the efficiency of internal and external markets in recycling industrial wastes
- To improve the reporting system for the generation, recycling and disposal of industrial wastes
- To support the development of methods for the recycling/reuse of certain kinds of wastes
- To substitute industrial wastes containing valuable substances and components for primary raw materials
- To help develop long-term programmes for the management of industrial wastes
- To facilitate the calculation of damage caused by hazardous wastes to human beings and the environment.

The classification system is based on 5 classes of hazardousness (see Table 5.1). The classification includes the lists of industries and of the hazardous wastes they generate. Also included are characteristics such as the nature of waste, methods of storage, methods of possible recycling and use, the physical state (liquid, solid, sludge), their composition (main hazardous elements and their concentration), and the type of production generating them.

Table.5.1: Classification of hazardous wastes

Class	Hazards
1	Explosive and flammable substances: - Explosives, flammable liquids; flammable solids; self-flammable; substances releasing flammable gases on contact with water
2	Oxidizers: - Self-oxidizing substances which release oxygen and promote the flammability of other substances, - Organic peroxides
3	Toxic substances: - Poisonous (lethal for man) substances; infections; substances releasing toxic gases on contact with water, toxic substances causing chronic diseases; - ecotoxic substances threatening the environment
4	Caustic and corrosive substances: - Substances causing damage on contact with living matter
5	Substances releasing toxic products by physico-chemical or biochemical airing: - Substances releasing other toxic products, for example by leaching

Source: Classifier of hazardous industrial wastes of the Republic of Kazakhstan, "Kazmekhanobre" Almaty, 1996

Generation of hazardous wastes

Table 5.2: Generation, use and disposal of hazardous wastes * in 1998

Thousand tonnes

	Generated	Used at enterprises	Treated at enterprises	Export	Transferred To sites of organized storage		To landfills	Permitted amounts	Stocks at enterprises at end of year
					Total	*of which:* meeting environmental requirements			
Kazakhstan	**83,911.8**	**12,558.3**	**1,459.9**	**1.3**	**70,385.8**	**64,907.5**	**2,491.1**	**110,247.9**	**2,964,881.4**
Almaty	1,216.2	-	-	-	1,216.2	1,216.2	28.6	8,062.8	58,270.9
East-Kazakhstan	31,298.0	9,971.9	2.6	-	21,233.3	21,031.3	329.9	38,015.4	1,342,707.7
Karaghandy	36,018.9	2,220.8	1,453.8	-	32,343.0	29,308.5	1,918.9	40,264.6	876,876.0
Pavlodar	5,086.8	300.0	0.0	-	4,695.6	3,561.4	85.4	8,034.5	165,693.1

Source: Agency on Statistics.

* Radioactive wastes not included.

Table 5.3: Generation, use and disposal of hazardous wastes * in 1994

Thousand tonnes

	Generated	Used at enterprises	Treated at enterprises	Export	Transferred To sites of organized storage		To landfills	Permitted amounts	Stocks at enterprises at end of year
					Total	*of which:* meeting environmental requirements			
Kazakhstan	**54,126.0**	**2,741.6**	**671.8**	**55.1**	**70,779.9**	**41,249.9**	**131.2**	**66,876.2**	**2,511,035.5**
Almaty	0.4	0.1	0.3	-	-	-	0.0	-	0.0
East-Kazakhstan	4,965.4	433.7	2.4	-	4,512.1	4,342.1	15.5	4,700.5	755,172.3
Karaghandy	3,281.5	494.2	611.9	-	1,463.3	1,463.3	84.4	2,471.5	72,103.8
Pavlodar	11,455.9	29.5	0.0	0.6	11,222.7	11,222.6	10.5	15,437.9	232,135.0

Source: Agency on Statistics.

* Radioactive wastes not included.

Table 5.4: Generation, treatment and disposal of hazardous wastes by type, 1997-1998

	Generated		Used		Treated		Transferred*	
	1997	1998	1997	1998	1997	1998	1997	1998
Total wastes *(1 000 tonnes)*	**69,397**	**83,912**	**3,187**	**12,558**	**626**	**1,460**	**95,558**	**70,386**
Solid waste *(1 000 tonnes)*	58,308	77,086	3,152	12,495	5	839	85,139	64,275
Liquid *(1 000 tonnes)*	814	776	32	48	615	617	147	164
Sludges *(1 000 tonnes)*	10,275	6,050	3	15	6	4	10,272	5,947
Radioactive waste *(1 000 tonnes)*	*71*	107	-	-	-	-	*77*	107
Galvanic wastes of classes of danger 1-3 *(tonnes)*	*275*	32	-	6	*5*	11	*289*	12
Waste containing:								
Arsenic *(1 000 tonnes)*	5	4	-	-	-	-	4	4
Oil products *(tonnes)*	3,481	5,411	2,883	17,463	6,644	86	395	298
Lead , classes of danger 3-4 *(1 000 tonnes)*	1,977	19,012	192	9,550	-	-	1,731	9,416
Zinc *(tonnes)*	150	326	25	20	-	-	102	306
Oil-limes *(tonnes)*	26,127	34,907	5,827	2,639	152	79	21,376	31,302
Asbestos *(1 000 tonnes)*	2,842	2,301	60	32	-	-	2,560	2,090
Fluorine *(tonnes)*	2,005	63	-	-	-	-	20,033	152
Phosphorus *(1 000 tonnes)*	338	3	-	-	-	-	312	3
Manganese *(1 000 tonnes)*	5	187	-	-	-	-	5	186

Source: Statistical Yearbook 1999.

* Transferred to places of organized storage and burial of waste.

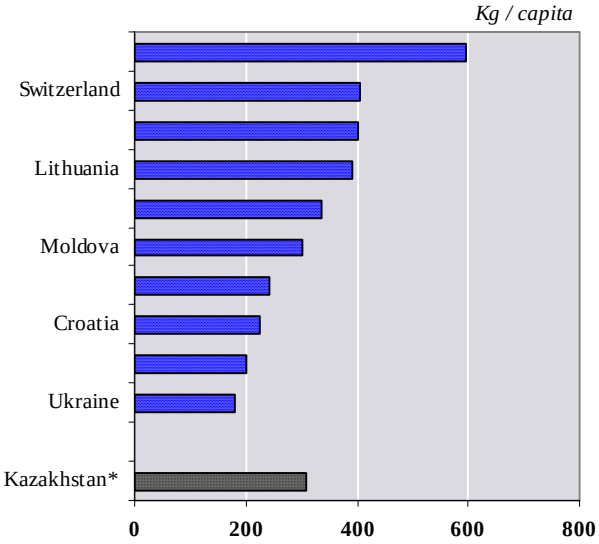
The statistical data concerning the generation, use and disposal of hazardous industrial wastes from 1993-1998 are presented in Tables 5.2 and 5.3. Wastes cover all five classes of Table 5.1. Wastes volumes from the mining industries (mining debris and rock wastes, slurry/sludge or tailings, wastes containing heavy metals, oil wastes, ashes, etc.) are only partly included, as about 95 per cent of the total mining debris are discharged into the environment in different forms. The tables show an increase in hazardous waste generation in the country. Recently, the annual average generation of hazardous wastes was between 70 and 85 million tonnes. In 1998, about 80 per cent of the wastes were generated in the East Kazakhstan and Karaghandy *oblasts*.

By 1998, accumulated hazardous industrial wastes amounted to almost 3 billion tonnes. About 80 per cent of these wastes had been generated in the eastern *oblasts*: 29.5 per cent in the Karaghandynskoi *oblast*, 45.2 per cent in the East Kazakhstan *oblast* and 5.5 per cent in the Pavlodar *oblast* (see Table 5.2 for details). The annual average of hazardous waste generated in this region is about 50 million tonnes. Table 5.4 presents data on hazardous waste generation and treatment in 1997-1998 by type of waste. About 90 per cent are solid wastes from mining and metal production processes. Toxic wastes, including arsenic, lead, zinc, phosphorus, fluorine, or heavy metals, require special treatment.

Generation of municipal waste

Data on municipal as well as on industrial waste are collected by the *oblast* departments of the MNREP. The *oblast* departments use special forms for reporting. The data on hazardous industrial wastes are submitted by the enterprises and data on municipal waste generation are submitted by the transport enterprises through the *oblast* administrations. All *akimats* have staff responsible for the economic and financial aspects of municipal waste disposal. There is no cadastre (i.e. a list of wastes generated, including their composition) for the collection, treatment, recycling and disposal of industrial and municipal wastes. In Almaty City, 340,000 tonnes of municipal waste are generated per year, equivalent to about 309 kg/capita. Figure 5.1 shows data on municipal waste generation per capita in some ECE countries. The composition of municipal waste in Almaty City is shown in Table 5.5.

Figure 5.1: Municipal waste generation, mid 1990s



Source: EPR , Armenia; Study on solid waste management for Almaty City, 1999.

* Almaty City.

Table 5.5: Composition of municipal waste in Almaty City

	Household waste	Commercial waste	Market waste
		as % of total	
Combustible	**88.1**	**89.3**	**88.5**
Paper	17.8	35.6	21
Textile	2.2	2.6	0.8
Plastic	10.9	8.4	7.8
Leather	0.9	0.9	0.1
Leaves	2.3	1.1	5.9
Food	54.0	40.8	52.9
Non combustible	**11.9**	**10.7**	**11.5**
Metal	2.6	2.7	2.4
Glass	5.6	5.4	4.1
Ceramic	0.7	0.7	0.2
Sand	3.1	1.8	4.9
Density (t/m^3)	*0.32*	*0.22*	*0.34*
Moisture content (%)	*43.1*	*35.7*	*43.0*
Lower calorific value	*1,731*	*2,030*	*1,722*

Source: Study on solid waste management for Almaty City, 1999.

5.2 Treatment, use and disposal of industrial wastes

At present, much industrial solid hazardous waste is accumulated and stored at industrial sites. Very little is reused or recycled. The storage of non-ferrous industrial waste occupies about 15,000 ha, of which 8,000 ha are mining dumps and 6,000 ha waste dumps at metallurgical processing plants.

The statistics in Tables 5.2 and 5.3 indicate an increased use in hazardous industrial waste generated by enterprises. Hazardous and non-hazardous industrial wastes are a potential source of raw materials, for example wastes from mining and metallurgy enterprises contain valuable metals which could be further extracted and used in other technologies and processes. The generation, use and disposal of waste by class of hazardousness are the subject of Tables 5.6 and 5.7.

As can be seen from these tables, about 97-98 per cent of wastes are hazardousness class IV wastes (see Table 5.1). Wastes from all classes, sometimes after detoxifying treatment, are stored at the industrial sites. According to the statistics, about 50 per cent of class III waste was treated in 1997/98.

Mercury is recovered from mercury-containing lamps and devices at the "TO Amal'gama" in Almaty. It is a private enterprise, supported by industrial installations using mercury lamps. Mercury lamps consume less energy than other lamps. All kinds of radioactive wastes, mercury- and arsenic-containing wastes as well as obsolete pesticides and other used hazardous chemicals are stored or disposed of at the "Baikal" complex of the Semipalatinsk nuclear testing polygon. At present, the plant is in operation but is experiencing financial problems.

5.3 Municipal waste recycling and disposal

About 97 per cent of municipal wastes are landfilled. There is no modern equipment or facility for waste collection, recycling or incineration. There are official landfills for municipal wastes in all *oblast* and regional capitals. Few meet international sanitary and hygiene conditions, norms and standards (e.g. monitoring systems for groundwater, leachate, air and soil in the vicinity of the landfills; protective layers; waste pretreatment and separation; possible methane recovery facilities; collection and treatment of leachate). There are also unauthorized or uncontrolled landfills inside and outside small towns or cities, which are visited at night. The reasons for uncontrolled municipal waste dumps are:

Table 5.6: Generation, use, treatment and disposal of hazardous waste* by class of danger in 1998

	Generated				Used at enterprises				Treated at enterprises				Transferred to sites of organized storage				Transferred to landfills				Stocks at en end o	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
Kazakhstan	**1.7**	**221.1**	**1,323.9**	**82,365.2**	**0.0**	**40.6**	**309.5**	**12,208.2**	**0.0**	**0.1**	**619.2**	**840.6**	**1.2**	**189.2**	**394.0**	**69,801.5**	**1.2**	**2.2**	**221.4**	**2,266.4**	**73.2**	**7,713.2**
Almaty	-	0.0	-	1,216.2	-	-	-	-	-	-	-	-	-	0.0	-	1,216.2	-	-	-	28.6	-	0.0
East-Kazakhstan	0.1	4.0	83.3	31,210.7	-	0.0	0.1	9,971.8	-	0.0	0.1	2.6	0.0	4.5	86.1	21,142.7	-	-	209.3	120.6	1.4	277.9
Karaghandy	1.2	26.5	617.2	35,374.0	0.0	23.1	0.0	2,197.6	-	-	617.6	836.2	1.2	1.4	0.0	32,340.4	1.2	0.6	-	1,917.2	71.3	2.5
Pavlodar	0.0	3.7	563.6	4,519.5	-	0.1	295.2	4.7	-	0.0	0.0	-	-	0.0	266.5	4,429.1	-	-	1.3	84.1	0.0	0.6

Source: Statistic Agency.

Table 5.7: Generation, use, treatment and disposal of hazardous waste* by class of danger 1995

	Generated at enterprises				Used at the enterprises				Completely detoxinated at enterprises				Transferred to sites of organized storage				Transferred to organized landfills of municipal wastes				Available enterprises l y	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
Kazakhstan	**16.7**	**179.1**	**953.2**	**71,003.2**	**7.6**	**26.6**	**45.5**	**2,280.7**	**2.3**	**0.5**	**300.9**	**423.7**	**0.9**	**151.2**	**606.4**	**666,623.5**	**-**	**0.3**	**5.7**	**-**	**1,167.1**	**6,949.0**
Almaty	-	0.1	0.0	0.0	-	0.4	-	-	-	0.0	0.0	-	-	144.8	-	-	-	0.0	0.0	0.0	-	0.1
East-Kazakhstan	0.0	4.7	22.3	18,491.9	-	-	0.0	653.6	-	-	4.4	218.4	0.0	4.7	204.1	546,627.7	-	-	4.6	167.9	1.4	266.3
Karaghandy	1.1	24.3	458.1	5,798.9	-	23.3	0.1	218.1	-	0.2	289.2	2.0	0.8	0.7	167.4	76,445.0	-	0.0	-	53.8	40,197.7	26.9
Pavlodar	0.0	1.4	405.2	10,117.0	-	0.2	35.3	0.1	-	0.0	0.0	0.0	-	-	191.1	10,095.3	-	0.1	0.4	29.5	0.0	0.6

Source: Statistic Agency.

* Radioactive wastes not included.

- Insufficient governmental control of landfills and the absence of a system of fines for the unauthorized dumping of municipal wastes, including small dumps in residential areas
- A lack of knowledge of municipal waste management practices in local administrations and a lack of responsibility for the implementation of waste management decisions taken by governmental bodies
- The absence of governmental coordinating bodies for municipal and industrial waste management
- An unfavourable economic situation and the corresponding lack of funds for the construction of waste-treatment and disposal facilities
- The absence of a law on municipal wastes
- The inefficient implementation of recent normative and methodological documents
- The absence of a governmental strategy for the disposal of municipal wastes
- The lack of control by the State environmental inspection services
- The absence of an economic scheme for the collection, transport and disposal of municipal wastes

There is only one authorized landfill for municipal waste disposal in Almaty. It is about 40 km from the city and has a surface of 39.4 ha. Residential areas are at least 2 km away. The capacity of the polygon has been calculated for 18.6 years. It is at present 13 per cent full. Monitoring of the landfill was envisaged, but is not in operation. In particular there are 3 wells for the analysis of groundwater, but they are not functioning. Monitoring is not practised at other landfills either.

The collection, transport and disposal of municipal wastes in Almaty and Kostanai are almost fully privatized. The main private collection company is 'Parasat', but 35 other companies are involved in the transport of municipal wastes in Almaty. The collection companies have about 210 trucks, 55 per cent of which are over 6 years old. There is no coordination between the companies involved in the delivery of municipal wastes to the landfills. Collection services cover about 75 per cent of the wastes generated in the city. The MNREP wants to privatize the collection, transport and disposal of municipal wastes in other big cities too.

In Almaty, the collection and transport of waste are organized through transfer stations, from which the waste has to be delivered to the landfills. The capacity of the transfer stations is not sufficient for all municipal wastes generated in the city. Since the landfill is far from the city, much of the municipal waste is transported to *oblast* landfills or uncontrolled dumps. A joint project by Japanese and Spanish companies to compress municipal wastes in order to reduce their volume and disposal at landfills has not been implemented so far.

Contaminated sites

There is no inventory of contaminated sites and abandoned landfills. When waste polygons are closed, there is no rehabilitation. Contaminated or closed landfill sites are not mapped, thus enabling new construction on the site.

Pavlodar Khimprom JSC is an example of an abandoned industrial site that was contaminated by mercury. The plant produced chlorine and caustic soda from 1975 to 1994. Inefficient production technologies caused the contamination by mercury of about 521m^2, at a concentration of 15 mg/kg of soil. The total amount of mercury released was 900 tonnes, of which 800 tonnes were discharged at the industrial sites and 15 tonnes in waste water.

Soil and water contamination by mercury may have serious effects on fauna, flora, and the health of the factory staff and the population in the vicinity of the industrial site; it contaminates underground drinking water and threatens the Irtish river. The analysis of water in observation wells showed that the concentration of mercury exceeded 10 to 100 times the maximum allowable concentration (MAC). The cleaning of the site had started, but is at present interrupted due to the lack of money.

5.4 Main environmental risks associated with waste

The accumulation of solid hazardous industrial wastes at the industrial sites, or that of municipal wastes at landfills, poses particular threats of contamination to surface and groundwater by heavy metals, especially in the East Kazakhstan *oblast*. There is no organized storage of highly toxic wastes, such as luminescent lamps, mercury thermometers or small batteries. These wastes are potential sources of mercury contamination of the population and the environment. For example, in Karaganda, the water supply from the Nura river was suspended a few years ago, because of contamination by the discharge of 150 tonnes of mercury into the river during the preceding 25

years. The concentration of mercury in the sediments of the river reached 200 mg/kg.

The data presented in the NEAP assess the annual damage caused to the population and the environment by hazardous wastes at US$ 300 million. The storage of untreated arsenic-containing wastes at industrial sites poses direct threats of pollution to groundwater by highly toxic arsenic compounds. High piles of stocked waste are the sources of dust, which is disseminated in the air in the vicinity of the dumps.

The other sources of environmental contamination are municipal waste landfills. The main risks are:

- Municipal wastes are not sorted for reuse or recycling, they are stored at landfills that do not meet sanitary-hygiene safety norms and standards
- In many regions, municipal wastes are disposed of together with hazardous industrial wastes containing heavy metals, increasing the volume of hazardous waste
- There are no facilities for the treatment and special disposal of medical wastes; they are disposed together with municipal wastes.

In rural areas, organic wastes pose a special problem. Sewerage is usually non-existing, and, therefore, liquid organic wastes and sludges, including liquid wastes generated from the open-air storage of manure and containing pathogenic micro-organisms, are not treated. They are in many cases discharged into natural watercourses. Contaminated water from these sources may be used by the population and by animals without any treatment (see Chapter 14 for details).

5.5 Waste policy and management

Legislation

The Law on Environmental Protection adopted in 1997 specifies ecological requirements for handling industrial and consumption wastes. It prescribes the conditions for the storage, treatment and disposal of wastes, which are determined by the decisions of local executive agencies in coordination with specially authorized executive agencies for environmental protection. According to this Law, wastes may be imported into Kazakhstan for processing, final disposal or storage only with special authorization from the Government. The import of products is prohibited if no technology exists for their treatment or use. Statistics should be available on the quantity and composition of both industrial and municipal waste generated.

So far there is no special law on wastes. At draft law on production and consumption waste is ready for submission to the Government. The list of existing legal, normative and methodological documents concerning the generation, treatment and disposal of different wastes, as well as the methodologies for calculating related economic charges, includes:

- An automated system for calculating permissible volumes of industrial waste disposal (1996)
- Temporary methodological recommendations for defining the limits of industrial waste discharge in the environment (1993)
- Temporary methodological recommendations for the application of regulations on the generation and use of industrial and municipal wastes (1993)
- Temporary methodological instructions for the assessment of environmental damage caused by unauthorized waste disposal (1996)
- A temporary order for giving permission for the discharge of wastes, products or materials in the environment (1994)
- Instructions for the control of the technical conditions of hydro-engineering constructions for industrial waste disposal at industrial enterprises (1994)
- Instructions for State control over environmental protection from pollution by industrial wastes (1996)
- Instructions for control over the transboundary transport of hazardous wastes and their disposal (1995)
- The classification of toxic industrial wastes from enterprises (1996)
- Methodological recommendations for the classification of toxic industrial wastes and their classification system (1996)
- Methodological instructions for regulating the amount of wastes generated by mining-benefiting enterprises and their disposal (1994)
- Methodological instructions for the determination of environmental contamination by toxic substances contained in industrial and municipal wastes (1996)
- Methodological instructions for the environmental impact assessment of

waste-storage facilities at industrial enterprises, including those in the open air (1993)
- An order on the collection, transport, treatment and final disposal of toxic industrial wastes (1993)
- An order regulating the amount of industrial waste generation and its disposal (1994)
- An order on temporary permissions for the burial of radioactive wastes on Kazakh territory (1994)
- A list of the maximum amount of toxic industrial wastes allowed to be stored together with municipal solid wastes (1993)
- A list of the maximum permitted concentrations of toxic substances in industrial wastes, defining the toxicity category of wastes (1993)
- Guideline documents on industrial and municipal wastes: system of normative requirements (1993)

Policy objectives

Kazakhstan started the development and implementation of a new environmental policy based on the principles of environmental safety and sustainable development. Strategic Plan Up To 2030 " The Environment and National Resources" calls for the creation of a new system of environmental management with the following short- and long-term policy objectives:

- To increase the degree of the use of mineral resources
- To minimize waste generation at the sources
- To reduce the adverse effects of hazardous wastes (arsenic, mercury and heavy metals containing wastes) on human health and the environment
- To prevent groundwater pollution from storage facilities for hazardous waste and municipal waste landfills
- To create an environmentally sound system for municipal waste management.

Environmental pollution from industrial and municipal solid wastes is one of the 7 priorities identified in the NEAP. The corresponding projects focus on:

- Developing and implementing a law on wastes
- Developing low-waste technologies and processes through cleaner production centres (see Chapter 11)
- The economic aspects of municipal and hazardous industrial waste management
- Developing a national programme for waste management
- Cleaning up highly polluted territories and reducing industrial waste generation in East Kazakhstan.

There are two important projects for Pavlodar city. The first aims at minimizing waste water during galvanic production at the Pavlodar machine-building plant. The second concerns the study of options for reducing the contamination of surface and groundwater by mercury at Khimprom JSC (for details about the problem, see above). The investment programme related to the NEAP clean-up of highly polluted territories and the reduction of waste generation by enterprises in zone B (see Figure 2.1) led to the establishment of a Project Coordination Group in 1999.

Institutional arrangements

The Ministry of Natural Resources and Environmental Protection is the main institution responsible for both industrial and municipal waste management. There is no coordinating centre for the two management tasks in the MNREP. The oblast departments of the Ministry have waste offices, which manage waste at regional levels. There are municipal waste services in local administrations. They are responsible for the transport of municipal wastes to landfills. They are also responsible for the disposal of municipal wastes, and they control the conditions of the landfills.

Production enterprises are responsible for the storage, recycling and disposal of the industrial waste generated. The central State inspection department of the MNREP examines and inspects the waste management conditions at industrial enterprises. "Kazmekhanobre" has been responsible for the environmental aspects of waste management for 80 years, through the development and implementation of legislative and regulative documents concerning waste management, as well as of processes/technologies for the recycling and environmentally sound disposal of industrial wastes.

According to NEAP, Cleaner Production Centres (CPCs) should be the main technical institutions for promoting waste reduction. They should develop and implement projects dealing with industrial waste minimization and recycling, treatment and

safe disposal methods. Chapter 11 contains information on the projects of the CPC in Pavlodar.

Management instruments and projects

Economic instruments. Payments are due for the disposal of wastes (for a description, see Chapter 2). The payment rates differ according to the *oblast*. In the East Kazakhstan *oblast*, the rates paid are as follows (in tenge per tonne, for the classes specified in Table 5.1): Class I: 3,200, Class II: 1,600, Class III: 400, Class IV: 200, Class V: 100, and municipal waste: 30. The waste-collecting companies charge households for municipal waste transport and disposal. In Almaty, the monthly rates are 27 tenge per person living in apartment buildings and 83 tenge per person in detached houses.

Projects. An umbrella project on environmental improvement for sustainable development for Akmola, East Kazakhstan, Karaganda and Astana city has 15 components, which are among NEAP priorities. The following projects concern waste management:

- Industrial waste-water prevention and minimization, through the establishment of four cleaner production centres. The project's purpose is to reduce adverse environmental impacts through cleaner production programmes (see also Chapter 11).
- Mitigation of the impacts of arsenic-containing wastes on health and the environment in the East Kazakhstan and Karaganda *oblasts* (pilot projects). The aim is to introduce safe treatment for such waste.
- Improvement of the collection, sorting and use of municipal solid wastes in the cities of Pavlodar, Shymkent and Almaty (pilot projects). Environmentally sound technologies for waste collection and recycling are to be introduced.
- A study preparing a new solid waste management for the city of Almaty.
- The preparation of a system for the collection, use and storage of organic wastes, including livestock wastes. The construction of three experimental facilities for the treatment of industrial, agricultural and domestic organic wastes is planned; they will produce organic fertilizers and initiate a programme for organic waste treatment.

5.6 Conclusions and recommendations

The development of a modern waste management system is a complicated task during the transition from a centrally planned to a market economy. It is therefore not surprising that much remains to be done in Kazakhstan, although substantial efforts have already been made, notably in trying to adapt norms, standards and regulations. The problem is exacerbated in a country of the size of Kazakhstan with a very low population density. The concentration of the main polluting sectors in the east of the country suggests that all the efforts for improvement should give priority to this zone, but the general rules to be developed and applied should obviously also be applicable to the other regions.

The legal framework for waste management is unsatisfactory. The relevant part of the Law on Environmental Protection is very general. While there is a long list of applicable legal, normative and methodological documents, they are not properly implemented. At present, a law on production and consumption waste exists in draft form. The development and adoption of a law on waste should be accelerated in order to improve the overall system of waste management. The law should be the basis for the development of new norms, standards and environmentally friendly technologies for the recycling and disposal of industrial and municipal wastes. The law and policy development should focus on waste minimization and recycling, as well as on existing international standards and regulations. The law should also envisage the establishment of a waste management agency or centre, which could develop and coordinate waste-management policies and programmes.

Recommendation 5.1:
The adoption and enforcement of a law on wastes should be seen as an urgent requirement for the introduction of a modern waste-management system, including appropriate capacity-building measures at regional and local levels. Once the law is adopted, the necessary by-laws should be developed and enacted. See Recommendation 1.1.

The future law should include all the necessary instruments and institutions for a successful waste-management programme. The implementation of that programme will be

time-consuming. No time should be lost in its preparation. The priorities are: (a) the coordination of waste management between different levels of administration, (b) steering the waste economy in the direction of waste prevention and minimization by encouraging reuse and recycling, as well as the introduction of cleaner production, and (c) the progressive introduction of waste collection, sorting and safe disposal, particularly in the eastern oblasts.

The Ministry of Natural Resources and Environmental Protection is the main institution responsible for waste management. The oblast departments of the Ministry have offices on waste management. Municipal waste services, responsible for the transport of municipal wastes to landfills and their actual disposal, also exist. Coordination of the various levels of waste management is not always ensured. The principal aim of coordination should be to equalize environmental conditions in different parts of the country to the extent possible. Special attention needs to be paid to the following waste problems in the eastern oblasts:

- Most metallurgical wastes are potential raw materials for other production processes. They could be used in the production of glass, ceramics, construction materials, etc.
- About 97 per cent of municipal wastes go to the landfills without separation or treatment. There are no modern facilities for municipal waste collection, recycling or treatment.
- Facilities for the treatment and special disposal of medical wastes are lacking, so that these wastes are often stored together with municipal wastes.
- Reliable funding plans for the construction and operation of modern disposal sites, the treatment of organic wastes, and all required monitoring activities are not available.
- Rural areas and small towns practically do not operate a system for the collection and disposal of municipal wastes.

Recommendation 5.2:
The coordination of waste management at the different levels of the administration should be undertaken through the development of a waste-management programme. The programme should aim at avoiding undesirable regional differences in environmental conditions. In addition, the following issues should be addressed, even before the final formulation of a comprehensive waste strategy:

- *Increasing the degree of extraction and recycling of valuable components from ore-mining and metallurgical wastes*
- *Introducing municipal waste collection, sorting and controlled disposal throughout the country, starting in the most problematic big cities, including the gradual closure of uncontrolled landfills*
- *Introducing the private collection, transport and recycling of municipal waste in all big cities, including for the generation of energy from waste*
- *Creating capacities for the safe treatment of medical wastes*
- *Developing and funding a monitoring system for all waste-disposal installations.*

See Recommendation 9.2

Successful waste management also depends on reliable waste information. According to the statistics, the decline in output in polluting industries did not imply a decrease in hazardous industrial waste generation. One reason may be that the Agency on Statistics has considerably improved the statistical reporting system for this type of waste generation. On the other hand, the statistical data on municipal waste generation are very poor and in many cases unreliable. Also, information on the existence of contaminated sites, particularly in the eastern part of the country, and on the storage of hazardous waste on industrial premises is incomplete. Abandoned landfills, whether officially controlled, illegal or uncontrolled, should be considered contaminated sites. The considerable lack of information on these matters greatly impedes realistic waste management as far as both municipal and industrial waste generation and disposal are concerned and needs to be improved.

Recommendation 5.3:
The Agency on Statistics, in cooperation with the Ministry of Natural Resources and Environmental Protection and local administrations, should further improve the statistical information and reporting system for the generation, treatment and disposal of both industrial and municipal wastes, including the preparation of lists of contaminated sites and of actually existing, closed or abandoned landfills.

Chapter 6

MANAGEMENT OF RADIOACTIVELY CONTAMINATED TERRITORIES

6.1 The radiation situation in Kazakhstan

Natural and anthropogenic environmental radioactivity

The radiation situation in Kazakhstan is characterized by large areas with high terrestrial radiation and exhalation of the radioactive noble gas radon from the ground, both occurrences being associated with large uranium deposits in the Kazakh subsoil. So, the mean total effective equivalent dose (H_{eff} as defined by the International Commission on Radiological Protection (ICRP)) due to external and internal irradiation from natural radioactivity is about two to three times higher than the global average of 2.4 mSv/a. In some areas it may well exceed the typical global range of 1.5 to 6.0 mSv/a mainly because of radon from soil and from building materials. It is known from more recent investigations in other countries that the radon dose may represent the highest contribution to the total radiation burden from natural radioactivity. Comprehensive studies on the radon situation and on sites of high natural radioactivity in Kazakhstan have not yet been completed. More than 700 such 'anomalies' have been identified so far, and it is estimated that for about half of the territory of the Republic a survey on increased radon concentrations of indoor air is required. As a consequence of uranium deposits in the subsoil, other natural resources, like gas, oil and metal ores as well as groundwater and artesian wells, are also highly radioactive.

Locally, much more serious consequences have been caused by previous human actions that have created much more intense sources of radiation with short- and long-term effects. This includes uranium mining and processing, the manufacture of nuclear fuel, the application of nuclear explosions for economic purposes and, finally, the development and testing of nuclear and thermonuclear bombs and missile-borne warheads. Uranium has been mined in 8 of the 14 *oblasts* at about 100 sites, and nuclear explosions were carried out at about a dozen military ranges and industrial areas occupying more than 150,000 km² or roughly 6 per cent of the territory. The most important sites for the military testing of nuclear devices, of conventional ammunition and of missiles of the military-cosmic complex are indicated in Figure 6.1.

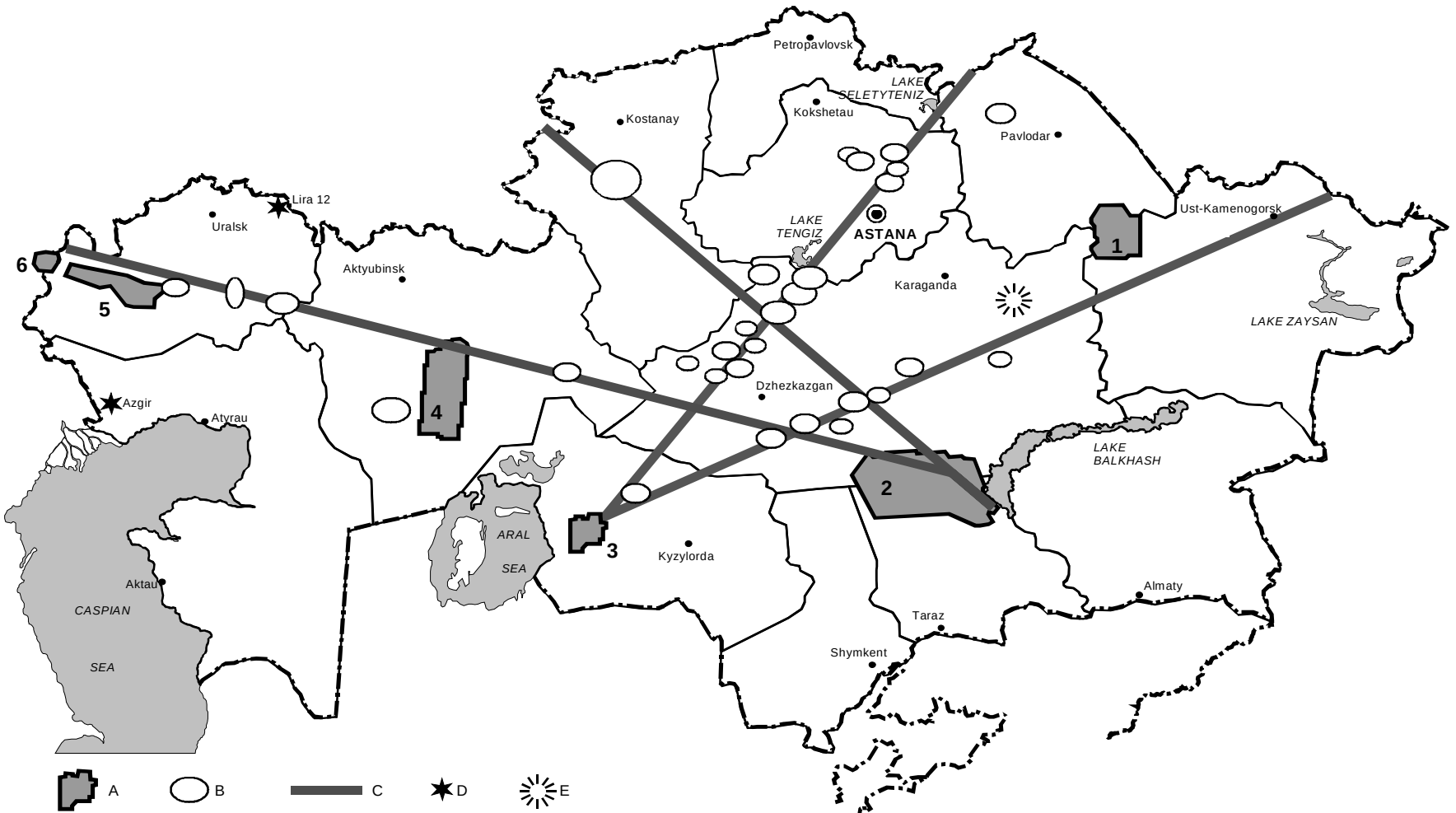
The best known military testing ground is the Semipalatinsk Nuclear Testing Site (SNTS), situated in eastern Kazakhstan. The other sites have received much less attention than this one, even though damage to individuals may have been just as serious as in the Semipalatinsk area. Furthermore, the country has been criss-crossed by rockets and missiles on their flights between testing sites and up into space with and without nuclear warheads, and there have been deliberate and accidental conventional or nuclear-type explosions and crash-downs of missile stages and other space vehicles.

With one small nuclear power plant and four research and test reactors in Kazakhstan, the burden from this application of nuclear energy is comparatively low and much easier to manage, and, very importantly, the amounts, types and whereabouts of radioactive waste from these operations are well known.

Areas of uranium mining and processing

The development of uranium mining in the former USSR was subordinated to the USSR Ministry of Medium Machine Building, the name of the Soviet nuclear weapons bureaucracy, which was very secretive about its activity. Even the very existence of the so-called 'nuclear towns' of this special kind of industry was classified as a State secret for many decades. The names of such places were frequently dropped from maps and administrative directories. So the local authorities lacked access to information about the environmental impact of the uranium industry on their area. Present-day investigations into the correlation of events and locations are additionally hampered by the use of code names, by changes from Russian to Kazakh

Figure 6.1: Testing sites of military-cosmic complex and objects of nuclear explosion



names (and by transcription into Latin script).

Uranium mining in Kazakhstan started in the early 1950s with the first large output in 1954, primarily in the Dzhambul region from the Kurdai, Aksuek and Mirny mining settlements. Ore processing and extraction of the uranium concentrate was carried out at the Hydro-Metallurgical Plant of the Kyrgyz Mining Complex in the village of Kara-Balta. It was put into operation in 1959. Today, together with the radioactive waste from uranium processing, it is situated on the territory of Kyrgyzstan. In August 1955, the decision was made to build the Virgin Land Mining and Chemical Processing Complex (VLMCPC), the first uranium-processing centre on Kazakh territory. Work on the first mine was started in May 1956, and the Centre's headquarter was established in Stepnogorsk in 1960. Operation of the hydro-metallurgical plants extracting uranium from molybdenum ore and from phosphorus ore started operation in 1968 and 1970, respectively. The mines were partially open-cast and partially underground.

At the end of the 1960s, the Caspian Mining and Smelting Complex (CMSC) became one of the major uranium producers in Kazakhstan, after the discovery of uranium deposits in the clay seabeds off the Caspian coast in Mangyshlak. The regional centre was established in Aktau (Shevchenko). Open-cast mining was carried out in the uranium deposits at Melovoe and Tomakskoe, and the ore was processed at the Chemical and Hydro-metallurgical Plant at Aktau.

In the 1970s, two more uranium mines were started, Tabakbulak (Shymkent region) and Chiili (Kyzyl-Orda region). A technique different from conventional mining was applied to uranium production in these regions. It was the so-called 'in-situ leaching' (ISL). This is a specifically environmentally hazardous method of obtaining uranium. With ISL or 'solution mining', the uranium-bearing ore is not extracted from its geological deposit. Instead, a leaching liquid, e.g. sulphuric acid, is injected through wells into the ore deposit, and the uranium-carrying solution is pumped from the corresponding wells. The wells cross aquifers and so contaminate the groundwater. The surfaces of those sites are very frequently heavily contaminated both chemically and radioactively by spills of leaching solutions. ISL creates less solid radioactive waste on the soil surface than conventional mining, but the main reason for its application, however, is the lower cost per mass of uranium produced.

The output of the Soviet uranium industry reached its peak of about 17,000 tU per year in 1980-82. Approximately one third of that was smelted from ore mined in the 30-odd active uranium mines in Kazakhstan, scattered over 8 of the 14 provinces of the country. Probably as a result of a qualitative turn in the arms race, the first decline in State orders for uranium by 25-30 per cent occurred in 1983, and a further reduction to about half the peak value after 1986, due to disarmament policies, and the revision of plans for nuclear power generation following the Chernobyl disaster. Since the mid-1990s, uranium output has levelled around 1,000 tU per year. About 15 old mines in the Dzhambul region, in Stepnogorsk and in Aktau as well as the Caspian production centre (KASKOR) have been closed down.

Today, uranium production is concentrated in South Kazakhstan, in Stepnoe, Zentralnoe, Moinkum and Plant No. 6. Plant No. 7 is in the planning stage. The ore is processed in the Zelinny Kombinat (Stepnogorsk) and in Kara-Balta, Kyrgyzstan. The emphasis on uranium production in South Kazakhstan means a shift from the high-cost conventional mining to the cheaper in-situ leaching technology. Table 6.1 gives details of the most important uranium mines.

The flagship plant in the former USSR and in today's CIS for producing nuclear fuel is the Ulbin Metallurgical Plant (UMP) in Ust-Kamenogorsk, which came on stream in 1949. The plant uses uranium concentrate supplied exclusively by domestic producers (now: Zelinny Kombinat at Stepnogorsk and Chemical Plant at Aktau) to produce uranium fuel for nuclear power plants and nuclear reactors used in the navy and in research establishments. The technological processes incorporate the enrichment of U-235 against U-238, the graduation of uranium pellets, their insertion into molybdenum cups and baking in special furnaces. These half-finished products are then filled into zirconium blocks or tubes, which represent the reactor fuel rods. Another important element for the nuclear industry processed at UMP is beryllium, which has also been used for atomic bomb shells.

During the mining and milling of the uranium ore and the subsequent extraction process, two physically and chemically different kinds of

Table 6.1: Uranium mines in Kazakhstan

	Name of deposit	Location	Company prod.: producer proc.: processor	Production technique	Status
	Prikaspi Uranium Province:				
1	Melovoe	Mangistau/ Aktau	Kaskor *prod. + proc.*	open pit	production stopped (explored/reserve)
2	Tomakskoe	Mangistau/ Aktau	Kaskor *prod. + proc.*	open pit	production stopped (explored/reserve)
	Kokshetau Uranium Province:				
3	Grachevskoe	Kokshetau	Zelinny *prod. + proc.*	closed pit	productive
4	Kamyshevoe (Ishimskoe)	Turgai/ N Esil	Zelinny *prod. + proc.*		production stopped
5	Vostok	Akmola/ Atbasar	Zelinny *prod. + proc.*	closed pit	productive
6	Saosernoe	Kokshetau/ E Kokshetau	Zelinny *prod. + proc.*		production stopped
7	Manybai	Akmola/Stepnogorsl (Aksu)	Zelinny *prod. + proc.*	heap leaching	production stopped
8	Semizbai	Pavlodar/ NE Stepnogorsk	Zelinny *prod. + proc.*	in-situ leaching	production stopped (explored/reserve)
	Chu-Sarysu Uranium Province:				
9	Inkai	Zhezkazgan/Stepnoc (E Kysyl-Orda)	Plant No. 7 *prod.*		explored/reserve
10	Mynkuduk	S Kazakhstan/ Stepnoe	Stepnoe *prod.*	in-situ leaching	productive
11	Uvanas	S Kazakhstan/ Stepnoe	Stepnoe *prod.*	in-situ leaching	productive
12	Moinkum	S Kazakhstan/ N Shanatas	Moinkum *prod.*	in-situ leaching	productive
13	Kanshugan (Kandjugan)	S Kazakhstan/ N Shanatas	Centralnoe *prod.*	in-situ leaching	productive
	Syr-Darja Uranium Province:				
14	Irkol	Kysyl-Orda/ Chiili	-		explored/reserve
15	N-Karamurun	Kysyl-Orda/ Chiili	Plant No. 6 *prod.*	in-situ leaching	productive
16	Sarechnoe	S Kazakhstan/ W Arys	Plant No. 6 *prod.*		explored/reserve
	Pribalchash Uranium Province: (Kendyktas-Chiili-Betpakdala Province)				
17	Dzhidely	Dzhezkazgan/ S Karashal	-	closed pit/ open pit	production stopped
18	Kysylsai Group	Dzhambul/ SW Chiganak	-	closed pit	production stopped (explored/reserve)
19	Bota-Burum	Dzhambul/	-	closed pit	production stopped

radioactive mining wastes are produced. Firstly, there is the rock overburden or mining debris, which is rock material of too low a uranium content for further use, but of higher ore content than surface rock. This material has to be mined or removed before getting access to the ore worth processing. It is disposed of in so-called waste rock dumps, or simply 'dumps', usually close to the entrance to a mine. Secondly, waste is produced in the processing of ore-containing rock, when this rock is mechanically crushed and then leached with strong acids to obtain the mineral in a pre-concentrated form. The remaining extremely fine-textured rock slurry is disposed of in ponds, and the deposits of this settled slurry are called mill tailings or 'tailings'. They are found near the processing facilities, which are usually called 'hydro-metallurgical plants'. Both types of waste contain radioactive isotopes radium-226, thorium-232 and uranium-238 in considerable quantities. The radioactive noble gas radon (essentially Rn-222) emanates from this waste, representing the main direct threat to people through the pathway of inhalation. In most cases, this waste can be classified as low-level radioactive waste.

Political changes coupled with the lifting of the veil of secrecy from the uranium mining industry has brought the problems of pollution and specifically radioactive environmental contamination into the spotlight. For Kazakhstan, radioactive waste disposal represents an especially serious problem because of the huge amounts generated during the past 50 years. According to an estimate of the International Atomic Energy Agency (IAEA) and the Organisation for Economic Co-operation and Development (OECD) (1999), more than 230 million tonnes of low-level and 2 million tonnes of medium-level radioactive waste from uranium mining and milling activities have accumulated in Kazakhstan over the past 50 years. They comprise 60 million tonnes of waste rock and 170 million tonnes of mill tailings. These wastes result from explorations at more 100 uranium sites and the production of 60,000 tonnes of uranium.

Over the course of its more than 40 years of operation, the Ulbin Metallurgical Plant at Ust-Kamenogorsk has accumulated about 1.4 million tonnes of radioactive and toxic beryllium waste containing U-238 and Th-232 and their decay products. This is of special significance in view of possible health effects, as both the plant and the radioactive tailings are located within the city limits. The associated beryllium plant was the place of the biggest disaster of this kind, when on 12 September 1990, an explosion ejected a large amount of metallic beryllium powder into the atmosphere. Reports on the "losses" of beryllium through this accident range from 40 kg to several tonnes.

Radioactive waste is temporarily stored in mining dumps and mill tailings in the Tselinny Mining and Chemical Enterprise (66 million tonnes), in the Dzhambyl *oblast* (54 million tonnes), in the Zhezkazgan *oblast* (57 million tonnes) and in the Mangystau *oblast* (68 million tonnes). Other local sources of radioactive contamination are the uranium mines in the Suzak and Kyzl-Kum *rayons* of Shimkent. According Agency on Statistics about 42 million tonnes of radioactive wastes are accumulated at the enterprises by 1998.

From 1964, processing plants belonging to the Caspian Complex have dumped radioactive tailing material into Lake Koshkar-Ata, a natural depression below sea level. Until recently, the waste material had been covered by sea water, which had been pumped from the Caspian Sea to replace evaporation losses. After financial constraints brought the pumping to a halt, the beaches have dried out, and resuspension has started to carry radioactive dust into the city of Aktau ('dusting beaches'). Furthermore, the existence of a connection between this depression and the Caspian Sea has not been investigated, nor has the possible contamination of groundwater by radionuclides and other hazardous substances. Due to a lack of proper storage facilities at Mangyshlak, about 1,000 tonnes of radioactively contaminated equipment and scrap are stored in the grounds of the Chemical Hydro-Metallurgical Plant. Waste is also dumped into the so-called "open-cast mine 400".

Prior to 1990, some radioactive waste had been transported to Russia. At the present time, there are three medium-size disposal sites for radioactive waste in Kazakhstan. One is operated by the Aktau (Shevchenko) Nuclear Power Plant and the other two by the Institute of Nuclear Physics, built at the beginning of the 1960s near Almaty. However, none of the disposal fully complies with IAEA safety standards and requirements. Apart from radioactivity, waste from uranium-ore processing also contains large amounts of sulphuric acid, which represents an additional threat to the population and the environment.

Another problem of great concern is some of the ways in which the uranium ore is transported from mines to processing facilities. On the outskirts of the city of Atbasar (Akmola *oblast*), for example, uranium ore is unloaded from open railroad flatcars into huge piles and then reloaded onto other flatcars and moved to Stepnogorsk. Southwestern winds blow dust from the ore piles over the city.

Natural resources development with high levels of radioactivity

As a consequence of petroleum and natural gas extraction, radioactive contaminants containing the naturally occurring radium-226 and thorium-232/230 were found in pipelines, petroleum sludge, equipment and on the soil. The reason for this appearance is storage and accumulation of radioactivity from petroleum-accompanying water, which simply evaporates, while the salts of those elements stick to surfaces. More than 250 oil wells produce contaminated oil in the Mangystau and Atyrau *oblasts*. There are no precise data at present on the quantity of radioactive waste produced by petroleum and gas extraction. Estimates of this low-active waste range between 3 and 5 million tonnes.

Some deposits of metal ores, rare earths and phosphorites show a certain uranium mineralization, which ends up in the deposits of the production residues. In certain cases, coal must also be stored as radioactive waste. At Ekibastuz in the Pavlodar region, a coal deposit is being explored. Preliminary measurements revealed irradiation doses of 50-100 μR/h (~0.45-0.9 μSv/h), while the background value in Kazakhstan is 10-15 μR/h (~0.09-0.13 μSv/h).

Nuclear weapons testing

The darkest legacy of the Cold War nuclear arms race is the residues and the consequences of nuclear weapons tests, many of which were conducted on Kazakh territory. The Russian Federation's Ministry for Atomic Energy (Minatom) and its Ministry of Defence have released a chronology of Soviet nuclear tests between 1949 and 1990, stating a total of 715 Soviet tests including peaceful nuclear explosions (PNEs). Out of the 715 tests, 489 were performed on the territory of Kazakhstan, 456 at the Semipalatinsk Nuclear Testing Site (SNTS) and 33 outside test sites. Inconsistencies in numbers given in other reports may result from different definitions of what constitutes a test and the relationship between explosions and tests. The commonly adopted definition was developed in the 1990 Protocol to the Threshold Test Ban Treaty. A test is defined as either a single explosion, or two or more explosions fired within 0.1 second of one another, within a circular area with a diameter of two kilometres (so-called 'salvo explosions'). The energy yield is the aggregate of all the explosions.

Tests of nuclear explosions have been conducted in various environmental media, and the following classification was adopted for the types of Soviet nuclear tests:

- Surface explosion: a nuclear test on the earth's surface or from a tower up to 100 m high, so that the expanding fireball touches the ground.
- Air explosion: a nuclear test in the atmosphere, when the fireball does not touch the ground (height up to ~10 km, e.g. air drops from bombers).
- High-altitude and space explosions (above 10 km, e.g. missile-borne nuclear warheads).
- Underground explosions, where the explosive device was placed below the surface in vertical shafts or in horizontal tunnels.

According to their observed effects, underground explosions were classified by Soviet scientists into three categories (percentages indicate frequency of occurrence at the Semipalatinsk Nuclear Test Site):

- Explosions with the eruption of deep rocks and radioactive products into the atmosphere, intentional or accidental creation of a crater (1 per cent).
- Not fully contained explosions (49 per cent)
  - with the release of radioactive inert gases
  - involving a non-standard radiation situation with material damage and heath effects
- Fully contained (camouflage) explosion without break-out of radioactive material except for traces of inert gases (50 per cent).

A nuclear device derives its explosive energy, usually expressed in kilotonnes (kt) or megatonnes (Mt) of TNT (trinitrotoluene) equivalent, from one or both of two nuclear processes:

- Fission of the heavy nuclides U-235 or Pu-239 in a chain reaction (atomic bomb)
- Fusion of the hydrogen isotopes deuterium (H-2) and tritium (H-3) in a thermonuclear process (hydrogen bomb).

Fission produces a whole spectrum of different radioactive nuclides, and the composition of radioactivity released during the explosion of an atomic bomb depends on the type of device, method of ignition and explosion and prevailing conditions during the explosion. Therefore, in addition to the fission products of the fissionable material, radionuclides are also generated by neutron interaction with the bomb charge, with the bomb casting and with the environmental elements in air, soil and water as well as by radioactive decay. In principle, the radioactive product from fusion is only tritium. However, because a thermonuclear device needs high pressures and temperatures to be ignited, in practice a fission device is needed as a primary stage to provide these conditions. Also in practice, the nuclear reactions do not proceed to ultimate completion, so some residual amounts of tritium will also remain. The highest degree of radioactive contamination is therefore created by surface and shallow underground-so-called cratering or excavation-explosions, as great amounts of soil are swept into the explosion cloud, and the soil components may undergo activation by neutrons generated during the reaction process.

Semipalatinsk Nuclear Test Site

The Semipalatinsk Nuclear Test Site (SNTS), also known as the Semipalatinsk Polygon, is a 18,500-km² zone in the north-east of Kazakhstan spanning the East Kazakhstan, Karaganda and Pavlodar *oblasts*. Today, the Polygon has no specific boundaries, and there is no physical limitation to free access. It is located in a relatively flat steppe area with several low mountains and delimited to the north by the River Irtysh flowing through Kurchatov. This town, which was formerly known by the code name "Semipalatinsk-21" or "Moscow-400" to confuse orientation, was built to service the test site and was the main settlement, with about 30,000 inhabitants during the 40-year test period.

The decision to establish SNTS was made on 21 August 1947, and the site was closed by Presidential Decree No. 409 of 29 August 1991. The official number of nuclear tests at SNTS published in 1996 by the Russian authorities is 456, comprising 26 surface, 87 air and 343 underground tests. They were performed at three places, called "technical areas" (Ploshchadkas). The early tests were surface and air tests, which were carried out in the northern technical area "Sh", located about 50 km west of Kurchatov. The centre of this area is historically referred to as "Ground Zero", denoting the explosion centre of the first Soviet atomic bomb ignited at 7:00 a.m. on 29 August 1949. Up to 24 December 1962, 26 surface and 87 air explosions were conducted in this area. Another 5 surface tests were not successful and resulted in the dispersion of plutonium (Pu-239 particles) in the local environment, as only the chemical igniters exploded. Today, this site is characterized by a number of damaged concrete buildings and underground premises erected for sheltering measuring devices and cameras.

After the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (signed on 5 August 1963), only underground tests were carried out at SNTS. Technical area "G" in the south of the Polygon was used between 1961 and 1989 for 213 test explosions in horizontal tunnels drilled into the Degelen Mountain massif and 21 tests in vertical shafts. The latter included a cratering experiment at Sary-Uzen in the framework of the programme on peaceful nuclear explosions. Another set of 109 underground explosions was conducted at technical area "B" situated in the east. It included 2 excavation explosions (Telkem and Telkem-2) and the largest of the PNE programme, "Chagan", which produced a lake about 500 m in diameter and 100 m deep with cliffs up to 100 m high, called "Lake Balapan" or "the Atomic Lake".

The main contribution to local and regional environmental radioactive contamination and to the exposure of the population of the regions near to SNTS, mainly Semipalatinsk, East Kazakhstan, and the Altai region of Russia, was made by 6 surface and 1 excavation explosions performed between 1949 and 1965 with energy yields of between 9.9 and 1,600 kt. Among those the most egregious event by far in terms of a collective dose of fallout on humans was the very first Soviet atomic bomb test on 29 August 1949. This test, called "Joe One" in the West and "RDS-1" ('Russia makes herself'), was conducted with a charge of as little as 6.5-7 kg of weapon plutonium on a 30-m tower at Ground Zero and caused an exposure to the population of the Altai region equal to 85 per cent of the collective dose from all SNTS tests. This collective dose for local populations is comparable in order of magnitude to the respective estimates for the Chernobyl accident. 10 to 25 per cent of the radioactive fallout of these explosions occurred within a distance of 100 to 300 km from the explosion site. The majority of the radioactive products were ejected into the stratosphere and

subsequently transported by dispersion and convection processes around the globe. Underground tests have a relatively small environmental and health impact, except for a few cases where the soil layer between detonation point and soil surface was too thin for the detonation power applied.

Usually after the tests, measurements of gamma radiation levels were conducted around the SNTS. In some cases these measurements were taken as far as 1,000 km away. In the former USSR until 1991, the results of those measurements were strictly classified and kept in archives of the Ministry of Defence and other State departments. Nevertheless, among the population of the regions adjoining the SNTS there was an awareness of a potentially negative impact of these tests on health. These feelings became public during the late 1980s and more widely in the early 1990s. It was not until 1992 that the more than one million residents living around the SNTS were officially informed about the tests, and there had been no relocation during the phase of highest exposure.

From 1957 to 1960, the Kazakhstan National Academy of Sciences and the Kazakhstan Ministry of Health sent a research team to the Semipalatinsk region to investigate the effect on health of nuclear tests. Although they found a higher prevalence in the surrounding villages than in control areas of symptoms confirmed today as typical for irradiation, their relation with radioactivity was rejected at a general meeting on the research results held in Moscow in 1961. Since then no further research by Kazakh institutions had been allowed until the independence of the Republic. In 1996, the Institute of Radiation Medicine and Ecology presented the results of a study covering the period from 1949 through 1956, which is assumed to have contributed 70 per cent of the total effective dose for the population around SNTS. Doses from external irradiation included contributions from radioactive clouds and from ground contamination. The internal dose was estimated to be due to the inhalation of radioactive gases and aerosols and to the ingestion of contaminated food. The calculated effective equivalent dose for the exposed group ranged from 0.87 to 4.5 Sv with an average of about 2.0 Sv. For the control group, living in the Kokpekty district about 300 km south-east of SNTS, the value was 0.07 Sv for the same period.

An aerial gamma spectrometric survey conducted within the SNTS in 1990 identified three distinct areas with significantly elevated concentrations of Cs-137 and other long-lived radionuclides: the experimental field around and south-south-east from Ground Zero with Cs-137 depositions between 20 and 185 kBq/m², the Balapan area with 5 to 11 kBq/m² but with certain hot spots exceeding 1,850 kBq/m² and the Degelen area with 15 to 75 kBq/m². A special problem in this area is that the washout of the explosion tunnels by rain and flooding has contaminated water which might be used to water animals. This precipitation water has taken accumulated radioactivity from the explosion sites outside the tunnels, leading to surface contamination of Cs-137 and Sr-90 on relatively small spots (1,000 m²). Dose rates in those areas are 0.5 to 10 mSv/h.

Following the Cooperative Threat Reduction Agreement between the United States and Kazakhstan signed on 4 October 1995, 180 of the 181 tunnels in the Degelen Mountains were blasted by conventional explosives and sealed between 1998 and 2000, in order to destroy the nuclear weapons infrastructure and to reduce the radiological hazard. The remaining open tunnel had not been used for nuclear tests. At the same time, silos for intercontinental ballistic missiles (SS-18) were permanently closed down.

During the nuclear test period, entry into the Polygon was forbidden, particularly for cattle breeding, and this rule was enforced by ground as well as helicopter control. Since the closing of the test activities, people have tended to return to the site to graze their cattle and horses. Farmers began to return to traditional breeding sites without any control. This happens in spite of Governmental Decree No. 172 of February 1996, declaring the SNTS a “reserved zone”, which means that it is exempt from economic use.

The Semipalatinsk area is quite rich in extractable deposits. The “Karajera” coal mine is currently operated inside the Balapan test area by the Semey Company based in the town of Semipalatinsk. The Jurassic coal layers are extracted by open-cast mining, the pit occupying an area of 2 km² down to a depth of 70 m. About 1,000 people work on this deposit, and they are not included in any radiation protection survey. The minimum distance between the centre of the pit and the nuclear test shafts is about 4 km. There is concern about the finding of high tritium concentrations in groundwater not far from the mine. H-3 contents of up to 1,000 kBq/l were measured, which would represent a danger for the miners as they proceed to greater depths. There are no radiation protection rules for working at the

mine on SNTS, neither is there any monitoring on the mined coal before it is transported or sold. Apart from coal, the Polygon also hosts a large molybdenum deposit of some 1 million tonnes, which could be extracted using open-cast mining.

There is also a State farm (Beriozka) operating on the site near Lake Balapan. Samples of food and drinking water have been analysed for radioactivity in the framework of various international scientific projects, but not on a regular basis. Activity contents were found to be below the health norms. Previously the Sanitary-Epidemiological Stations were responsible for controlling foodstuffs produced on or near the Polygon. But due to financial constraints, the controls have been cut dramatically.

However, the 'cable business' is probably one of the most profitable activities on the Polygon now, more so than its agricultural use. It consists of retrieving cables used earlier for the power supply to and remote control of the former technical areas. There are companies involved, but individuals from the small surrounding villages too dig up the cables and sell them to middlemen, who in turn sell them on to China. Shortly after the opening of the Polygon, people also collected spare parts from some machinery that had been left in the technical areas. There has been no control of radioactive contamination of the parts taken.

Measurements of external dose rates taken in 1996 show background or nearly background levels at most parts of the Polygon. At some hot spots they range between 10 and 50 μSv/h. At the epicentre of Ground Zero, the dose rate is currently about 30 μSv/h and strongly decreasing away from the spot. Along the Atomic Lake, the dose rate varies between 10 and 50 μSv/h. It is estimated that persons making daily visits to Ground Zero or Lake Balapan would receive annual doses in the region of 10 mSv, mainly due to external exposure. If permanent inhabitation of those areas were to occur in the near future, it is estimated that annual exposures would be some 100 mSv. According to the International Safety Standards for Protection against Ionizing Radiation (IAEA, 1996), intervention would be 'expected to be undertaken under any circumstances' when the annual effective dose exceeds several tens of millisieverts, which is clearly the case with the above estimate. Outside the test area, the estimated annual effective dose from residual radioactivity is about 0.1 mSv, which is only a small contribution to the exposure from natural sources of radiation (2.4 mSv/a).

"Kapustin Yar" Missile Testing Range

Missiles with nuclear or thermonuclear warheads to be tested at high altitudes or in space were launched from the Kapustin Yar Missile Testing Range (MTR). The missile launchers were stationed near the town of Kapustin Yar, which is located in the Astrakhan region of the Russian Federation, while the main area of the military complex stretches far into the West Kazakhstan *oblast* occupying about 1.5 million hectares of Kazakh territory. 11 such missile-borne tests were carried out between February 1956 and November 1962. Energy yields ranged between 0.3 and 300 kt, and explosion heights were up to 300 km. The first launch resulted in a surface explosion near Aralsk, north-west of the Aral Sea. This test must have been an accident, as neither before nor afterwards was the site of impact considered a nuclear test area.

Radioactivity contamination found on the range as well as in the Atyrau and West Kazakhstan *oblasts* by aero-gamma spectrometric surveys conducted in 1993/94 was attributed to those nuclear tests with missiles launched from Kapustin Yar. The area is also polluted by heavy metals and missile fuel. Parts of rockets and military equipment are scattered across the countryside. Because of its relative proximity to the Azgyr site (see below), missile and nuclear warhead testing from Kapustin Yar has also affected the Azgyr region.

Other military test ranges

There are a number of additional military test ranges scattered over the territory of the Republic, as indicated in Figure 6.1. The "Sary-Shagan" test range was established in 1965 and occupies an area of 6.1 million hectares west of Lake Balkhash. The headquarters is located in the town of Priozersk. At this range, ground-to-air missiles were tested by Soviet/Russian forces until 1994 and by Kazakh forces since then. The main pollutants of this territory are spills of highly toxic rocket fuel as well as parts of rockets and ammunition. From 1994 to 1997, a project to clean the test range of fragments of missiles and military targets was carried out at the initiative of the Air Force of the Russian Federation and the Ministry of Defence of Kazakhstan.

The "Emba-5" military test range is situated in the middle of the Aktyubinsk *oblast*. It occupies an area of 3 million hectares, and it was established for testing anti-aircraft defence systems. By Decree of

the Cabinet of Ministers of the Kazakh Soviet Republic No. 980-91 of 18 May 1955, this territory and its infrastructure was leased to the military forces of the Soviet Union. The range is still in use and rented by the Russian Federation. Assumptions that small-scale nuclear tests have also been conducted at Sary-Shagan and Emba-5 as well as at some other military ranges, like Taysoygan, Kurmangasi, Makat and Jamansor in the Atyrau *oblast*, could not be confirmed. Some ranges in southern Kazakhstan are no longer in operation.

Baikonur

The "Baikonur" Space centre or 'Cosmodrome' is situated near the town of Leninsk (Tyuratam) in the Kyzylorda *oblast*. The technical area covers 670,000 hectares, but was extended to 10 million hectares, to ensure that the first stages of missiles and launch failures would crash within the official borders. The basic concept of the "5th Scientific Research Test Range" was approved on 2 June 1955, and the first launch of an intercontinental ballistic missile (ICBM) took place on 15 May 1957. Up to 1995, 1,100 space vehicles for different purposes, some of them equipped with nuclear energy devices, and 100 ICBMs took off from the various civil and military launching pads on the site.

Since 28 March 1994, the space centre has been leased to the Russian Federation for 20 years for national and international, military and civil space programmes. Environmental studies performed at the technical area and at the sites of missile crashes revealed local spills of highly toxic fuel components and burned down vegetation, but no significant increase in environmental radioactivity. After a number of missile crashes in 1996, 1997 and 1999 with considerable environmental damage, the leasing agreement was interrupted by the Kazakh Government until complete clean-up of the consequences of the accidents.

Sites of peaceful nuclear explosions

Within the framework of the Soviet nuclear programme, so-called 'peaceful nuclear explosions' (PNEs) were carried out also. Their main purpose was to support the oil, gas and mineral industries. In Kazakhstan, 39 PNEs were performed, 7 inside and 32 outside military test sites, for the following purposes:

- Cavity construction for the underground storage of gas condensate
- Deep seismic sounding for minerals exploration
- Canal and water reservoir building
- Research on deep geological structures by simultaneous detonations.

For research projects, explosions were performed in series that sometimes involved more than one of the former Soviet republics. Although called 'peaceful', military intentions cannot be excluded.

PNEs at Semipalatinsk

On the Semipalatinsk Nuclear Test Site, 7 experiments with PNEs were conducted between 1965 and 1974 with energy yields between 0.23 and 140 kt. The best known of these is the "Chagan" explosion, which created the Atomic Lake. The actual background of this test was not only the creation of a water reservoir, but also an investigation into whether a series of excavation explosions could be used to build canals to feed small rivers drying out in summer from those carrying water all year round. The characteristics of the PNEs at SNTS are given in Table 6.2.

Table 6.2: Peaceful nuclear explosions at the SNTS

Name of object	Date of explosion	Energy yield *kt TNT*
"Chagan", shaft 1004	15/01/1965	140
"Sary-Uzen", shaft 1003	14/10/1965	1.1
"Telkem", shaft 2308	21/10/1968	0.24
"Telkem-2", shafts 2305-07	12/11/1968	3 x 0.24
Tunnel 148/1	09/04/1971	0.23
"Lazurit", shaft R-1	07/12/1974	1.7
Tunnel 148/5	16/12/1974	3.8

Source: Minatom, Russian Federation, 1996.

Between 1964 and 1984, another 35 explosions were performed as tests of 'industrial nuclear charges for use in peaceful activities'. The energy yields ranged from a few tonnes to 1.5 megatonnes TNT equivalent.

PNEs outside military test sites

A total of 32 nuclear explosions for economic purposes were performed outside military test sites in Kazakhstan. The parameters of these tests are given in Table 6.3.

Table 6.3: Parameters of peaceful nuclear explosions conducted outside military test sites.

Name of object and location	Date of explosion	Energy release *kt TNT*	Depth *m*
Experimental studies on development of a technology to form cavities in masses of rock salt			
"Galit", Atyrau oblast, within a radius of 20 km from the settlement Big Azgyr			
Shaft A-I	22/04/1966	1.1	160
Shaft A-II	01/07/1966	27	600
Shaft A-II-2	25/04/1975	0.35	600
Shaft A-II-3	14/10/1977	0.1	600
Shaft A-II-4	30/10/1977	0.01	600
Shaft A-II-5	12/09/1978	0.08	600
Shaft A-II-6	30/11/1978	0.06	600
Shaft A-II-7	10/01/1979	0.5	600
Shaft A-III	22/12/1971	64	990
Shaft A-III-2	29/03/1976	10	990
Shaft A-IV	29/07/1976	58	1,000
Shaft A-V	30/09/1977	10	1,500
Shaft A-VII (salvo explosion of 2 devices)	17/10/1978	73	970
Shaft A-VIII (salvo explosion of 2 devices)	17/01/1979	65	995
Shaft A-IX (no cavity but artificial lake)	18/12/1978	103	900
Shaft A-X (salvo explosion of 3 devices)	24/10/1979	33	980
Shaft A-XI (salvo explosion of 3 devices)	14/07/1979	21	980
Development of technology to form cavities and to study seismic engineering by explosions			
Shaft 1-T, Eraliev rayon, Mangystau oblast, 100 km east of settlement Saj-Utes	23/12/1970	75	740
Shaft 2-T, Eraliev rayon, Mangystau oblast, 115 km east of settlement Saj-Utes	06/12/1969	30	410
Shaft 6-T, Eraliev rayon, Mangystau oblast, 113 km east of settlement Saj-Utes	12/12/1970	80	500
Deep seismic prospecting to reveal underground structures and to explore natural resources			
Region-3, Janybek rayon, West-Kazakhstan, 250 km east of settlement Janybek	20/08/1972	6.6	490
Region-5, Naurysum rayon, Kostanaj oblast, 21 km north of settlement Dokuchaevka	24/11/1972	6.6	425
Meridian-1, Kurgaldji rayon, Akmola oblast, 110 km east of settlement Arkalyk	28/08/1973	6.3	400
Meridian-2, Suzak rayon, South-Kazakhstan, 260 km north of settlement Chulak-Kurgan	19/09/1973	6.3	400
Meridian-3, Kzylkum rayon, South-Kazakhst. 40 km north of settlement Tabak-Bulak	15/08/1973	6.3	610
Batolit-2, Bajganin rayon, Aktyubinsk oblast, 40 km from settlement Jarkymys	03/10/1987	8.5	1,000
Experimental work on forming underground cavities for storage at the Karachaganak gas field			
Lira, West Kazakhstan oblast, 140 km east of the town Uralsk:			
Shaft 1T	20/07/1983	15	920
Shaft 2T	20/07/1983	15	920
Shaft 3T	20/07/1983	15	920
Shaft 4T	21/07/1984	15	850
Shaft 5T	21/07/1984	15	850
Shaft 6T	21/07/1984	15	960

Source: Minatom, Russian Federation, 1996.

Azgyr. The largest set of explosions in this programme was performed on the Azgyr test site, which is situated in the furthest west of Kazakhstan near the border with the Russian Federation. The former test site (military code name "Galit") includes the settlement of Azgyr (800 inhabitants), several technological buildings and test grounds used for underground nuclear explosions. All the grounds of about 2 hectares each are located inside the territory of the "Balkuduk" State farm at distances of between 2.5 and 20 km from Azgyr. Between 1966 and 1979, 17 nuclear explosions were conducted at 10 different locations with energy yields of between 0.01 and 103 kt TNT at depths of between 160 and 1,500 m. The eleventh test on site A-XII had been prepared but not carried out. These experiments served the development and further improvement of technologies for creating underground cavities in a salt dome, which unlike explosions in crystalline rock, was expected not to

show cracks or leaks. The technology was meant to be applied to prepare cavern storage for the large oil and natural gas deposits in the Caspian Depression.

Today the site is accessible, and no permit for entering is required. There is no fence or other safety measures installed to ensure the simplest safety requirements. The climate is typically arid with an annual precipitation of 200 mm. Strong winds are characteristic of this area, with wind speeds ranging up to 20 m/s. In summer, dust storms occur very frequently, with the potential of carrying radioactive particles into the settlement of Azgyr. In documents reporting on the Azgyr site, it is often referred to as a military testing range. This may be due to the fact that all nuclear explosions were carried out by military forces, however, under the umbrella of the Soviet Ministry of Medium Machine Building. For Azgyr it is also assumed that older explosive devices (bombs) have been used to renew the arsenal.

The volumes of the cavities range between 15,000 and 235,000 m³. Due to the plasticity of salt under pressure, the empty volumes tend to decrease with time. Five (A-I to A-V) of the nine cavities are entirely and two (A-VII and A-X) are partly filled with salt leach. The explosions at shafts A-I, A-II, A-VIII and A-IX were 'incompletely contained explosions with a non-standard radiation situation', which means that radioactive material escaped into the atmosphere and also contaminated the vicinity of the shafts. In the 1980s and 1990s, the test grounds were subject to a partial clean-up. Radioactively contaminated equipment and soil were removed and disposed of in two of the cavities, A-III and A-X, respectively, with a total volume of about 24,000 m³ and a radioactivity of $1.85*10^{12}$ Bq. This amount is only 0.02 per cent of the almost 10^{16} Bq resulting from the nuclear tests at Azgyr. Measurements of the National Nuclear Centre's Institute of Nuclear Physics and Hydromet in 1995 have revealed Cs-137 soil contamination of up to 320 kBq/m² at certain spots. This is more than 100 times the deposition density of the global fallout in Kazakhstan (2.4 kBq/m²). Estimations of effective equivalent doses for members of the population resulted in 130 to 380 mSv for the test period. However, there is no recognition of this exposure and its associated health effects as in the case of SNTS victims.

Lira. In the framework of the "Lira" project, 6 underground explosions were carried out in rock salt at depths down to 960 m, to form cavities for the storage of gas condensate. The cavity volumes are about 60,000 m³ each. During the explosions no release of radioactivity into the atmosphere was observed. At present, one out of the six cavities is filled with brine, it is not clear why. Measurements of leaks of radioactivity have not revealed any extraordinary findings.

Mangystau. Also for storage purposes, experiments for forming cavities in solid rock were carried out in the Mangystau oblast. They were not as successful as those in rock salt.

Seismic experiments. For the purpose of the seismic investigation of deep geological structures and for the exploration of natural resources, 6 PNEs were carried out on Kazakh territory in conjunction with explosions on neighbouring territories. Details are given in Table 6.3. The results concerning the possible radioactive contamination of environmental media by those tests are not available.

Nuclear reactors

The first Soviet Experimental Industrial Fast Neutron Reactor BN-350, which is located in Aktau (Shevchenko), came on stream in November 1972. This type of reactor is also called a Fast Breeder Reactor, as it produces more fissionable material than it burns. The product is plutonium, which was used as a "stuffing" for nuclear warheads. BN-350 was a major supplier of 'raw material' for weapons plutonium production at the radiochemical complex in 'Cheliabinsk-65' (Ozyorsk) in Russia. The generation of net energy began in July 1973, and it was used for the desalination of salt water from the Caspian Sea. The reactor was shut down permanently in January 1999. 560 spent fuel assemblies have been sent back to the Russian Federation in the past. More than 2,000 spent fuel assemblies are at present stored in the cooling pond. It is still not known whether the reactor fuel will be returned to the Russian Federation or stored temporarily at the "Baikal-1" intermediate storage facility at SNTS, south of Kurchatov. The development of a decommissioning concept is currently the subject of a TACIS project.

Until the early 1990s, the Institute of Nuclear Physics at Alatau (north-east of Almaty) of the National Nuclear Centre (NNC) operated a 10-MW experimental VVR-K reactor. It was started in 1967, but operation was suspended in 1988, as it is situated in a seismically active area. Three research and experimental reactors are located on SNTS,

including one spacecraft reactor. The reactors are operated by the Institute of Atomic Energy (NNC) at Kurchatov. The waste from the four research reactors is estimated to be small in terms of quantity and radioactivity compared with that of the Fast Breeder at Aktau, especially as there are no plans to decommission them in the near future. The accumulated amount of medium- and high-level waste is assumed to be about 15 m³.

Radiation sources in industry and research

At present, there are about 100,000 encapsulated radioactive sources with a total of approximately 10^{15} Bq in circulation. There is a large number of radiation sources in smoke detectors, which are no longer in use. Stock-taking and control are the responsibility of the Sanitary-Hygiene Inspectorate. Because of the limited availability of tools for this task, it has to rely on reports from users. This is in serious jeopardy due to massive company closures. Returned radiation sources are temporarily stored in a central intermediate storage location on the SNTS ("Baikal" nuclear reactor complex). The storage method, however, does not comply with international standards.

6.2 Legal framework for the management of radioactively contaminated sites

Laws and regulations for existing and newly produced contamination

The management of radioactively contaminated land for the purpose of protecting man and the environment against the negative impact of ionizing radiation on the one hand and for the purpose of reducing or eliminating contamination on the other needs to be based on scientifically derived norms concerning acceptable or unacceptable radiation doses. As knowledge about the biological effects of ionizing radiation has progressed, the established norms have changed towards significantly lower dose limits during the past 50 years.

At the time of the first nuclear test at SNTS in 1949, the maximum permissible dose from external irradiation in the Soviet Union was 520 mSv/a. There was no differentiation between radiation workers, e.g. personnel carrying out the nuclear tests, and the population. This value was halved in 1950 and again in 1953. In 1957, a differentiation was introduced between Category A, radiation workers, and Category B, people not working with radioactivity, who were permitted only one tenth of the dose of Category A. After further reductions, the currently valid dose limits documented in the previous (NRB-96, edited by the Russian Goskomsanepid supervision in 1996) and in the most recent Norms of Radiation Safety (NRB-99, edited by the Kazakh Agency of Health in 1999) for external and internal irradiation without a natural background are 20 mSv for radiation workers and 1 mSv for members of the public. These limits are in agreement with ICRP Recommendation 60 and with European Norm Euratom 96/29, which became compulsory for EU Member States in May 2000.

The fundamental law for the management of radiation protection in Kazakhstan is the Law on the Radiation Safety of the Population, No. 219-1, of 23 April 1998, which has to be taken in conjunction with the NRB-99 Norms. In harmony with the respective laws in other countries, it includes the 'ALARA' Principle (As Low As Reasonably Achievable), which means that when applying radioactivity or radiation sources, the radiation dose should be kept as low as possible under the consideration of economic and social aspects. The Law also addresses high natural radioactivity as well as radiation emergencies. It does not explicitly refer to already existing, man-made high radioactivity situations, such as can be found at the nuclear test sites.

The most important legal instruments concerning the contaminated sites are:

- The Decree of the President of Kazakhstan, No. 409, of 29 August 1991 on Closing the Semipalatinsk Nuclear Testing Site. This date marks exactly the 42nd anniversary of the first nuclear explosion at SNTS.
- The Law on the Social Protection of the Citizens and Victims of the Semipalatinsk Nuclear Test Site of 18 December 1992. The Law defines the categories of the zones which had been subject to radioactive fallout during nuclear tests. The baseline is an area which is considered not to be contaminated, where the effective equivalent dose for a person for the entire test period did not exceed 1 mSv. The following subdivisions are made:
  - Zone of extraordinary radiation risk (above 1,000 mSv),
  - Zone of maximum radiation risk (350 to 1,000 mSv),
  - Zone of increased radiation risk (70 to 350 mSv),

- Zone of minimum radiation risk (1 to 70 mSv),
- Territory with the status of socio-economic support. These areas border on zones of minimum risk, but the doses have not exceeded 1 mSv. However, there is a significant negative effect on psycho-emotional factors, which is related to living near radioactively contaminated and seismically dangerous *rayons*.

- According to the defined categories, the Law assigns compensation, payments and support to the zones' inhabitants. Regulations to this Law name settlements and *rayons* as well as the assigned category. It is also officially recognized that 1.2 million people have been exposed to ionizing radiation as a consequence of operations at SNTS. Of those, 67,000 people received doses above 1,000 mSv and 27,000 of them survived. Including their 39,600 children and 28,900 grandchildren the group of extraordinary radiation risk comprises 95,500 individuals. Regulations to implement this Law have been changed a number of times because of financial constraints. Many victims eligible under the regulations have not received any compensation.
- Resolution of the Government of Kazakhstan, No. 1361, of 8 November 1996 on additional measures concerning the consequences of nuclear explosions. It is a first step on the way to formulating general rules on the supervision and control of radioactive contamination in environmental media.
- For the development of legislation and regulations governing the management of radioactive waste and the use of atomic energy, several intermediate provisions and resolutions have been drawn up in preparing the respective laws:
- Decree No 364 of the Cabinet of Ministers of Kazakhstan, of 11 April 1994, on approval of Temporary Regulations on the Use of Nuclear Energy, Nuclear Activity, Radioactive Waste and Spent Nuclear Material Management, the Provision of Radiation Safety for the Population of Kazakhstan. It defines the State system of regulation and control of the safe use of nuclear energy, the State bodies involved and the distribution of responsibilities.
- Resolution No 1161 of the Cabinet of Ministers, of 11 October 1994, on the Procedure of Issuing Temporary Permits for the Burial of Radioactive Waste. It defines waste categories according to physical state and radionuclide concentration. The right to issue temporary permits for waste burial is split between the Ministry of Natural Resources and Environmental Protection and its *oblast* departments depending on the amount of radioactivity. The resolution is further improved by Regulations No 1283, of 18 October 1996, on the Order of Burial of Radioactive Waste in Kazakhstan.
- Resolution No. 1285of the Government of Kazakhstan, of 18 October 1996, Regulations on the Procedure for the Maintenance of a State Cadastre for the Burial of Harmful Substances, Radioactive Waste and Waste Water Discharge into Deep Soil. The maintenance of the cadastre is delegated to the Ministry of Geology, and the specifications of the cadastre are defined.
- The Law on Atomic Energy Use of 14 April 1997 defines the legal basis and principles of public relations in the field of atomic energy use and is oriented towards the protection of the health and life of the population and the environment. It also provides the regime of the non-proliferation of nuclear weapons, the safe and final disposal of radioactive waste and of nuclear and radiation safety.
- The law on radioactive waste management is still only a draft. It specifies in more detail waste management aspects that have already been outlined in the Law on Atomic Energy Use. The justification of the assumption made in this draft that the safety level required for human protection will be sufficient for the protection of all other living organisms has been questioned more recently in the scientific literature.
- Decree No. 100 of the Government, of 12 February 1998, on approval of the Regulations on the Licensing of Activities Related to the Use of Nuclear Energy requires the licensing of any activity on sites contaminated by nuclear testing.

State authorities in the field of nuclear matters

In total, four ministries, one committee and one agency bear responsibility for the management of radioactive contamination and radiation protection in Kazakhstan. The Ministry of Natural Resources and Environmental Protection (MNREP) is the central executive organ for the State control of the environment and the use of natural resources. With regard to aspects of information on and

management of radioactively contaminated territories, the following committees and departments of MNREP are of special relevancy:

- The Committee for Environmental Protection holds information relevant to standards for controlling access to and use of land in contaminated areas, e.g. at SNTS;
- The Committee for Geology and Underground Resources is responsible for geological surveys, including groundwater conditions;
- The Committee for Water Resources deal with the quality of surface water and drinking-water reservoirs;
- The National Environmental Centre for sustainable development determines the priorities for environmental protection and rehabilitation actions;
- The State Enterprise Kazhydromet is attached to MNREP and is responsible for monitoring radioactivity in environmental media. Up to 1994, 45 stations had been involved in a radiometric network, but their number has decreased drastically since then. Most of the equipment and measuring methodologies are outdated.

The Ministry of Energy, Industry and Trade (MEIT) is the contractor for mineral resource development. Institutions subordinated to MEIT are:

- The Atomic Energy Committee of Kazakhstan (KAEC), founded in 1993, reports directly to the Cabinet of Ministers. It is responsible for the control of radiation sources, issues licences for the operation of nuclear facilities and for any activities within the SNTS, and drafts legal acts associated with nuclear energy and radiation protection.
- The National Nuclear Centre (NNC) was part of the Academy of Sciences, then under the Ministry of Science and is now under MEIT. It comprises 4 institutes within MEIT:
  - The Institute of Nuclear Physics (INP), based in Alatau/Almaty with a branch in Aksay, performs monitoring and radiological studies at the Azgyr and Lira PNE sites;
  - The Institute of Radiation Safety and Ecology (IRSE), based in Kurchatov, is responsible for the management and research of contaminated areas on SNTS. It performed most of the radioecological work on SNTS;
  - The Institute for Atomic Energy (IAE), based in Kurchatov, operates the reactor facilities within SNTS;
  - The Institute of Geophysics (IGP), based in Kurchatov, undertakes geophysical studies within SNTS and at other sites in Kazakhstan.

The Agency of Health, and its Sanitary & Epidemiological Service (SES) is responsible for workplace conditions and environmental monitoring outside sanitary zones. The Institute of Radiation Medicine and Ecology, based at Semipalatinsk (Semey), subordinated to the Agency of Health, carries out investigations on the dose reconstruction of the nuclear test phase and of the present situation. It is the successor to "Dispensary No. 4", the secret medical institution which had collected data on the health of the population in the Semipalatinsk area during the test phase.

The Ministry of the Interior supervises the transport of radioactive materials and the means of transport.

The Committee of Land Resources, which is directly subordinated to the Cabinet of Ministers, participates in the evaluation of sites for nuclear facilities and for the final disposal of radioactive waste.

The Ministry of Defence has broad responsibility for nuclear facilities on military sites.

The uranium mining enterprises are at least partially State-owned and responsible for radioactively contaminated sites. After independence, this industry went through a series of organizational processes, ultimately creating the Kazakhstan State Atomic Power Engineering and Industry corporation "KATEP", 51 per cent owned by Kazakhstan, to manage uranium exploration, production, processing and marketing activities, although ownership of all mineral resources remain with the State, and all producers require licences. In November 1996, the Government announced the creation of "Kazatomprom", a joint-stock company, which became a legal entity in February 1997 as the successor to KATEP and is 100 per cent State-owned. Since then, Kazatomprom has been responsible for the management of uranium mines and deposits and hence also for the radioactive waste from uranium mining and milling. It also holds shares in the Volkovgeology exploration unit and the 51 per cent State share in the Ulbinski Kombinat at Ust-Kamenogorsk.

6.3 Programmes and projects for the clean-up of radioactive contamination

The National Environmental Action Plan

For radioactive contamination, the NEAP/SD (see Chapter 1) identifies three actions:

- Pilot projects for the mitigation of the negative impact of radioactive waste in the East Kazakhstan and Karagenda *oblasts* (US$ 22.7 million)
- The development and implementation of measures to reduce air pollution by radioactive dust from the "Koshkar-Ata" tailings in Aktau (US$ 0.7 million)
- The establishment of the International Centre for Investigation of the Impact of the Semipalatinsk Nuclear Testing Site on Health and the Natural Environment (US$ 2 million).

Financial contributions to support the work on the development of the NEAP have been made by a number of international funding organizations as well as by national European and Asian governments (see Chapter 3).

The Environment and Natural Resources Strategic Plan – 2030

The Environment and Natural Resources Strategic Plan up to the year 2030 defines in its 'Plan of Action for 1998 to 2000' a total of 82 actions in three priority areas. Seven of those actions are connected with radiation protection measures including the three actions of the NEAP/SD. The four additional actions are:

- Improving the management and control system to ensure radiological safety and to prevent radioactive environmental pollution
- The accession of Kazakhstan to a number of international conventions, including the Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their Disposal
- The implementation of a programme on the burial of spent radioactive sources
- Prospecting work on water supply for urban and populated areas affected by SNTS and on serious water management and sanitary-epidemiological problems in the Semipalatinsk, Zhambyl, West Kazakhstan and Pavlodar provinces.

The Semipalatinsk Relief and Rehabilitation Programme

The United Nations General Assembly adopted resolution 52/169 M at its 52nd session on 16 December 1997, in which it called on the international community to assist the Government of Kazakhstan in its efforts to meet the needs of those affected by nuclear testing at the Semipalatinsk Polygon. In early 1998, the Government of Kazakhstan established a Governmental Inter-Ministerial Committee to identify the issues affecting the Semipalatinsk region. The United Nations Development Programme initiated a meeting of 20 international experts with a group of 25-50 Kazakh experts from governmental authorities and NGOs and a field trip to the SNTS between 15 and 30 June 1998 to assess impacts, problems and needs. During late 1998 and throughout 1999, numerous consultations took place, until at the International Conference on Semipalatinsk from 6 to 7 September 1999 in Tokyo, Japan, a set of 38 project proposals in the ecology (6 projects), health (13 projects), economics (11 projects), human aid (6 projects) and public information (2 projects) sectors could be presented. The total sum required amounted to US$ 43 million. By mid-May 2000, a little more than half the sum had been pledged by donor organizations and national governments with the highest commitments (85 per cent of the required amount) in the health sector.

Numerous other international and bilateral projects are being carried out, e.g. those coordinated by the International Science and Technology Centre, Moscow (ISTC-Projects) or those funded by the TACIS programme of the European Union. They cover quite a broad range of investigations and developments, including retrospective dosimetry, the development of reactor decommissioning technologies, the improvement of ISL technologies, etc.

6.4 Conclusions and recommendations

After independence, Kazakhstan inherited a large number of environmental and humanitarian problems especially concerning ionizing radiation and its effects on man and the environment. Not only had hundreds of thousands of people suffered from direct radiation emitted from nuclear explosions to such an extent that the succeeding generations carry this burden physically and

mentally too, but there were also the after effects of the uncontrolled spreading of radioactivity, whose geographical location, primary source of contamination and actual extent are not even fully known. This will require great efforts and a large sum of money in the future. There has been strict secrecy about all actions directly or distantly associated with military operations for many decades. Now that the argument for secrecy on these matters is no longer valid, it seems that the possibilities of information and transparency concerning this period of history have not yet been fully used. This has led to an extraordinary engagement of non-governmental organizations (NGOs) in issues of radioactive contamination and the socio-economic effects of nuclear testing.

Kazakhstan also inherited a set of radiation protection norms, regulations as well as legislation, and a governmental structure which had proved unable to avoid or mediate the consequences of such operations. Progress has been made in replacing them, but the system is still not complete, nor internally consistent. New regulations have to be devised on issues that were beyond consideration at earlier times, such as regulations on the recycling of radioactively contaminated metal scrap, and civil jurisdiction has to replace military jurisdiction over objects which have been released from military control.

On top of that, Kazakhstan is finding it very difficult to develop economic sources of State income, so that the budgetary means for financing rehabilitation measures and projects is extremely limited. It is therefore necessary for the Government of Kazakhstan to mobilize all possible sources of funding to support the various programmes that aim at least to reduce further damage to the population and to the environment, and to pay special attention to the needs of the victims of previous harmful operations.

There is no doubt that a considerable amount of Kazakh and international money could be saved, or rather, spent on more humanitarian and rehabilitation measures, if the complete documentation on past activities in uranium mining and waste dumping, on the storage of radioactive and radioactively contaminated material, on the military and peaceful testing and applications of nuclear explosions as well as on the results of dosimetric and medical investigations of the people affected carried out by the Sanitary & Epidemiological Services (SES), which are still kept in Russian and Kazakh archives, were made available to the governmental and scientific institutions concerned and to the public.

Recommendation 6.1:
It is necessary to acquire all relevant documents on uranium-mining dumps (location as well as other), safety zones, nuclear explosions, the storage of radioactively contaminated material, environmental monitoring and on radiation exposure investigations from the Russian authorities and archives (military, environmental, SES) as well as from all possible other sources including the international ones, and to declassify, evaluate and forward all information (in full geographical detail) for consideration in national, regional and local decision-making and further processing.

Under the prevailing conditions of scattered radioactive contamination over large parts of the country from past operations of the nuclear industry, a well-structured, well-equipped and efficient monitoring system of the key environmental media as well as of foodstuffs and drinking water at least in the highly affected areas is indispensable. The monitoring system would help establish a minimum level of safety from the negative effects of ionizing radiation. The radiometric network operating until 1994 must be re-established, and the measuring techniques updated, as measuring techniques and methodological instructions for environmental monitoring have to comply with the most recent advances of science and technology. They have to be standardized and officially certified in order to be accepted in cases before court.

Recommendation 6.2:
The radiometric network of Hydromet should be revitalized and equipped with modern measuring and analytical techniques. Standardized measuring, evaluation and reporting procedures have to be introduced. Of primary importance are the areas with high natural or anthropogenic radioactivity. Measurement should be extended to the monitoring of radon levels. *See Recommendation 14.4.*

The Semipalatinsk Nuclear Testing Site (SNTS), the Azgyr and Kapustin Yar range as well as a number of uranium mining and processing sites represent huge reservoirs of accumulated hazardous materials of very heterogeneous kinds. It has to be accepted that none of these sites can be restored to conditions that prevailed before man started to inject radioactive material into the environment and into the ground. In many situations it would be

impossible to remove the radioactive contamination, or removal would represent an overall higher radiation exposure than certain means of confinement on site. In view of the low population density in the country, instead of trying to resume pre-nuclear use of the sites by any means and to invest a large amount of money to achieve an acceptable level of radiation exposure, it would be worth considering the reverse approach starting from the question of how a given site could best be used under the given circumstances or after a reasonable clean-up, in order to produce optimum yield at minimum radiation exposure. This decision would be site-specific and should be elaborated at local or regional levels with the active participation of the public.

For this procedure, all the results of radioactivity measurements must be made available, compiled and evaluated for their consistency and completeness and missing information be supplied. Secondly, a set of so-called "secondary standards" and guidelines should be drawn up. They would be maximum permissible contamination levels derived from consideration of land use (e.g. industrial facilities, parks, natural reserves) and recycling procedures (e.g. contaminated metal scrap). They have been developed in some countries facing the legacy of residues from uranium mining and processing and would need adaptation to Kazakh conditions. This procedure requires strict control over the application of those norms and guidelines. If a site were to be exempted from any further use, as would very likely be the case for some areas of the SNTS and the Azgyr site, access must be prohibited and prevented. There are various methods to do this, and the circumstances of the site would dictate the most effective and practicable: (i) fencing off the contaminated territory, (ii) the provision of alternatives to the use of the exempted land, (iii) information and education of the affected population about the risks associated with the use of the sites. A number of projects of type (ii) and (iii) are in preparation.

Recommendation 6.3:
Standards and guidelines, which are commonly derived from accepted dose limits, should be developed for the future use of contaminated land and material. Decisions on future use should be made at State or local level after consideration of the optimum effects of a clean-up or the safe confinement of radioactivity to the site and prospected use. The population should be involved in all decision-making as part of an information programme.

In view of the large amounts of radioactive waste from uranium mining and processing operations (mainly low-level waste, about 1 per cent medium-level waste), the problem of its safe storage has to be solved in the near future. The solution requires a fully integrated, nationwide concept for all types of radioactive waste and for each waste accumulation site. As an urgent measure, the maintenance of dumps and tailings of abandoned mines and processing plants has to be resumed, in order to control processes that promote the dispersion of radioactive material above and under ground.

Several different kinds of solutions for the rehabilitation of uranium mining sites have already been worked out in countries with similar waste problems. In order to keep handling or even transport operations to a minimum, safe containment on the site (sealing of the surface to prevent/reduce resuspension of dust, exhalation of radon and leaching processes of rainwater) is often proposed as a method that creates the least radiation burden for the population and those performing the rehabilitation work. If there are ditches from abandoned open-cast mining, the bottom surfaces could be sealed with impermeable layers and then be filled with the waste material prior to soil covering and recultivation. Also, depending on the residual uranium content, reprocessing of the waste material could reduce activity concentrations before dumping.

For the storage of medium and high-level waste no solution for final burial is in sight in the near future. Engineered near-surface facilities would represent a medium-term alternative.

Recommendation 6.4:
A comprehensive storage concept should be developed for radioactive waste from the mining and milling of uranium and other natural resources, from military and peaceful nuclear explosions, from the industrial applications of radiation sources and from nuclear reactor operation, in line with site-specific parameters and the ALARA principle. See Recommendation 9.4.

Some streamlining of administrative mandates appears necessary. All in all, four ministries, the Committee on Land Resources and the Agency for Health are involved in the management of radioactively contaminated territories and radiation protection. Their responsibilities overlap, and this may lead to duplication of work. The tremendous work to be carried out in the near future can be

completed only if it is done in a cost-effective way, presupposing a clear administrative structure. The executive bodies should be screened with the aim of concentrating their workforce.

Recommendation 6.5:
The distribution of responsibilities in the management and regulation of contaminated territories and radiation protection should be streamlined. The Atomic Energy Committee should be subordinated to the Ministry of Natural Resources and Environmental Protection to emphasise policy priorities. See Recommendation 1.3

There is no doubt that the health and socio-economic effects of nuclear testing at the Semipalatinsk Nuclear Testing Site (SNTS) imposed on the population of the East Kazakhstan, Pavlodar and Karaganda *oblasts* were the most severe and grave in the country. Therefore, national and international programmes to remedy the present situation, like the Semipalatinsk Relief and Rehabilitation Programme, have focused on the towns and villages of these areas. It is a good example of mobilizing international recognition and support for the associated problems. At other test sites, like Azgyr in conjunction with the Kapustin Yar missile range, dose estimates may be lower but probably not much lower in individual cases. Programmes and projects initiated for the SNTS area should therefore serve as a model or should be extended to the victims of other heavily affected communities. Specific measures would have to be adapted to the conditions of the site under consideration.

Recommendation 6.6:
Remedial and rehabilitation measures and projects prepared for the Semipalatinsk Nuclear Testing Site should be adapted to other sites which have been subject to similar impacts. Experience gained at the Semipalatinsk Nuclear Testing Site should be used and incorporated.

Chapter 7

MANAGEMENT OF WATER RESOURCES AND QUALITY

7.1 Water resources

General availability

The territory of Kazakhstan lies in the central and southern latitudes of the moderate climate zone, while the extreme south is adjacent to the subtropical zone (for details see *Features*). This inter-continental position determines the specific hydrography of the region, soil, vegetation cover and fauna. Because of its climate, Kazakhstan's water bodies and systems are of crucial importance for life.

Kazakhstan has one of the smallest available water resources among the States that were part of the former Soviet Union, although the main water bodies of Central Asia, the Caspian Sea and the Aral Sea, are partly situated on its territory. The water stocks are made up of surface water outlets, temporary water flows and groundwaters. They are distributed extremely unevenly and characterized by significant long-term and intra-year dynamics, with an excess of water in the north and northeast, but very limited resources in the south-west and the centre of the country. The average surface water resources per year, taking into account transit waters flowing from neighbouring countries, constitute 100.5 km^3, of which only 56.5 km^3 are formed on Kazakh territory.

River water

Kazakhstan has 7,000 rivers more than 10 km long, 155 rivers more than 100 km long and 7 rivers more than 1,000 km long. There are 2,128 small rivers with average annual flows of less than 10 m^3/s, 40 rivers with flows of 10-50 m^3/s, one river with a flow of 100-200 m^3/s, three with flows of 200-500 m^3/s, and two with flows of more than 500 m^3/s (see Table 7.1).

Kazakhstan's rivers belong to the following basins:

- The Arctic Ocean: Irtysh, Ishim, Tobol
- The Caspian Sea: Ural, Emba
- The Aral Sea: Syr Darya, Sarysu, Shu, Talas
- Lake Balkhash: Ili, Karatal, Lepsy and other Zhetisu rivers
- The Alakol and Sasykol Basins: Rivers of Zhunghar Alatau
- The Chelkar-Tenghiz Basin: Nura, rivers of Irghiz, Turgai and Kurgaldzhin.

The flow of the Irtysh river is regulated by two hydropower stations (Bukhtarma and Shulbinskaya). Part of its flow goes to central Kazakhstan via the Irtysh-Karaganda canal. The Syr Darya river (1,400 km in Kazakhstan) is an important source of water for agricultural production in the south, and its water is almost completely used up during summer. Another very important river is the Ural (1,100 km in Kazakhstan). Rivers such as the Ili, the Karatal, the Lepsy, the Aksu and some others are used for irrigation and water supply. The rivers in northern central Kazakhstan (the Tobol, the Ishim, the Sarysu and the Nura) are typical flatland rivers. They have a very low flow, except during a short period in spring of up to two weeks, and they have almost no flow during the summer.

The total water resources are estimated at around 450 km^3, of which 250 km^3 are made up of freshwater of rivers, lakes and glaciers. The potential use of river water is 100.5 km^3 per year. In the years with average flows (75 per cent of the time) or minimum flows (95 per cent), the potential use is 76 km^3, respectively 58 km^3.

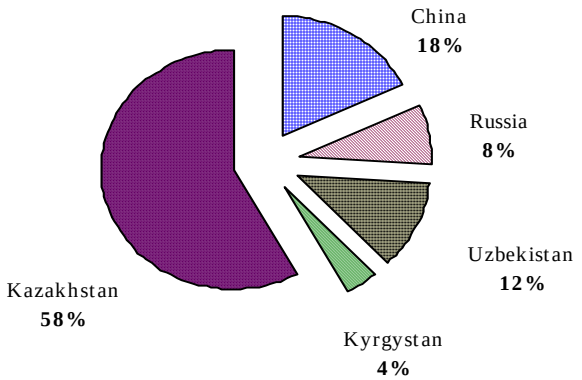
The available volume of water resources for use in the economy is smaller, as losses from evaporation and filtration, transport and power generation, and discharges from reservoirs have to be taken into account, and because these rivers rise abroad. River water availability for abstraction is therefore about 45 km^3 on average, 54.5 km^3 are used for ecological and sanitation needs, 29 km^3 for fish farms and 9 km^3 for power generation.

Table 7.1: Annual water discharge of main rivers in Kazakhstan

Basins and rivers	Length		Catchment area	Annual water discharge	
	Total	In Kazakhstan		Maximum	During 97% of time
	(km)		(km^2)	(m^3/s)	
Artic Ocean					
Irtysh	4,248	1,200	179,000	895	537
Ishym	2,450	1,089	11,800	70	1.68
Tobol	1,591	800	44,800	13.5	0.28
Nura	978	978	50,800	19.2	3.79
Shiderty	502	502	12,100	1.8	0.02
Sileti	407	407	12,500	7	0.56
Kulanuptes	364	364	13,600	1.97	0.01
Tundyk	318	318	9,200	2.14	0.03
Caspian Sea					
Ural	2,428	1,082	231,000	355	75.6
Uil	800	800	25,800	10.8	1.52
Emba	712	712	38,800	15.5	1.24
Bolshoyi Uzen	650	217	10,700	10.8	1
Small Uzen	638	296	3,900	5.2	0.71
Sagyz	511	511	9,900	1.59	0.11
Aral Sea					
Syr Darya	2,137	1,700	219,000	730	398
Shu	1,186	800	39,500	77	50.7
Torgai	872	872	56,500	9.7	0.02
Sarysu	800	800	65,000	7.5	0.05
Talas	661	661	7,900	3.25	2.3
Balkhash-Alakol					
Ili	1,001	815	111,000	470	334
Ayaguz	492	492	8,200	8.84	0.88
Lepsy	417	417	2,200	25.7	15.4
Karatal	390	390	12,800	66.7	37.5
Aksu	316	316	1,300	11.8	7.79

Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

Figure 7.1: Dependence of Kazakh water resources on neighboring countries



Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

Due to climatic features, about 90 per cent of surface water outflow takes place during spring. In a normal year the water deficit amounts to approximately 6.6 km^3. In dry years, water supply is covered by approximately 60 per cent (Figure 7.1), in a special region like central Kazakhstan to only 5-10 per cent, and in this situation, the deficit is mainly at the expense of irrigated agriculture.

Artificial reservoirs

A total of 180 water reservoirs were constructed on rivers, mainly for irrigation purposes, with an overall capacity of about 50 million m^3 (assessed at normal water level). The biggest for irrigation use alone are the Tashutkulsky reservoir on the Chu river and the Bortogaisky on the Chilik river. The biggest reservoirs of multiple use are: the Bukhtarminskoe and Shulbinskoe reservoirs on the Irtysh river, the Kapchagaiskoye on the Ili river, and the Chardarinskoye and Toktagul reservoirs on the Syr Darya river.

The plans for water mains and district channels have been approved. In the Kizilirad area, there are 286,000 ha of irrigated land of which 215,000 ha of rangeland. 2,575 km of channels, 560 big hydrotechnical works, 2 hydrotechnical knots, the Aiteisk weir and the Karaozek water intake have been built on irrigated land. The Aiteisk weir dam was built on the main stream of the Syr-Darya river to reduce floods, and to provide irrigation water for lands with a water deficit. This construction diverted 50 m^3/s of water from the Aitesk channel and provided irrigation water for about 16,600 ha of land cultivated with rice, alfalfa, wheat and other crops in 1990.

In order to regulate the lake system of the Syr Darya river delta, 2 regulating locks were built 20 years ago, Amanotkel and Aklok, with a capacity of 150 and 60 m^3/s, respectively. The Amanotkel works supply lakes Kanislobask, Laikol, Raim and Karakol. The Aklak works provide water for Tushibas, Akbastu and other lakes. It limits the supply to the Aral Sea. For this reason, when the river discharge exceeds 60 m^3/s, the barrier towards the old river bed is opened and water flows through it. The river bed has deepened by about 10 m, due to erosion.

In 1997, total dam capacity (not only for hydropower) was 88,750 million m^3, and total harnessed hydropower capacity around 3 GWh, in comparison with the economically feasible hydropower potential of 35,000 GWh/year.

Glaciers

In the mountains of Kazakhstan, there are 200,724 glaciers, covering a total area of 1,963 km^2. Most of the individual glaciers cover up to 1 km^2. The largest glaciers of an area of about 10 km^2 or more are the Korzhenevsky, the Bogatyr in Zaili Alatau, the Kolesnik, the Berge and the Nekrasov in Jungar Alatau, the Great Bukhtarmy Glacier in South Altai, etc.

Lakes

Kazakhstan has about 48,262 lakes with a total volume of 190 km^3 and a total area of 45,000 km^2. The largest are the lakes Balkhash (area of 106-112 km3, and depth of 5-6 m), Alakol, Tenghiz, Markakol and Borovoye.

The Republic's lakes are generally shrinking, which is explained by over-regulation of river outlets and by natural fluctuations in their water level. Many of them are an important source of municipal water supply, especially in northern Kazakhstan. Lakes are used for fish farming, medical and recreation purposes and serve as animal habitat and for bird nesting. Most are small lakes fed from snow. During the summer, small lakes often dry out.

The steppe lakes of central and northern Kazakhstan, including the Tenghiz, Kurgaldzin, Aksuat, Selety, Chany, Stanovoye, and Shagly-Teniz, are the habitat of hundreds of bird species, many of which are listed in the International and the Republic's Red Data Books. In 1975, the Tenghiz-Kuldzhi lake system was included in the Ramsar List. Currently, documents are being drafted jointly with the German Union of Nature Protection to organize the Tenghiz-Kurgaldzhi biosphere reserve as an example of a stable eco-socio-economic development region.

Groundwater

The operational reserves of groundwater resources are estimated at 61 km^3, including about 40 km^3 of freshwater. The water volume with mineralization below 1.0 mg/l is estimated at 10.5 km^3. The largest reserves are found in the mountainous regions of the northeast, the east and the south. The smallest reserves are in the northern and central regions, and the zones of the Caspian and Aral Seas. Groundwater is used, especially in desert territories, for water supply (about 2.2 km^3) and for irrigation (about 0.35 km^3).

7.2 Water quality

Ambient water quality

Most surface-water-quality standards are included in SNIP 2.1.4.559-96, Moscow 1996, which is applied in Kazakhstan. SNIP (Basic Standards, Norms and Regulations) was originally established during the period of the former USSR. It covers economic activities, in addition to environmental issues such as water, air, soil, flora and fauna. In addition to SNIP, the GOST standards are also used. Table 7.2 reproduces the water-quality classes of SNIP 2.1.4.559-96.

Table 7.2: Water Pollution Index

Code	Water category	Range of Water Pollution Index (WPI)
I	Very clean	WPI< = 0.3
II	Clean	0.3<WPI< = 1
III	Moderately Polluted	1.0<WPI< = 2.5
IV	Polluted	2.5<WPI< = 4.0
V	Dirty	4.0<WPI< = 6.0
VI	Very Dirty	6.0<WPI< = 10
VII	Extremely Dirty	WPI > 10

Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

An overall water pollution index is calculated. It is defined on the basis of the ratios of measured values and the maximum permitted concentration (MPC) of the water-quality parameters. Maximum permitted concentrations are shown in Table 7.3. There are also norms concerning the content of harmful chemicals reaching water-supply sources, which are shown in Table 7.4. The favourable organoleptic properties of water, conditioned by its conformity with the respective norms, are listed in Table 7.5. There are also norms for α and β activity.

Water quality by basin

The measurement of surface water pollution is based on self-monitoring by the water users, as well as samples occasionally taken by Kazhydromet (see also Chapter 1 on current problems with monitoring). Surface water pollution, in 1999, was monitored in the following river basins: the Ural (Atiran region), the Ishim (north), the Talas, the Shu and the Assa (Jambil region), the Syr-Darya (and its tributaries). The data regarding the quality of water resources before 1990 are stored in Moscow and not available in Kazakhstan.

The characteristics of water pollution depend on the economic activity within a region. The most important economic sectors are the mining industry, extensive cattle breeding and agriculture. They were developed with no particular regard to environmental protection measures or to environmental restoration possibilities. Military bases, the Baikonur cosmodrome and weapon testing sites, including for nuclear weapons, occupied vast territories. The consequences for the water environment include pollution with heavy metals, pesticides, radioactive materials, rocket fuel and other toxins. The quality of the main rivers in Kazakhstan is shown in Table 7.6.

The most ecologically hazardous industries are the lead-zinc industry in Ust-Kamenogorsk, the lead-phosphate industry in Shymkent, the phosphorus industry in Taraz, the chromium enterprises of Aktyubinsk and the oil and gas industries of west Kazakhstan. In spite of decreases in pollution levels in the late 1980s, the quality of the country's water has remained poor. In 1990, water quality tests revealed that 14 per cent of samples did not meet public health norms for chemical content.

The Caspian Sea and the Aral Sea suffer from serious environmental problems (see Chapter 8). Other surface waters are also polluted with oil products, phenols, heavy metals and nitrites. In general, the major water pollutants are generated by ionizing waste (over 28,000 tonnes generated in 1994, 23,000 tonnes in 1995), nitric organic compounds (around 1,800 tonnes), phosphor compounds (over 1,300 tonnes in 1994 and 800,000 tonnes in 1995), and zinc (42,600 and 24,900 tonnes, respectively). Practically all chemicals enter the water through industrial sewage from light, food, chemical, machine-building, oil-processing and non-ferrous metallurgy industries.

Over-regulation of big rivers, such as the Irtysh, the Ili, and the Syr-Darya, has had a negative impact on the ecology of their lower reaches. The most unsound ecologically is the Irtysh river basin. Its water is highly contaminated by mercury from a caustic soda plant, kerosene from contaminated groundwaters, heavy metals, such as copper (average MPC of 3.4 during 1990-1994), zinc (up to 1 MPC), cadmium, lead, arsenic, which penetrate into Irtysh water through industrial sewage, and oil

Table 7.4: Standards for harmful chemicals in industrial effluents

	Unit of measure	MSc	Index of hazard	Class of danger
pH value	pH units	Within 6-9		
Total mineralization (dry residue)	mg/l	1000 (1500)		
Total hardness	nmol/l	7.0 (10)		
Permanganate oxidizabiity	mg/l	5		
Oil products, total	mg/l	0.1		
Surfactants, anion-active	mg/l	0.5		
Phenol index	mg/l	0.25		
Inorganic substances				
Aluminum (Al3+)	mg/l	0.5	Low toxic	2
Barium (Ba2+)	mg/l	0.1	"	2
Berillium (Be2+)	mg/l	0.0002	"	1
Boron (B,total)	mg/l	0.5	"	2
Iron (Fe, total)	mg/l	0.3(1.0) org.	"	3
Cadmium (Cd, total)	mg/l	0.001	"	2
Manganese (Mn, total)	mg/l	0.1(0.5)	Org.	3
Copper (Cu, total)	mg/l	1	Org.	3
Molybdenum (Mo, total)	mg/l	0.25	Low toxic	2
Arsenic (As, total)	mg/l	0.05	Low toxic	2
Nickel (Ni, total)	mg/l	0.1	Low toxic	3
Nitrates (for NO_3)	mg/l	45	Org.	3
Mercury (Hg, total)	mg/l	0.0005	Low toxic	1
Lead (Pb, total)	mg/l	0.03	"	2
Selenium (Se, total)	mg/l	0.01	"	2
Strontium (Sr2+)	mg/l	7	"	2
Sulfates (SO42-)	mg/l	500	Org.	4
Fluorides (F) for climatic area I and I	mg/l	1.5	Low toxic	2
Fluorides (F) for climatic area III	mg/l	1.2	"	2
Chlorides (Cl-)	mg/l	350	Org.	4
Chromium (Cr6+)	mg/l	0.05	Low toxic	3
Cyanides (CN-)	mg/l	0.035	"	2
Zinc (Zn2+)	mg/l	5	Org.	3
inainte de ultimul gama, sci)(lindane)	mg/l	0.002	Low toxic	1
DT (sum of isomers)	mg/l	0.002	Low toxic	2
2,4- D	mg/l	0.03	Low toxic	2
Chlorine -residual free		Within 0.3-0.5	Org.	3
-residual fixed		Within 0.8-1.2	"	3
Chloroform (with chlorination of water)		0.2	Low toxic	2
Residual ozone		0.2	Org.	

Table 7.3: Surface water pollution criteria

	Maximum allowable value	High level of pollution
Dissolved Oxygen (DO)	6.0 mg O_2/l	3.0 mg O_2/l
BOD_5	3.0 mg/l	15.0 mg/l
Phenol	0 mg/l	0.03 mg/l
Petroleum products	0.05 mg/l	1.5 mg/l
Nitrate ions	9.0 mg/l	10 PDK
Nitrite ions	0.02 mg/l	10 PDK
Ammonium saline	0.39 mg/l	10 PDK
Fluoride	0.75 mg/l	10 PDK
Copper (Cu)	0 mg/l	0.03 mg/l
Zinc (Zn)	0.0 mg/l	11 PDK

Sources: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

Table 7.5: Water standards of organoleptic properties

Parameters	Unit of measure	Maximum
Odor	points	2
Flavor	"	2
Chromaticity	degrees	20(35)
Turbidity	EMF* or mg/l for kaolin	1.5(2)

Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

* Formazine turbidity unit.

Table 7.6: Water quality index for the main rivers, 1994-1996

Rivers	Main pollutants	1994	1995	1996
Ural	Phenols, oil products,heavy metals	2.6	7.2	11.5
Irtysh	Heavy metals, oil products	8.1	6.6	6.0
Sarysu	Phenols, oil products,heavy metals	3.8	3.6	5.4
Nura	Oil products,nitrogen ammonia,nitrates ions	2.9	2.1	2.8
Ili	Nitrats ions, BOD, oil products,fluorides	1.7	1.3	1.4
Syr Darya	BOD, nitrites ion, Cu, sulphates,oil products	0.8	1.6	1.7
Ishim	BOD, nitrites ion, sulphates, tensio-activ sub.	1.6	1.2	0.8

Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

products (5.0 MPC) flowing into Kazakhstan with the Black Irtysh.

The Ili-Balkhash river is heavily polluted by non-ferrous metallurgy and agriculture. Substantive prevention measures have been taken in the basins of the Ili and the Balkhash. The main water polluters are industrial, mining and refinery enterprises, animal farms and irrigated farming. Of the nearly 1,200 major industrial plants in the country, less than half have functioning pretreatment facilities. Municipal waste-water treatment facilities are frequently overloaded or out of order. Yearly more than 200 million m^3 of polluted waste water is discharged into surface water.

Several big cities located in the Aral Sea basin (Shymkent, Kyzylorda, Turkestan, Aralsk, Kazalinsk, Arys, Taraz and many others) both draw water from and discharge municipal waste directly into rivers, sometimes without any treatment. The situation is complicated by the fact that the Syr Darya River is already highly polluted with pesticides when it arrives in Kazakhstan and cannot be used for domestic purposes without special treatment.

The over-exploitation of the Ili River contributed to an increase in the salinity of water in the west of the country, putting the water supply of the city of Balkhash in jeopardy. Also, the Balkhash copper smelter heavily pollutes lake Balkhash with heavy metals and sulphites.

The Nura-Sarysu basin water resources are completely depleted, and the Nura River is extremely polluted with mercury (the river has some 50 tonnes of mercury in its sediments) below Temirtau, preventing use of the Nura-Ishim canal for the water supply of the new capital, Astana. In general, the water resources are very polluted by industries and mines, and the degradation of technology and of waste-water treatment plants put the population and ecosystems at risk. An additional problem is that the development of the surface water resources in that area requires international cooperation, precise evaluation and forecast of the water needs, if problems with the neighbouring countries are to be avoided.

Groundwater pollution with oil, heavy metals, fluorine, pesticides, radioactive contamination and other toxic substances is widespread, and therefore drinking-water quality does not meet standards in most of the populated areas. In large areas, the abstraction of groundwater has caused surface depression.

Over the past 30 years, extensive irrigation works mainly for cotton crops in Uzbekistan and Turkmenistan, with excessive use of fertilizers and pesticides, have caused the pollution of groundwater, a reduction in agricultural yield, and extensive salination of the whole area. The most adversely affected regions in Kazakhstan are the Aralsk and the Kazalinsk *rayons* in the Kyzylorda *oblast*. There are local problems regarding the pollution of groundwaters. In the Semipalatinsk area, the accumulation of oil in the soil of the military airport (6,460 tonnes in an area of about 42 ha) affects the Irtysh river. In the Pavlodarsk area, waste waters are polluted with mercury (900 tonnes on 50 ha).

The quality of drinking water is described in Chapter 14.

7.3 Water use

Abstraction and major use categories

The total volume of water available for use is about 49.7 km^3. The future development of groundwater resources may increase this amount to 61.5 km^3. Surface freshwater is primarily abstracted from the Syr Darya (31 per cent), the Irtysh (14.7 per cent), the Ili (12.9 per cent), the Schu (8 per cent), the Nura (4.1 per cent), and Lake Balkash (0.7 per cent).

Four river basins (with eight River Basin Management Offices reporting to the Water Resource Committee) provide water totalling 32.5 billion m^3 per year, including 27.5 from surface waters, to consumers in Kazakhstan. The remaining water needed is taken from underground sources, the Caspian Sea (for industrial use), or recycled from waste-water treatment. Industries use up to 5.0 billion m^3 per year. The largest water-using sectors are electricity generation, the ferrous and non-ferrous metal industries, and oil production and exploration. These industries are also the biggest water polluters. About 2-3 per cent per year of the total amount of water used becomes irreversibly polluted by industry and is kept in special reservoirs to avoid reuse.

Oil exploration and production is the dominant industry in the Ural-Caspian River Basin (Caspian Sea Basin). The main consumers of oil are the municipalities of Atyrau, Aktubinsk, Uralsk and the industries of their *oblasts*. The most difficult problem in the area is the water supply of the capital of Mangystau *oblast*, the city of Aqtau. The nuclear power plant was used for sea-water desalinization until 1990, but desalinization has been discontinued for economic reasons.

In the Balkhash-Alakol River basin (Balkhash Lake Basin), the main water users are the big municipalities of Almaty, Taldy-Kurgan and several others. The water is used primarily for agriculture and for domestic use. The Ili River, an affluent of Lake Balkhash, originates in China and is very much used for irrigation (cultivation of rice, watermelons and onions). As a result, it does not reach Lake Balkhash. The unique characteristic of this lake is that its western part contains freshwater, while the water in the eastern part is salty.

In the Nura-Sarysu, Tobol-Torgai, Ishim and Irtysh River Basins (Arctic Ocean Basin, except Sa-su River, which belongs to the Aral Sea Basin), the main water users are in industry. The Syr Darya and Shy-Talas River Basins (Aral Sea Basin) provide water primarily to agricultural enterprises. Several big cities are also located in the Aral Sea basin, i.e. Shymkent, Kyzylorda, Turkestan, Aralsk, Kazalinsk, Arys, Taraz and others.

Agriculture uses about 75 per cent of all the water in Kazakhstan. Irrigation technologies are very water-intensive, and half of the used water filters into the ground, causing waterlogging and salinization. It is estimated that some 60 per cent of

Kazakhstan is affected by desertification (see Chapter 12). Water is particularly required for the cultivation of cotton (Syr Darya, Shu, Talas), rice (Syr Darya, Ili), cereals (Irtysh, Tobol), potatoes (Tobol, Ishim) and fodder. Water use in agriculture is not subject to any water-saving scheme (be it economic or administrative), so there is considerable wastage. Also, land reform and the privatization of the State and collective farms did not give rise to the development of a special programme for water use for irrigation by small farmers.

The availability of water differs between *oblasts*. The regions Aktynbinsk, Jeskajgans, Koksytau and Semipalatinsk are in the group of regions with few resources. Starting in 1994, there was a decrease in the volume of water used in the main economic sectors, irrigation and households. The volume used for make-up water in closed circuits has also decreased.

Drinking water

Kazakhstan is divided into 14 administrative regions and 158 administrative districts. It has 84 cities, 198 urban settlements, 2,456 rural districts, and 7,071 rural settlements. In many areas, less than 50 per cent of the water needed by the population is available. The situation is extremely difficult in the Aral Sea area.

In 1997, 93 per cent of the urban population was connected to a piped water supply, and 26 per cent of the rural population enjoyed a piped water-supply system. The percentage of the urban and rural population that has a safe water supply for more than 300 days a year is unknown. Most of the water – up to 90 per cent – is available in spring, making groundwater of great importance for Kazakhstan. Groundwaters meet 56 per cent of the population's needs, and about 45-55 per cent of the industrial needs. The water needs of many southern cities are satisfied by mixing groundwater of good quality (without treatment) with water from artesian wells and mountain rivers and lakes in water-mixing units.

Municipal water use stands at 1.3 billion m^3 per year. Water networks are developed in 82 towns with a population above 50,000, and in 186 small townships. The officially calculated average national water use is 220 litres per capita a day. However, the large quantities of water lost in distribution are not included in this figure.

The water supply for the Aralsk and the Kazalinsk *rayons* in the Kyzylorda *oblast* depends on the Syr Darya and its system of irrigation canals, artesian groundwater bores and highly saline shallow wells. The majority of the villages in these two districts had big waterworks installed in the late eighties or early nineties, with water-treatment plants, including desalinization equipment, reservoirs, water towers, generators, etc. Some of the villages were supposed to be served by the Aralsk-Sarybulak Water Supply (ASWS) system. Construction of the well field in Kosoman and Berdykol and the pipeline system started in 1977. Some of the villages are actually connected to the system, but only very few are getting their water from it, as the cost is too high (60 tenge or 80 tenge per m^3), the system is very big, it is difficult to operate and to maintain, and there are many leaks in distribution.

Water use from decentralized, open sources (including irrigation channels) for drinking-water purposes has increased. For example, in the Akmola *oblast* in 1998, the population using water from open sources doubled. In 1999, 26.4 per cent (23.5 per cent in 1998) of water samples from the piped networks did not meet sanitary-hygiene requirements, for lack of sanitary protection areas or of facilities for disinfection and neutralization.

7.4 Water policies and management responsibilities

Legal provisions

The Law on Environmental Protection is the principal regulatory instrument for managing water resources. The Water Code, adopted on 31 March 1993, regulates water management in detail, provides the framework for the regulation of domestic, industrial and agricultural water use, and ensures the respect of environmental requirements. It allows the creation of water associations for irrigation at farm level, and privatization of the district water organizations. The irrigation infrastructure (on-farm network, inter-farm secondary network, and equipment/machinery) may also be privatized.

The Water Code’s water protection provisions against pollution, littering and depletion do not cover the standardization of water quality and the maximum admissible discharges of harmful substances into water, specific features of the legal protection of seas from pollution, or the oil

contamination of water bodies. Only sanitary rules and standards of coastal sea water protection from pollution at places of water use by the population were approved in 1988 by the USSR Ministry of Health, and are being applied.

Kazakhstan adopted a new Law on subsoil and mineral exploitation on 27 January 1996 by Presidential Decree No. 2828. This Law retains the basic licensing and contracting regime for granting subsoil use rights from the old law. Thus, the Law provides for State ownership of the subsoil, including groundwaters. However, the rights for the exploration, development and extraction of minerals and groundwater may be licensed by the Government, and a contract concluded with a private enterprise.

Drinking-water quality is regulated by the GOST Drinking Water Hygiene Requirements and Quality Control, GOST 2874 –82 (introduced 01.01.85) and SNIP 2.1.4.559-96-Drinking Water and Water Supply for Localities, Hygiene Requirements for the Quality of Centralized Water Supply, Quality Control. The epidemic safety of drinking water is assessed for its conformity with microbiological standards (GOST 2874-82) listed in Tables 7.2 and 7.3.

Policies and priorities

The Strategic Plan up to 2030 for the environment and natural resources reflects water policy objectives. On this basis, the National Environmental Action Plan for Sustainable Development (NEAP/SD) includes the following priority measures for water policies and management:

- The rehabilitation of the water conservation zone of the Syr Darya river
- The development and implementation of inter-State measures to preserve transboundary watercourses ecosystems
- The study of methods and approval of action aimed at reducing the negative impact of highly toxic mercury pollution of ground sediments of the Nura river (in the Karaganda *oblast*) and groundwater (in the city of Pavlodar)
- The improvement of water resource management in the Balkhash-Alakol river basin (pilot project)
- Reducing drinking-water consumption and losses in the municipal sector (a pilot project for Almaty as a case study)
- The construction and rehabilitation of sewage treatment facilities in Kyzylorda and Shymkent (pilot projects)
- The prevention of pollution of water sources by mining and industrial waste in the northern in the East Kazakhstan *oblast*
- The prevention of leaching of oil products into groundwater
- The building and reconstruction of municipal waste-water treatment facilities
- Water resources conservation

For details, see Chapter 1. The Ministry of Agriculture has developed a strategy regarding water for irrigation, but it was not available during the EPR review mission.

Transboundary water issues

Following the independence of the Central Asian republics in 1991, the management of water resources became an international task to be undertaken jointly by the countries concerned. The management tasks include the sharing of water resources, the related water-quality management, and the management of water storage and control. Additionally, common tasks relate to the measurement of rainfall, river flows and water quality – all quite well developed in the Soviet period. Since independence, the respective monitoring systems have deteriorated, and modern methods for the electronic transmission and storage of data are not yet in place. Finally, remedial measures for the Aral Sea and wetlands ought to be agreed. The practical measures in these respects are strongly linked to the management of the Aral Sea problem and are reviewed in Chapter 8.

Institutional responsibilities

The Ministry of Natural Resources and Environmental Protection approves discharge limits, grants and revokes permits and licences for discharges of pollutants to water bodies, and grants and cancels permits for special-purpose water use. Among the ministerial bodies managing natural resources, or supervising specific aspects of water management, are the Committee for Water Resources and the Committee for Geology and Underground Resources Protection. In addition to the MNREP, the Ministry of Health, the State Committee on Emergency Situations, the Agency for Control of Strategic Resources and the Ministry of Agriculture also have water management tasks.

The Committee for Water Resources is responsible for maintaining and operating the existing inter-farm system for the delivery of irrigation and rural drinking water through regional and district water resources committees. It is responsible for inter-sectoral and inter-regional water allocation, and for defining national polices on water quality and the protection of water resources. It administers international river systems with respect to water sharing. It supervises the eight national River Basin Water Directorates (GoskomVodResurs), which are the Aral-Syr Darya, Balkhash-Alakol, Irtysh, Ishim, Nura-Sarysu, Tobol-Turgay, Ural-Caspian and Chu-Talas.

The Committee on Water Resources regulates the use of surface water resources, avoiding overuse and contamination. It implements the scientific and technical policies needed for the continuing use and protection of water, and protects the interests of the country in inter-State distribution of water resources. The Committee is in contact with other water management partners, including water users. The Committee on Geology and Underground Resources Protection has analogous responsibilities for groundwater.

The Ministry of Agriculture is in charge of agricultural research and extension, and on-farm agricultural and land reclamation development. It is also responsible for the monitoring of drainage, waterlogging and soil salinity conditions in the major irrigation projects in the five southern provinces. After the dissolution of the Ministry of Municipal Services in 1993, the Ministry of Municipal Affairs supervises domestic water supply and waste-water treatment, while the management of the main water supply network at provincial and inter-provincial levels falls under the authority of the Committee for Water Resources. In addition to water users, Kazhydromet is responsible for water monitoring.

Local bodies are involved in the implementation of the NEAP/SD. Permitting, monitoring and control of compliance with the conditions of nature use, as well as enforcement measures, are mainly applied at local level.

7.5 Drinking-water and waste-water treatment

Treatment of drinking water

From an institutional point of view, municipal companies (‘vodokanal’), where they exist, are charged with drinking-water supply as well as sewerage and waste-water treatment. The conditions under which these companies operate vary considerably from city to city.

Almaty. The municipal company supplies about 1 million m^3 of drinking water daily to the 1.2 million people in the city and surrounding settlements. The present supply system in the municipal area extends over 300 km. The pipes are of steel and approximately 25 years old, except main pipes (about 30 years old). Loss within the pipe system varies between 34 per cent and 80 per cent. In the course of a pilot project, 200,000 water meters have been installed in 98 per cent of houses and in 30 per cent of flats. Since then, water use has gone down. It is now quoted as being at approximately 280 litres per inhabitant daily, but calculations based on the volume of waste-water treated would indicate considerably higher water use. The price per cubic metre of water is between 9 and 10 tenge. Unmetered water use is charged on the basis of flat size and number of occupants registered in the flat. Industry pays nearly all its water use bills, and up to two thirds of households pay theirs.

About 75 per cent of the water supply is abstracted from groundwater sources (well depth between 15 m and 500 m). Groundwater is chlorinated in 74 treatment stations before being fed into the distribution network. The remaining water comes from rivers and is processed in two waterworks, equipped for self-monitoring and sample analysis. The treatment of water includes coagulation, sedimentation, flocculation, filtration and chlorination.

Kokshetau. The majority of the population in the settlement area is centrally supplied, in some parts a piped supply outside the building is available (at a distance of 200 m in the town), and settlements of the town of Kokshetau are supplied by tanker. Some 140,000 people are supplied in these ways, at a rate of around 170 litres per person per day. Water losses due to burst pipes (an average number of 37 a month) officially stand at 30 per cent. Most supplied people pay flat rates, but enterprises and some houses are metered. The fee, including the supply price and waste-water treatment, amounts to 33 tenge/m^3.

Groundwater is the source of about 30 per cent of the supply. This part is used without treatment. The remaining water is drawn and produced from a reservoir by a water plant, in which treatment has similar characteristics to those described for

abstracted surface water in Almaty. However, its laboratory equipment appears to be less developed.

Atyrau. The water supply is shared between the public petroleum company (KazTransOil) with distribution being in the hands of the local 'vodokanal' company. Water production amounts to around 60,000 m^3 daily, abstracted from rivers flowing down from the Ural mountains close by. Groundwater cannot be used, as it is too saline. The treatment of raw water for use in Atyrau includes coagulation, sedimentation, filtration and chlorination. Biological and some chemical parameters are being tested in the company's laboratory. Water quality in the network is monitored by 'vodokanal'. The distribution pipes in Atyrau are of high-grade steel, showing, however, signs of corrosion. KazTransOil not only supplies water to the city of Atyrau and the surrounding villages, but by pipeline and untreated, over a distance of about 1,000 km, it also supplies oil fields, as well as the city of Aqtau. The steel pipeline has serious leaks.

Atyrau has around 110,000 registered inhabitants, but estimates are that a further 85,000 unregistered people are also supplied with water. The drinking-water pipes in the city total some 200 km, and have large leaks, producing losses in distribution of up to 60 per cent. Present water consumption is calculated at 270 l/person/day, and the plan is to reduce it to 160 l/person/day. It is assumed that people in wooden houses without central supply require 40 l/person/day. There are few meters. Water costs roughly 14 tenge/m^3 and about 40 to 50 per cent of the consumers supplied actually pay for it. Investments in the water-supply system are being prepared.

Waste-water treatment

Waste waters from industry, agriculture and households represent about 9 km^3, of which 2 km^3 are discharged directly into rivers. The remaining quantity is discharged into specially prepared lakes, so that part of the abstracted water will not return to its source. The quantity of pollutants discharged into surface waters through waste waters is shown in Table 7.7.

Almaty. About 80 per cent of the 1.2 million inhabitants of Almaty and the surrounding settlements are connected to municipal sewerage. Separate collectors exist, but only waste water is collected in sewage collectors, while storm water is discharged to surface waters directly. A few industrial enterprises have their own waste-water treatment installations, however, they also discharge into public sewerage, as only the municipal company is entitled to discharge into surface waters. Steel collectors along all streets collect sewage from households, and commercial and industrial enterprises. The pipes lead to the waste-water treatment plant, located 45 km outside the city. The treated waste water is discharged to a lake, another 45 km away from the treatment plant. From the lake, a 52 km long canal leads to the Jri river. Discharge to the river is controlled in such a way that river water pollution does not exceed standards. As a rule, discharge is only possible during summer. In 1999, a discharge of 13 million m^3 of treated waste water was authorized. This corresponds to waste-water generation of about 30 days. The water in the above-mentioned lake is used for irrigation. The sludge from waste-water treatment is pumped to a large surface 10 km away from the treatment plant, where it is dried and then deposited.

Table 7.7: Discharges of pollutants into surface waters, 1995-96

	Units	1995	1996
Suspended solids	*10^3 tonnes*	159.83	205.00
Nitrogen ammonia	*10^3 tonnes*	3.46	1.64
Nitrate ions	*10^3 tonnes*	1.91	2.03
Organic compounds	*10^3 tonnes*	12.84	6.26
Oil products	*10^3 tonnes*	0.44	0.24
Phenols	*tonne*	0.57	0.58
Tensio-active subst.	*tonne*	84.01	46.27
Total phosphorus	*tonne*	51.39	35.77
Iron compounds	*tonne*	204.63	147.49
Copper	*tonne*	7.12	9.46
Zinc	*tonne*	24.89	18.65
Nickel	*tonne*	0.05	0.05
Mercury	*kg*	35.70	25.10

Source: Kazakhstan National Department of Hydrometeorology, "Report on the Pollution of Environment in Almaty City", 1990.

The treatment plant was first built in 1974. It contains mechanical and biological treatment technology, which are separated by pipes over a distance of several hundred metres. The daily inflow of waste water totals 400,000 m^3 and contains 48 to 72 tonnes of BOD_5 (i.e. 120-180 l/day). The plant treatment efficiency is reported to be 88.5 per cent. The long distances over which collected sewage is transported between point of generation and treatment leads to chemical

reactions inside the pipes, which create nuisances and complicate treatment. Furthermore, pumping is required prior to the treatment plant, inside the treatment plant and for the sewage sludge, making the system energy-intensive.

Kokshetau. The sewers in the city area of Kokshetau are similar to the installations in Almaty. Separate systems exist as in Almaty. They transport waste water to a treatment plant 7 km out of town, from which the treated waste waters are led to a first lake 17 km away, then to a second lake. The inflow is regulated through maximum allowable limits for selected parameters (BOD_5 of 20mg/l, oils and fats 0.05mg/l, phosphorus 15mg/l, nitrogen 20mg/l). The limits for phosphorus and nitrogen are often exceeded, leading to fines payable to the environmental protection fund. The charge for normal effluents is around 14,000 tenge per tonne of polluting substance. Information on how many users are connected to sewerage was not available during the EPR review mission.

The treatment plant was built for a capacity of 32,000 m^3/day, and it handles currently 23,000 m^3/day. The inflow carries around 150 mg/l of BOD_5 and has a COD concentration of around 300 mg/l. The efficiency of the station's mechanical and biological treatment reaches 83 per cent. The sludge obtained in waste-water treatment is stabilized in a digester tank before its use in agriculture. It is not clear whether the gas generated in the tank is used or can be used for reducing the plant's high energy requirements.

Atyrau. Sewerage is limited to municipal and industrial waste water. The Ural divides the city. The waste water from one side is transported to a mechanical treatment plant, from where it flows to a lake 4.5 km away. The waste water collected in the other part of the city (including several industrial sites) remains untreated and is transported to another lake.

The treatment plant was built for a capacity of 31,000 m^3 per day, but currently treats only 13,000 m^3/day. Its treatment efficiency varies between 30 and 60 per cent, depending on the characteristics of the effluents. The plant is in bad overall condition and requires refurbishing and extension. The sludge generated in the process remains in the grounds of the treatment plant. Special problems have occurred because of the rising water table during recent decades (Atyrau is located on the Caspian Sea, see Chapter 8) and the substantial leakage from pipes.

7.6 Conclusions and recommendations

Kazakhstan has strengthened its water management efforts in recent years and is continuing to do so. The Government outlined its priorities for water management in the strategic action plan. Much attention is given to the reformulation and extension of the legislative and regulatory framework, e.g. charges for water use and the coordination of State monitoring. Furthermore, problem-oriented programmes and projects for their implementation are being developed (e.g. plans for the improvement of the drinking-water supply). However, despite all the regulations and programmes, few measures have been taken so far to reach the water management objectives.

As for the further development of an adequate legal framework for water management, the Water Code no longer corresponds to the real social and economic situation in the country. In particular, it does not include the necessary legal basis for ensuring that water is protected from pollution, littering, and depletion, and that water for economic and other needs is used rationally. Water wastage by households and industry is high, also because there are no incentives to save water. The Water Code developed economic instruments and governmental management mechanisms insufficiently, and standards allowing water use for business activities are not covered. Furthermore, legal acts dealing with sea pollution need to be revised. There is an urgent need for the regulation of oil pollution of water. The corresponding legal instruments will have to comply with the international conventions that Kazakhstan has signed.

Recommendation 7.1:
The Water Code should be revised as soon as possible. The revised law should focus on the efficiency of water use and the reduction of water pollution. It should cover ambient water quality as well as waste-water discharge and effluent standards and should identify necessary regulatory and economic instruments which are likely to reach the objectives specified in the law. See Recommendations 1.1 and 14.1.

The development of an adequate legal and political framework for water management has to be complemented by sufficient organizational measures. Improving the management of water resources requires further implementation of the river basin approach. National action plans have already been developed for some rivers. Further institutional changes might be required to design an

effective integration of land-use planning with water management and conservation for the country as a whole. Such integration should coordinate activities at all levels and include the development and management of contingency plans for accidental spills and the response to natural disasters.

The authority of the local bodies and basin authorities and their responsibilities in the organization and implementation of environmental measures should be expanded, possibly with the help of legal instruments that promote the participation of all relevant stakeholders. The newly established associations of agricultural water users are still too weak to manage the system and prevent overuse of water resources. The joint solution of environmental problems at all levels between national and local authorities would improve links and cooperation between national and local administrations. In Kazakhstan, the majority of nature protection expenditures by the public sector are made by local sources. Yet, the decentralization of responsibilities is rarely matched by sufficient resources. The result is an excessive fragmentation of capacities, resources and responsibilities.

Recommendation 7.2:
Institutional frameworks should be envisaged that bring together water utilities, non-governmental organizations, the private sector, and community groups to exchange views, contribute skills and prepare decisions on water-supply and sanitation projects. The responsibility for standard-setting should be streamlined in order to avoid differences in water management as undertaken by the various participating institutions.. Institutional changes should favour the preparation of basin action plans, particularly for high-risk basins, including their rivers, lakes and groundwaters.

The most important water management tasks in Kazakhstan are to ensure a safe water supply, suitable water quality in rivers and groundwater, and waste-water treatment facilities throughout the country. Immediate action is required to solve acute problems that endanger the safety of the drinking-water supply. It seems that supply systems are not functioning properly because of a lack of maintenance. This results in water losses during distribution, and direct exposure to pollution. It is therefore necessary to evaluate the situation in each region, identifying major accidents and problems that occur or have occurred in both public and "unorganized" water-supply systems. The criteria that need to be used in this analysis are the quality of the water, the sensitivity to environmental pollution and water losses in the networks.

As groundwater is growing in importance as source of drinking-water supply, the gradual decrease in its quality is likely to become a serious concern if adequate measures are postponed for too long. Priorities and action plans should begin to concentrate on preserving groundwater resources for drinking water. Due to the increasing degradation of the currently exploited aquifers, it is important that deeper aquifers are sought, and protected and managed appropriately. The implementation of mapping programmes for the identification of aquifer recharge areas, the establishment of national inventories of known groundwater resources and the characterization of aquifers and the determination of their response to groundwater development activities could respond to the requirements. Such aquifer information would allow water managers to identify recharge and abstractions areas as well as interactions between surface waters and aquifers, and to establish adequate control of the types of activities taking place in these areas.

Recommendation 7.3:
Measures are required for improving the long-term security of the drinking-water supply to both the urban and the rural population. They should involve the identification of suitable groundwater reserves and their protection, as well as the development and application of rapid assessment procedures for the identification, inventory and quantification of pollution sources endangering groundwater quality in abstraction areas *See Recommendation 14.1.*

To establish a long-term programme and a national strategy for water it is important to identify goals, priorities and financial resources. One way of preparing a coherent overall strategy would be to specify (a) a national water planning programme, (b) a national master plan for water resources and sewage treatment, (c) general plans for groundwater resources, and (d) general plans for runoff basins. Planning future water resources needs a strategic programme and policy guidance, in order to direct and set up action plans. Improving waste-water treatment performance should be a priority among the protection measures, in order to reduce the pollution burden on freshwater. The envisaged measures should be integrated into the revision of NEAP/SD (see Recommendation 1.2), but must not be delayed by that process.

There have been no significant investments in the domestic water or waste-water infrastructure since the dissolution of the Ministry of Municipal Services in 1993. Other factors have contributed to the problems of the water economy. The urbanization process in Kazakhstan was such that many settlements developed around industries. This implied that many of the water-supply and sewerage networks were built as temporary schemes, which were never optimized. This is the case of Karaganda, Zhezkazgan, Satpaev, Temirtau and some others. Also, most of the industries had their own water systems, now in the hands of the municipal water companies, but completely depreciated, with no maps or technical specifications of the infrastructure available.

Monitoring is of great importance to water management and is another area requiring development in Kazakhstan. So far, monitoring-including the provisions for effluent self-monitoring by polluters-has mostly been used to show and record point sources of pollution. It should be extended to both individual and public supply systems, to help detect leaks and prevent quality problems. The monitoring data should be used more systematically in analysis and for action plans. The required environmental information strategy should, *inter alia*, ensure that the planning, construction and management of engineering works are based on the best scientific information. See Recommendation 1.3.

Recommendation 7.4:

A comprehensive water strategy and a complementary programme for implementation should be developed. In addition to drinking-water supply issues, it should focus on waste-water treatment efficiency. The following measures could be envisaged:

- *The identification of a priority list for investments in sewerage and waste-water treatment, covering the construction of new and the repair of old installations, their scheduling, and their funding arrangements.*
- *The introduction of water metering for all users.*
- *The specification of a long-term water pricing strategy to cover the full cost of investment, maintenance and operation of all water-production and waste-water treatment infrastructure. The resulting social hardship should in the long term be avoided through solutions other than water pricing, in order not to complicate water supply and treatment unduly.*
- *The training of waste-water treatment staff in plant operation, process control and instrument operation.*

Chapter 8

MANAGEMENT OF SELECTED PROBLEMS IN THE ARAL AND CASPIAN SEA REGIONS

8.1 Overview of the problems

Problems in the Caspian Sea area in Kazakhstan

The rise in sea level. The Caspian Sea is the largest landlocked water reservoir in the world with a surface of 378,000 km^2 (Table 8.1). Five large rivers supply 90 per cent of the inflowing freshwater. The largest two, the Volga and the Ural, enter the Sea in the shallow zone in the north, keeping salinity down. The average salinity of the Sea is 1/3 that of average sea water; it is classified as brackish and mesosaline, creating a specific hydrochemical environment. The Sea and its coastal region have a rich biodiversity, with a high number of both aquatic and terrestrial endemic species. A key feature is that the sea level has progressively risen by more than 2.5 metres since 1977, and is continuing to rise. The causes of this phenomenon, likely linked to tectonics and climate change, have not been fully explained as yet.

Table 8.1: Characteristics of some major landlocked water bodies in Central Asia

	Area (km^2)	Maximum depth (m)	Water volume (km^3)	Salinity g/l
Caspian Sea* 1975	378,000	1,025	78,700	5-12
Caspian Sea* 2000	418,000 **	1,027	79,700	5-12
Aral Sea 1960	~68,000	53	~1,040	~10
Aral Sea 1998	28,700	35	181	~45
Balkash Lake	18,200	26	112	..
Issyk kul Lake	6,236	695	1,740	..

Source: UNEP/CEP webpage; Lonely Planet on Central Asian Countries, 1999; German Remote Sensing Data Centre, 1999.

* the world's largest landlocked lake

** will further increase by about 25 000 km^2 if the rise continues at the same pace

The Kazakh coastline (2,300 km) in the north (Atyrau *oblast*) borders the Caspian depression and in the east (Mangystau *oblast*) borders the stony desert of the Ustyurt plateau. Most of this coastline is very shallow, being mainly less than 5 metres deep. Therefore the rise in the water level is particularly sensitive there, as it floods large flat inland zones. Moreover, storms are not rare. Wind tides and waves lead to a threat of flooding of low-lying areas as far as 50 km inland. In these lowlands 43 petroleum deposits are located, as are petroleum and gas pipelines, an oil refinery in Atyrau, major communications and transport structures and arteries, the Atyrau airport and city, high-voltage electricity lines, the Mangyshlak nuclear power plant, sewers, and the seaport of Aktau. Since 1977, about 1.1 million ha have been affected by the fluctuations of the sea level, causing damage estimated at US$ 2 billion. An additional 2.5 million ha are expected to be flooded soon, posing a threat to key infrastructures, such as the nuclear power plant.

Environmental pressures from economic activities. The principal economic activities in the Atyrau and Mangystau *oblasts* are (i) petroleum production and

related industries, (ii) fisheries, centred on the sturgeon stock, and (iii) agriculture.

The Caspian region is endowed with rich oil deposits (46 per cent of Kazakhstan's potential oil reserves are in the Atyrau *oblast* and 28 per cent in the Mangystau *oblast*). The development of oil production is being hampered so far by the transport problem. As soon as transport routes are open, production will increase in accordance with the development strategy. The oil and gas industry occupies the first place in terms of investment. It is also the main polluter. Most installed technologies and equipment are outdated and oil spills are frequent. A total of about 12,000 stationary sources of air pollution have been registered. Gas flaring inflicts significant ecological damage: heavy emissions of sulphur and nitrogen dioxides, CO and toxic hydrocarbons with a negative impact on air quality, deposition on soils, a toxic impact on vegetation and animals, increased greenhouse-gas emissions, etc. (see Table 8.2). In addition to the current pollution, the rise in the sea level has flooded an estimated 200 to 800 oil wells and oilfields, including the largest ones, Kalamkas and Karazhanbas, polluting the Sea and threatening its biological diversity (sturgeons, Caspian seals and other endemic species). For more details on oil production and its environmental impacts, see Chapter 9.

Table 8.2: Emissions of pollutants into air at the Tenghiz site

	MPE*	Actually achieved	Air deposition - Atyrau oblast
	1 000 tonnes/year		*average kg/cap*
1997	..	..	287
1998	55	82	..
1999	36	75	440
2000	22	18**	..

Source: NGOs Atyrau.

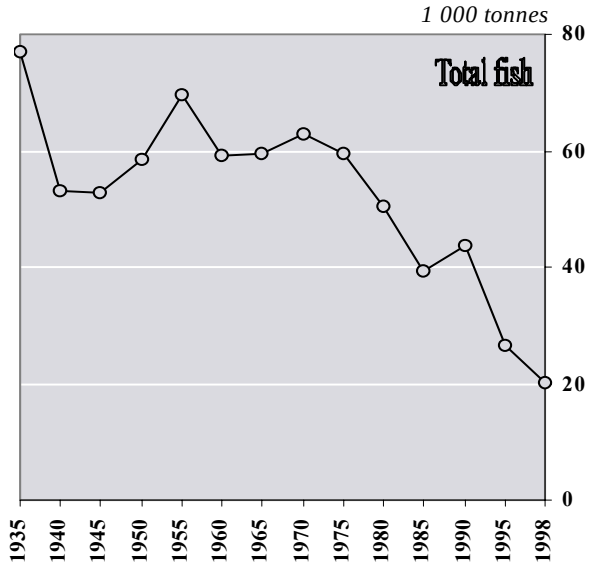
* maximum permitted emissions

** for the first 3 months of 2000

Table 8.3: Fishing by Kazakhstan of selected commercially exploited species in the Caspian Sea and Ural River Delta, 1995-1998

1 000 tonnes

	Sturgeon	Pike perch	Sprat	Bream	Herring	Total
1935	4.1	12.4	1.8	5.8	6.6	76.9
1940	1.3	2.7	2.1	4.3	27.7	53.1
1945	0.3	8.3	0.6	15.3	10.2	52.8
1950	0.1	10.2	1.3	14.5	5.1	58.6
1955	0.7	10.5	12.0	6.6	8.0	69.7
1960	1.6	7.4	20.1	3.6	4.2	59.2
1965	3.9	1.1	43.5	1.8	0.02	59.6
1970	5.2	0.5	45.4	1.4	-	62.7
1975	8.2	3.2	36.7	2.1	-	59.4
1980	8.1	0.2	35.2	0.2	-	50.3
1985	5.9	0.8	26.0	1.2	0.01	39.3
1990	1.9	3.6	28.1	3.3	0.02	43.8
1995	0.6	3.2	10.1	6.6	0.01	26.7
1998	0.5	-	6.4	-	0.2	20.3



Source: Caspian Regional Thematic Centre on Biodiversity Protection, Atyrau, 2000.

The second important traditional economic activity of the two *oblasts* is fishing. For a long time now, the Ural River has been known as being second only to the Volga River for its sturgeons and other fish stocks, of which sprat is the most fished. The sturgeon population of the Caspian Sea used to represent about 90 per cent of world sturgeon stocks. The catch of sturgeon for food and caviar is highly valuable. The Ural-Caspian region is inhabited by four commercial species of sturgeons: the great sturgeon *Huso huso*, the Russian sturgeon *Acipeser gueldenstaedtii*, the stellate sturgeon *Acipeser stellatus*, and the spine sturgeon *Acipeser nudiventris*. Compared with the Volga River, the Ural is less affected by human and industrial activities upstream, except in the delta itself (oil industry). There are still spawning areas for sturgeon where natural reproduction occurs.

However, in the 1980s, fishing of sturgeons intensified dramatically, as has poaching since the 1990s, stimulated by the economic crisis and social problems, and facilitated by the weakening of institutions. At the same time, pollution reduced plankton productivity and affected sturgeon reproduction rates. The result is a drop in sturgeon catch in the Ural from about 8,000 tonnes in 1980 to 400 tonnes today, a trend that is similar for other fish species (See Table 8.3).

Though ranking third in economic activities, agriculture is underdeveloped. It consists mostly of animal husbandry (1 million head of cattle, 0.6 million sheep, 65,000 horses and 45,000 camels), with nomadic pasturing on generally vulnerable pastures. The Caspian depression is the sub-area for Astrakhan sheep breeding (see Table 12.5). The production of grain is not important (10,000 tonnes for both districts together). The rise in the sea level has caused the loss of productive agricultural lands and pastures, thus pushing cattle to graze in polluted areas, overgrazing vulnerable lands threatened by desertification. Another problem in the Mangistau *oblast* concerns the residues of persistent pesticides, herbicides and defoliants in animal food. Broad Beta-HCH and DDT contamination has been detected.

Mining activities were also important in the Aktau region. About 105 million tonnes of radioactive uranium mining wastes are deposited in a natural pond of 72 km^2. Previously, they were covered by water pumped from the sea. The pumping, too costly, has been interrupted and the deposits are now in the open air, the dusty materials suspended by the wind. There is a suspicion that the pond is leaching, thus threatening the underground aquifer used for drinking-water abstraction.

Threats to biodiversity. The aquatic and terrestrial biodiversity in the Caspian Sea region is very rich and specific. This is due to a combination of various factors. As a landlocked water body, the Caspian Sea holds a rich endemic fauna and flora. It possesses a unique variety of habitats: from vast river systems like the Volga, Ural, Kura, which discharge into the Sea through shallow deltas, where freshwater and sea water mix, to intense evaporation zones with high salinity (brine water in the Kara-Bogaz-Gol). Water depth ranges from shallow (Atyrau depression around the Ural delta with an average depth of 4.4 metres) to deep in the southern part of the Sea (1025 m). The climate varies from cold with continental deserts and semi-deserts in the north and east to warm in the south and southeast.

Table 8.4: Pollutant contents in the Ural River and the Caspian Sea, 1990, 1995 and 1999

	in Ural River				in the Caspian Sea			
	MAC mg/l	1990	1995	1999	*MAC mg/l*	1990	1995	1999
Copper	***0.001***	0.012	0.0006	0.00	***0.001***	0.000	0.00	0.00
Zinc	***0.01***	0.037	0.004	-	***0.05***	0.000	0.00	-
Chromium	***0.001***	0.0016	0.002	0.00	***0.001***	0.000	0.00	0.00
Manganese	***0.01***	0.009	0.016	0.00	***0.01***	0.00	0.025	0.00
Oil products	***0.05***	0.039	0.071	0.0031	***0.05***	0.0028	0.052	0.03
Phenols	***0.001***	0.001	0.001	0.00	***0.001***	0.00	0.00	0

Source: Laboratory of the regional office of the MNREP, Atyrau City, 2000.

The regulation of river discharge (i.e. hydropower stations) modifies the natural hydrographic regime and hampers the reproduction of semi-migratory fish (in particular sturgeon, Caspian salmon and herring). It causes the clogging of channels in the Ural River delta, and disturbs fish migration and spawning areas. Water, air and soil pollution represents further dangers. In the 1980s, various diseases hit the fish population because of the accumulation of heavy metals and pesticides in their tissue. These substances were brought with river water, as were other organic substances (surfactants) that are responsible for the eutrophication of coastal waters (Table 8.4). Since the early 1990s, pollution pressure has decreased with the economic crisis, but the rise in the water level caused the flooding of oil wells and fields, thus polluting the sea water. This has currently a detrimental impact on biodiversity conservation and on fish reproduction (the pollution of sturgeon spawning areas for instance). In 1980s, huge numbers of sturgeons died from cumulative polytoxicosis, presenting signs of disruption in the caviar structure. Some contaminated sites in the

Ural delta became unsuitable for fish and other aquatic organisms.

The Sea contains about 400 endemic species. 76 species of fish are represented, 40 are of commercial importance (e.g. sturgeon, herring, sprat, grey mullet, pikeperch, bream, roach, carp, sander, asp). Sturgeon, the most ancient phylogenetic fish group, is represented by five species and two sub-species (of which only four are commercially exploited). Like others (e.g. Caspian salmon, Caspian lamprey), they are becoming rare. Five species of fish are included in the Kazakh Red Data Book. Similarly, the diversity of benthic fauna and plankton is decreasing, as they are affected by high levels of phenol concentration and the polluting substances discharged by the Volga and Ural Rivers. Average annual concentrations of oil compounds in coastal waters are about 100-150 µg/l. There have been repeated accidents involving oil spills into the sea.

The Caspian Sea shelters an important population of indigenous seals (estimated 450,000-500,000 animals). They are badly hit by the pollution of the Sea, in particular pollution from oil and gas exploitation. In spring 2000, seals suddenly died in great numbers (4,000 or more, mostly young). Previous studies have shown that exposure to chronic pollution makes them vulnerable to the long-term effects of toxic substances: 16 per cent have heart diseases, 24 per cent lung diseases, 52 per cent stomach problems, 32 per cent intestinal problems, and many have liver diseases and bile accumulation.

Table 8.5: Biodiversity of the Caspian Sea region on Kazakh territory

	Species	Types	Families
Flora	**945**	**371**	**88**
High plants*	357	185	35
Benthic algae	64	..	..
Phytoplankton	414	..	..
Fauna			
Animal plankton	100	..	..
Benthic fauna	379	..	..
Fish**	76	..	17

Source: Caspian Region Thematical Centre, Atyrau.

* 7% of them endemic to the Kazakh Caspian Sea region

** including marine, anadromous, self-migratory and river/coastal fish species; in total 124 fish species inhabit the Caspian Sea

Wetlands represent the transition between aquatic and terrestrial biota. The shallow coast in the north is a large and expanding zone of high (3-6 metre high) reed thickets (mostly *Typha angustifolia* and *Phragmites australis*). It is an important habitat for seasonal bird migration and has rich bird populations (pelicans, grey goose, river ducks, common shelduck, sea gulls, etc). 10 to 12 million waterfowl rest or nest there for their annual migration. The bird population peaks in summer (density 930 birds per km), although 3-3.5 million birds of 278 different species stay over winter (density 170-220 birds per km). 36 species of them are included in Kazakhstan's Red Data Book.

The biodiversity of inland coastal territories is important as well. The vegetation of the Caspian plain is represented by 945 species belonging to 371 types and 88 families. 357 species of 35 families of high plants are represented in the coastal flora (Table 8.5). 7 per cent of flora species are endemic to Kazakhstan, 6 of them are in the Red Data Book. The *tugay* woods in strips along rivers in the delta consisting of dense groves of hydrophilic plants have been reduced by 90 per cent, owing to overgrazing. They used to shelter a wide variety of flora and fauna. The desertification of the Ustyurt plateau (a stony desert bordering the east coast) with salt-tolerant desert plants, has been accentuated by the disappearance of Saxaul trees, a typical vegetation that stabilizes soils. The Kazakh inland also hosts 56 species of mammals. For example, the Ustyurt plateau is the habitat for mouflon, oytred gazelle, saiga and falcon.

Currently, the biodiversity of inland coastal territories is increasingly threatened by natural (climate, droughts, the rise in groundwater level), but also by anthropogenic factors (unsustainable use of nature, the oil industry and other polluting activities, urbanization, uncontrolled grazing, the uprooting of bushes, intensive agriculture, etc). The result is that the land desertifies, the soil salinizes and becomes polluted, natural habitats shrink (in particular for migrating birds), and the evolution of vegetation becomes unpredictable. There are a few protected areas, such as the water and flood plains in the north Caspian zone and a series of sanctuaries with specific protection purposes (Karagy-Karakol, Shortanby, Aktau-Bresachin), but there is not yet a biosphere or Ramsar reserve.

Human health risks. About half a million people live in the Kazakh coastal area of the Caspian Sea. There are no monitoring systems for air and water

quality in Aktau and Atyrau cities, making it difficult to establish links between environmental conditions and human health problems. Nevertheless, in both *oblasts* the situation is serious (see Chapter 14 for details). The degradation of public health is attributed, in part, to existing environmental problems. The heavy impact of oil production and associated gas flaring on air quality, dust storms and winds that are registered 320 days per year in the Atyrau region, all affect the respiratory tract. A high level of cancer incidence, two to three times the country's average, is attributed to the presence of hydrocarbons. The poor bacteriological quality of drinking water and contaminated food cause hepatitis A and other waterborne diseases. The high content of mineral salt in drinking water explains kidney and bladder diseases. Almost 40 per cent of the population drinks untreated surface water of poor microbiological quality. 30 per cent of schools and as many hospitals are not connected to a centralized drinking-water supply. At the same time, infrastructures do not meet the needs of the population. The water supply is insufficient, disinfection irregular, sewage networks are poor and waste-water treatment plants are rudimentary (only primary treatment, if any). Moreover, in the Atyrau region, the plants are exposed to flooding when the sea level rises, causing the direct microbiological contamination of sea water.

Problems of the Aral Sea area in Kazakhstan

Reduction of inflows to the Aral Sea. The Aral Sea Basin covers an area of approximately 1.5 million km^2 and is located in Afghanistan, the Islamic Republic of Iran, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, and Kazakhstan. The major affluents, the Syr Darya and the Amu Darya, rise in the Tien Shan (Kyrgyzstan) and Pamir (Afghanistan) Mountains, respectively. Upstream, they are fed by melt water from mountain glaciers, before crossing, northbound, the alluvial valleys of the Kyzl Kum and Kara Kum deserts and discharging into the Aral Sea from the north (Syr Darya) and south (Amu Darya). The Aral Sea is located in the lowlands of the Turan. Politically, the Aral Sea is divided between Kazakhstan in the north and Uzbekistan in the south. In Kazakhstan the Aralsk and Kazalinsk *rayons* of the Kyzylorda *oblast* border the Aral Sea. Through its hydrological functions, the Aral Sea used to moderate the continental climate of the neighbouring deserts, with a climatic influence over a radius of 100-400 km. It also acted as a groundwater head.

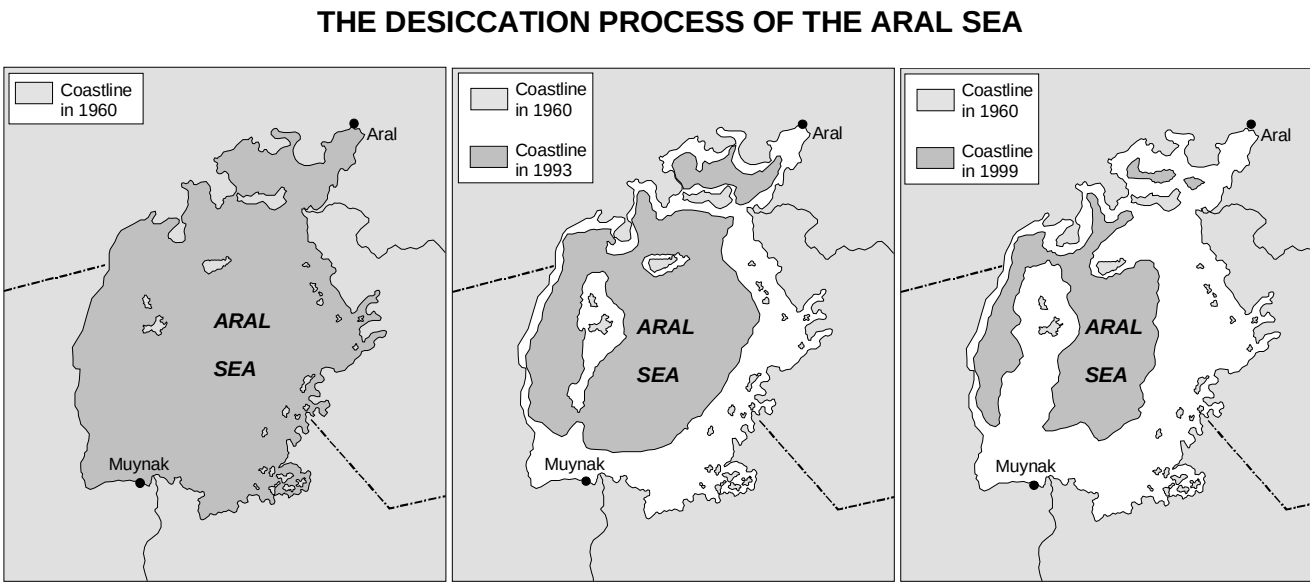
Up until the 1960s, the Aral Sea used to be the world's fourth largest lake with a surface of over 68,000 km^2 and a volume of over 1,040 km^3. However, large irrigation schemes were then set up to produce cash crops such as cotton and rice. The total irrigated area in the Aral Sea basin increased from 3 million ha to 8 million, making it the world's fourth largest producer of cotton. In the same period, the use of mineral fertilizers increased 3.5 to 6 times. Furthermore, the 1,200-km-long Kara Kum canal was constructed to provide Turkmenistan with an annual flow of 10 km^3 of freshwater, and in Kyrgyzstan, dams were built for the generation of hydropower. These measures resulted in a continuing decrease in discharges from the Syr Darya and Amu Darya rivers into the Aral Sea. Before 1960, the average discharge ranged from 50 to 60 km^3 a year. From 1960-1980 the discharge was reduced to 20-30 km^3 a year, and only 5 km^3 water were reaching the sea on average in the 1990s. There have also been years in which practically no water has reached the Aral Sea.

Desiccation, shrinking and water quality. The reduction of water inflow has resulted in the desiccation and shrinking of the Aral Sea, combined with an accelerated salinization of the water. The surface of the Aral Sea has been reduced to almost half of its original size or 34.800 km^2 and its volume by more than 75 per cent to 181 km^3 in 1998. The sea level has dropped by more than 18 metres, and shores have receded 100-150 km, exposing a large area of its seabed.

The magnitude of the Aral Sea disaster can be seen on the satellite images of Figure 8.1. The dark blue area represents the surface of the Aral Sea and the disappearance of the Aral Sea between 1977 and 1995 is most apparent by the increased size of the 'islands'. The desiccation process of the Aral Sea led in 1989 to the division of the Sea into two parts, a southern section and a much smaller northern section in Kazakhstan (Figure 8.1). If the current low inflow continues, it is expected that the larger sea will separate again as soon as 2004-2005.

Table 8.6 shows the steady deterioration of the Aral Sea over a period of almost 40 years. The decrease in freshwater inflow into the Aral Sea has led to irreversible changes in its hydrological and hydrochemical regimes. From a 'brackish' salinity of approximately 10 g/l, the mineral contents of the Aral Sea increased to 40-50 g/l. Furthermore, the level of dissolved oxygen, pH and nutrient concentrations decreased. Before the major changes

Figure 8.1: The desiccation process of the Aral Sea



Source: Encyclopaedia Britannica, 1999

Table 8.6: Overview of main indicators of the Aral Sea disaster, 1960-1998

	Area (km^2)	Volume (km^3)	Sea level (m)	Salinity (g/l)
1960	~68 000	~1 040	53	~10
1985	45,713	468	41.5	~23
1986	43,630	380	40.5	..
1987	42,650	354	40	..
1988	41,134	339	39.5	..
1989	40,680	320	39	~30
1990	38,817	282	38.5	..
1991	37,159	248	38	..
1992	36,087	231	37.5	..
1993	35,654	248	37	..
1994	35,215	248	37	..
1995	35,374	248	37	..
1996	31,516	212	36	..
1997	29,632	190	35	..
1998	28,687	181	34.8	~45

Source: German Remote Sensing Data Centre, 1999.

in its ecosystem, the Aral Sea contained at least 24 commercial species of fish. The rapid and marked changes in its hydrochemical and hydrological systems led to a critical decrease in the reproduction of fish stocks, resulting in the complete cessation of fishing and the liquidation of the fishing fleet, leaving over 60,000 persons unemployed in the Aral Sea area. The two deserted and abandoned fishing ports, Moynaq in Uzbekistan and Aralsk in Kazakhstan, have become symbols of this environmental disaster.

The quality of the water is not only affected by increased salinity, the extensive use of pesticides and fertilizers on agricultural land and industrial discharges also contributed to the increase of pollution in the Amu Darya and Syr Darya river water. The most common pollutants of the Aral Sea are considered to be oil hydrocarbons, phenols, synthetic surface-active substances, chlorine, organic pesticides and heavy metals. The highest level of pollution by oil hydrocarbons was observed in 1970, when the actual concentration was 54 times the maximum allowable concentration (MAC) of 0.05 mg/dm^3 in the northern section, 80 times the MAC in the larger sea and 96 times the MAC in the estuary coastal waters of the Syr Darya. In the 1980s, many monitoring stations in shallow waters were closed due to the drop in the sea level. With the decrease of inflows, the inflow of pollutants into the Aral Sea dropped too. Currently, only small amounts of pollutants enter the Sea, mainly from the remaining shipwrecks and, irregularly, from river discharges.

Competing water requirements. The problem of the limited inflow and discharge of the river systems is further complicated by the difference in needs for water in upstream and downstream countries. Kyrgyzstan has little natural energy resources, and the provision of electricity from the former Soviet Union has stopped since independence. Therefore, in spring and summer Kyrgyzstan wants to store water in its dams to generate electricity in winter when the need for electricity is greatest. On the

other hand, Kazakhstan needs water for irrigation in the growing season, which does not correspond with the storage schemes of the upstream country.

In 1998, UNESCO created a Scientific Advisory Board for Aral Sea basin problems (SABAS). As part of the ongoing World Water Vision project, the initiative relies on local expertise as providing the best available knowledge of the region and its problems. Local scientists, in cooperation with international scientists from UNESCO, IFAS and SABAS developed the Water-related Vision for the Aral Sea Basin taking into consideration the objectives and cooperation of the five Central Asian States. The Vision was presented at the 2nd World Water Forum in March 2000. Its main conclusions are that

- the water resources are sufficient for a population twice the present size
- water supply and sanitation can be improved to reduce child mortality by at least two thirds
- available resources are sufficient to provide industry with the necessary water, and
- the available water can produce cash crops to sustain diversified economic growth, leaving enough water for a healthy and stimulating environment.

The important prerequisites are an increase in agricultural productivity per cubic metre of water, a change in the type of agriculture, and a strong increase in industrial productivity. The Vision does not take into account the water demands of Afghanistan and the Islamic Republic of Iran. Included in the Aral Sea basin, Afghanistan covers almost 12 per cent of the basin and generates up to 20 per cent of its water. It is expected that its future water demand will increase. The inclusion of Afghanistan in the institutional framework and agreements can be seen as a prerequisite for sustainable water resource management. Furthermore, the Vision presupposes strong economic growth. It was financed by UNESCO, the World Bank, the World Water Vision Project, the Netherlands and IFAS.

Climatic modifications. The Aral Sea used to have a moderating influence on the meso-climate by softening cold Siberian winds in winter, and functioning as a conditioner in lowering heat in summer. Due to the desiccation, summers appear dryer and shorter now, while winters are longer and colder. The growing season has been shortened to 170 days. In coastal areas, precipitation has decreased tenfold, and humidity of air by 10 per cent. Along the former shoreline, salt and dust have accumulated due to evaporation and have formed a thin, white crust. As a result of strong northeastern winds in the area, salt and small dispersed dust, containing remnants of pesticides and fertilizers, are being picked up and transported and deposited over thousands of square kilometres of cultivated land. Scientists estimate the amount of transported toxic salt and dust to be between 15 and 75 million tonnes annually. Some severe dust storms transport particles and aerosols as far as the Antarctic and the Himalayas. Pesticides, used in the Aral Sea region, have been found in the blood of penguins. The deposition of particles is affecting soils, crops and human health and has contributed to the 50 per cent reduction in pasture productivity.

Biodiversity reduction. The deltas of the Amu Darya and Syr Darya had abundant fauna and flora. The desiccation process led to a decline in populations and the biomass of micro-organisms. Euryhaline forms of phyto- and zooplankton have replaced freshwater and brackish-water species and acclimatized fish species, e.g. smelt (*Atherina mochon pontica n. caspia)* and bullhead (*Burbis caucasicus)* have replaced commercially interesting species. The reed growth in the deltas decreased and the *tugay* (riverine or floodplain) forests disappeared. Of the 220 species and subspecies of birds that nested and wintered in the delta areas at the beginning of the century, fewer than 30 remain. Fauna further included species such as wild boar, muskrat, 'reed cats', jackals, foxes, wolves and corsac foxes (*Vulpes corsac)*. Also the ecosystem on the Island Barsakelmes, once a unique desert reserve surrounded by seawater, is under threat.

Desertification. The desiccation of the Aral Sea has resulted in severe desertification of the exposed seabed. Bad agricultural practices have added a second desertification process. The arid soils in the Aral Sea region have a natural self-reliant regime of feeding and moistening. Due to excessive watering, excess irrigation water flowed off to drainage basins in the deserts, instead of being returned to the rivers, and groundwater tables rose, pushing dissolved minerals up. This led to secondary salinization. The arid soils are now transformed into meadow-marsh soils with a strong dependence on water inflow. In order to support this regime, the water supply required is not at the biologically necessary level, but two to three times higher. By abandoning 'used' land and introducing the irrigation practices on new arable land, the cycle is being repeated. The new desert around the Aral Sea is already being referred to as the 'Aral Kum'.

Box 8.1: Vozrozhdenye Island

In 1952, the former Soviet Defence Force started to conduct experiments with biological agents and aerosols for a range of military purposes. Due to its remoteness, Vozrozhdenye Island in the Aral Sea was selected for open-air testing. The sparsely populated deserts and semi-deserts surrounding the Aral Sea, the island's climatic conditions and the isolation from the neighbouring mainland reduced propagation and transmission risks. The agents tested at Vozrozhdenye Island included anthrax, tularaemia, brucellosis, plague, typhus, Q fever, smallpox, botulinum toxin, and Venezuelan equine encephalitis. The experiments were conducted on horses, donkeys, sheep, monkeys and on laboratory animals, such as white mice, guinea pigs and hamsters. The mass death of fish in the Aral Sea in 1976, outbreaks of plague among sheep in 1986 and the mass death of approximately half a million saiga antelopes within the course of about an hour on the Turgay steppes in 1988, caused concern among the local population. In 1992, the Russian Government declared the closure of Vozrozhdenye Island. The special structures were dismantled, and the island was decontaminated and transferred to Kazakh control. In August 1995, specialists of the United States Department of Defense confirmed this after site visits.

Because of the tests, environmental specialists have for many years been concerned about the contamination of the island by pathogenic micro-organisms, some of them resistant to standard antibiotics. Anthrax spores can survive in soil for decades, creating a lasting source of contamination. Moreover, burrowing rodents, such as gophers, field mice and marmots, are natural hosts of plague and other pathogens, and can migrate long distances, spreading infectious disease. Kazakhs and Uzbeks went to the island, after it was abandoned by the Russian army in 1992, to seize equipment. It is unclear whether they visited only the settlement in the northern part or also the test zone in the southern part of the island.

The desiccation of the Aral Sea resulted in the increase of Vozrozhdenye Island's surface. Its initial surface of 200 km^2 expanded to 2000 km^2 in 1990. Kazakh experts believe that Vozrozhdenye Island will be connected to the mainland by 2010-there is already a small connecting zone between the Island and Muynak in Uzbekistan. Connection of the island with the mainland would undermine major safety aspects. Contamination therefore poses a continuous and increasing threat to the environment and the health of the population around the Aral Sea. In 1997, a proposal was submitted to the Kazakh Government to study the environmental situation on the island.

Apparently, almost all irrigated land in Kazakhstan is subjected to this salinization process, as only 4 per cent have a drainage system, which is necessary to avoid salinization.

Health risks. Pesticides and fertilizers have also found their way into water and irrigation channels, thereby polluting food and drinking water and affecting the lives of 5 million people in the Aral Sea region. Pesticides have been found in breast milk in Aralsk and Kyzylorda. Over 80 per cent of irrigation pipes and canals are not sealed, and more than half of them are used for municipal purposes such as drinking water. They are often in a critical condition. The ingestion of contaminated (surface) water presents health hazards that are thought to contribute to the increase in various diseases. For details see Chapter 14.

8.2 Policy and management regarding the Caspian Sea problems

Policy objectives and programmes

In 1994, the five littoral States of the Caspian Sea (Azerbaijan, the Islamic Republic of Iran, Kazakhstan, the Russian Federation and Turkmenistan) adopted the Almaty Declaration on Cooperation for the Environmental Protection of the Caspian Sea Region, in which they recognized that the Caspian Sea region was facing severe environmental problems with serious social and economic impacts. They decided to undertake coordinated action and called for the assistance of the international community.

As a response, a joint UNDP/UNEP/World Bank Caspian initiative was taken in 1995. Its purpose was to coordinate the activities of international organizations for the environmental protection of the Caspian Sea. It resulted in 1997 in the drawing-up of the Caspian Sea Environmental Programme. The Programme is a comprehensive long-term strategy (20 years) for the protection and sustainable management of the Caspian environment. It contains regional goals and actions to achieve them. It also encourages the development of a legal instrument for the protection of the marine environment of the Caspian Sea, which is currently being worked out in the form of a framework convention. See also Chapter 3. The main aims of the Programme are to:

- Ensure a sustainable development of economic activities bearing in mind the fluctuations of the sea level
- Decrease pollution levels and improve the quality of the environment and bioresources of the Caspian region
- Improve and rehabilitate the ecosystems of the Caspian Sea and conserve its biodiversity
- Ensure environmental safety in the region and conserve an environmental quality compatible with sustainable human development.

At national level, the 1999 NEAP of Kazakhstan identifies three territorial zones of priority activities (see Figure 2.1). The Caspian zone A includes the two *oblasts* of Atyrau and Mangistau. The integration of nature protection into economic and social policy is the idea underlying the NEAP/SD, in full compliance with the Caspian Environmental Programme. The NEAP is fully consistent with the Programme's objectives. It proposes a series of projects, some of which have been submitted for financing through priority investment projects (PIPs) under the Programme and would benefit from GEF financing, others are to be financed from domestic sources.

The priority problems of the Kazakh Caspian region, already identified in the NEAP, have recently been updated and refined. The seven most important are:

- The spreading of industrial pollution during the rise of the sea water level, threatening all infrastructures (flooding of infrastructures such as the nuclear power plant is critical)
- The pollution of air during gas flaring, dust dispersion and deposition
- The degradation of soils and vegetation from industrial (oil production) activities
- The degradation of groundwater quality due to the unregulated extraction and use of water
- The decrease of freshwater and sea ecosystems, and drop in their productivity due to unsustainable use (sturgeon and other fish)
- Inadequate normative and legal documents and insufficient awareness of the population
- The increase in human morbidity in areas close to oil sector activities.

Priority actions (not ranked) have been decided to tackle the problems:

- Establishing a network of protected areas
- Restoring ecosystems and biodiversity components
- Cleaning up oil pollution, mostly pre-1996
- Encapsulating flooded oil wells and toxic wastes (in particular radioactive tailings) in situ
- Using the hitherto flared gas for heating purposes
- Improving preparedness for and response to emergencies such as oil spills and flooding
- Setting up health rehabilitation centres.

A list of 18 project proposals has been prepared, with their respective cost estimate and expected duration. These projects have been proposed as PIPs to the Caspian Sea Environmental Programme. Various IFIs and donor countries (Belgium, Japan, Portugal, Switzerland, GEF, TACIS and USAID) will study their eligibility. Also, in 2000, it is intended to (i) develop a national strategy and action plan for the Kazakh part of the Caspian Sea region, (ii) participate in the preparation of transboundary diagnostic analysis (TDA) and (iii) promote the framework convention for the protection of the marine environment of the Caspian Sea.

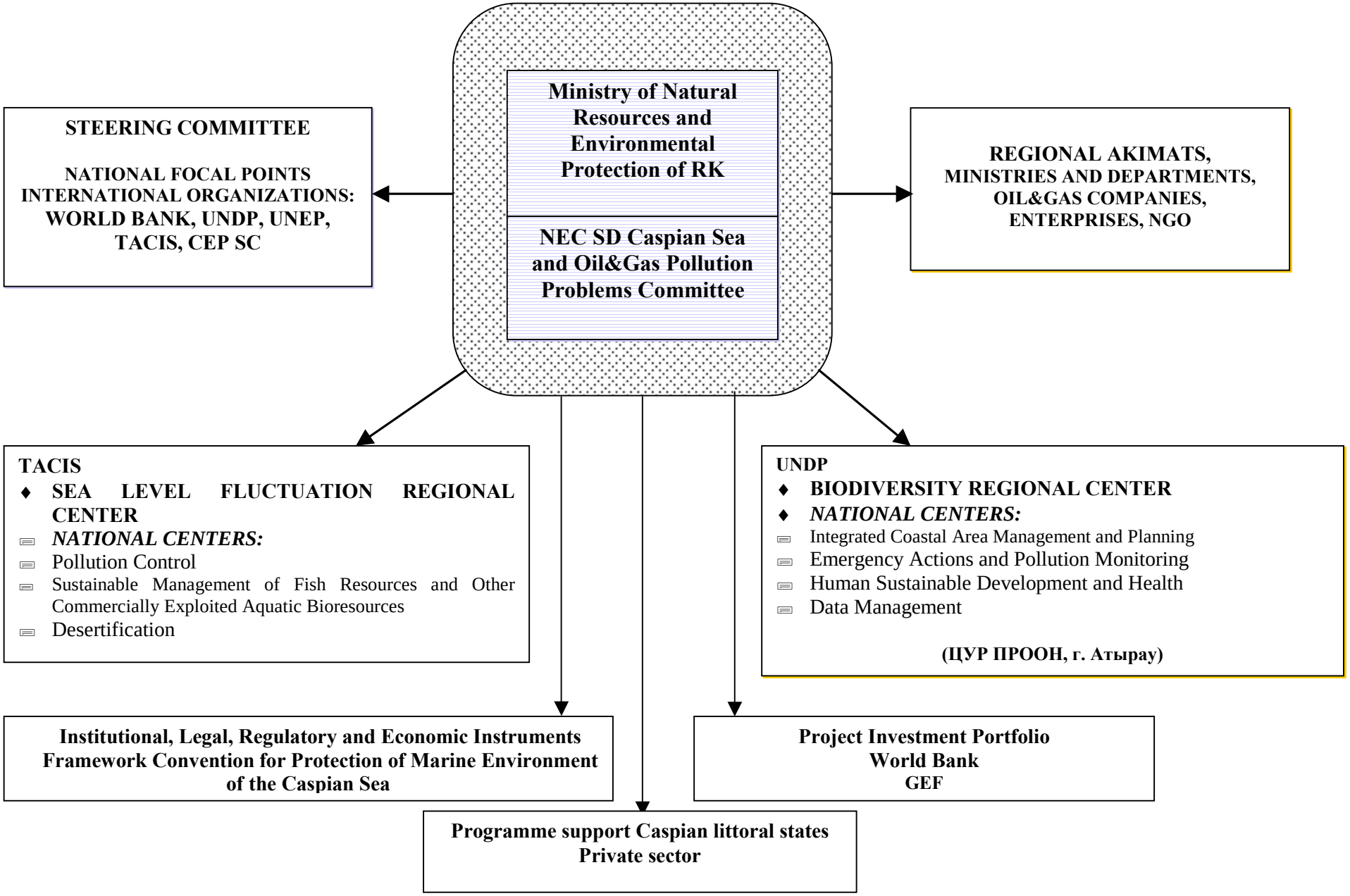
The Caspian Environmental Programme

A programme steering group and a programme management unit were set up to implement the Programme. The management unit coordinates projects implemented through a network of Caspian regional thematic centres (CRTC). These will initially be financed by GEF, except two that have been financed by TACIS since 1998. 13 major themes have to be addressed. Each country hosts at least one CRTC; Kazakhstan has two. This is the complete list:

- CRTC on Pollution Control (Baku, Azerbaijan)
- CRTC on Sustainable Management of Fish and other Aquatic Resources (Astrakhan, Russian Federation)
- CRTC on Desertification (Ashgabat, Turkmenistan)
- CRTC on Water Level Fluctuations (Almaty, Kazakhstan)
- CRTC on Integrated Coastal Zone Management and Planning (Tehran)
- CRTC on Pollution Monitoring and Regional Emergency response Actions (Tehran)
- CRTC on Database Management (Baku)
- CRTC on Sustainable Human Development and Health (Ashgabat)
- CRTC on Biodiversity Conservation (Atyrau, Kazakhstan)
- CRTC on Institutional, Legal, Regulatory and Economic Instruments (Moscow)

At national level in Kazakhstan, in December 1998, the Intersectoral Committee on Caspian Sea and Oil & Gas Pollution Problems (ICCSOGPP) was created as part of the National Environmental Centre for Sustainable Development. It works under the authority of the National Focal Point for the Caspian Environmental Programme, which is the MNREP. The work plan of the Committee has

Figure 8.2: Kazakh Institutions involved in the Caspian Sea Environment Programme



been established in concordance with the "Programme Priorities Guidelines for Cooperation between UNDP and Kazakhstan for 2000-2004" defined by GEF and UNDP. The Committee coordinates the work of different groups involved in the implementation of its work plan.

The Committee coordinates the work of ten national thematic groups (TGs) that were established to contribute specific information about the Kazakh situation to the Caspian regional thematic centres. These groups are located in the cities of Almaty (4), Atyrau (5) and Aktau (1). The information will help to orient the Programme's policies and actions, and define priorities. Kazakh national reports from the TGs on water level fluctuations, on biodiversity, on fish/sturgeon resources, on planning and coastal zone management, on oil spill management and on desertification have been completed and will be submitted soon to the CRTCs. The coordination of the TGs with other ministries is of great importance, as intersectoral activities will be numerous in the Programme's implementation. In particular the groups on integrated coastal zone management, pollution monitoring and regional emergency response actions need to liaise closely with ministries other than the MNREP.

The Committee cooperates with all stakeholders, including private companies and regional and local administrations (see Figure 8.2). The two concerned *oblasts* establish their environmental plans and submit them to the MNREP. For instance, the Atyrau *oblast* has an environmental programme for 1996-2005. A report on the development of natural resources use was issued in 1998, and a report on the management of the environmental fund in 1997. The MNREP checks whether *oblast* priorities are in accordance with the priorities of the NEAP and the Caspian Environmental Programme. It monitors the projects implemented at region level. All funds forwarded through the Programme will be managed at national level and not by the local administration. Local administrations complain that they are not sufficiently involved in the preparation and implementation of the Programme, and that they do not see concrete projects.

Measures carried out by Kazakhstan

The country has undertaken a few remedial actions. For example, to stabilize soils, afforestation is taking place on the Urstyurt plateau, with 200 ha of indigenous tree species (*Saxaul*) planted annually. Similar planting will take place in the delta of the Ural River. The clean-up of the estimated 50,000 to 200,000 tonnes of used oils that pollute the soil around drilling facilities has been ongoing for four years. 100 ha are cleaned annually in the Atyrau *oblast*, and about the same in the Mangystau *oblast*. 40 million tenge from the local environmental fund have been allocated to the rehabilitation of radioactive tailing ponds close to Aktau. Other tailings containing 10 million tonnes of wastes are also being rehabilitated with finance from the *oblast* and the mining company.

Studies have been undertaken to fight the rise in water level and minimize its consequences. In 1995, a project on the development of flood forecasting and warning systems was undertaken. It was financed by the Atyrau *oblast* and benefited from the support and technical assistance of Denmark. The project was interrupted in 1998 before yielding any results.

Before 1994, some of the environmental charges collected by local funds went to the national environmental fund, which spent them on local environmental projects. Since then, as the part of local charges allocated to the national level goes to the general State budget, national financial resources are no longer directed to the local level for environmental purposes (see Chapter 2). All expenditure on environmental protection comes from meagre local environmental budgets that are very often spent on priority actions such as public health protection, or social security. In 1999, about 33 million tenge from the Atyrau *oblast* local environmental fund were used for monitoring, scientific research, health care, ecological education, biodiversity protection, greening actions, the building or reconstruction of environmental protection facilities, and an inventory and closure of old oil wells. Very often, spending on environmental protection and public health infrastructures relies on sponsoring by the oil industry.

8.3 Policy and management regarding the Aral Sea problems

Policy objectives and programmes

In cooperation with donor organizations and donor countries, the five member States of IFAS approved an overall programme, the Aral Sea Basin Programme (ASBP), to combat and mitigate the problems related to the Aral Sea. Within the ASBP, the following projects have been identified:

- Project 1.1 Regional Water Resources Management Strategy
- Project 1.2 Improving the Efficiency and Operation of Dams
- Project 1.3 Sustainability of Dams and Reservoirs
- Project 2.1 Hydro-meteorological Services
- Project 2.2 Database and Management Information System
- Project 3.la Water Quality Management
- Project 3.lb Agricultural Water Quality
- Project 3.2 Uzbekistan Drainage
- Project 4.1 Wetland Restoration in Amu Darya Delta
- Project 4.2 Restoration of the Northern Part of the Aral Sea
- Project 4.3 Environmental Studies in the Aral Sea Basin
- Project 4.4 Regulation of the Syr Darya Riverbed and the Northern Part of the Aral Sea
- Project 5 Clean Water, Sanitation and Health
- Project 5.1 Clean Water, Sanitation and Health in Uzbekistan
- Project 5.2 Clean Water, Sanitation and Health in Turkmenistan
- Project 5.3 Clean Water, Sanitation and Health in Kazakhstan
- Project 6. Integrated Land and Water Management in the Upper Watersheds
- Project 7. Automated Water Management System in the Amu Darya and Syr Darya Basins
- Project 8. Aral Sea Basin Capacity Development
- Project 9. Water Resources Management and Agricultural Production in the Central Asian Republics (WARMAP)

ASBP is aimed at the regional level. Kazakhstan does not have a national programme to implement projects under the ASBP. Since programmes and projects carried out at national or local level are not under the umbrella of the ASBP, they should not contradict the ASBP but are considered internal affairs. The National Environmental Action Plan on Sustainable Development (NEAP/SD) supplements the ASBP in related environmental problems, in particular the conservation of biodiversity, of the fight against desertification, and the restoration of pastures and irrigated lands. Of the 15 NEAP/SD projects in the southern zone 'C' of Kazakhstan (see Figure 2.1), 7 are within the Aral Sea region. Local administrative bodies are responsible for implementing the NEAP/SD projects. The *oblasts* are required to develop action plans on hot spots that are in line with the ASBP. In the Kyzylorda *oblast*, this action plan, including priorities, is currently being considered.

In 1998, the member States of IFAS expressed their need for stronger regional cooperation on ecological problems and in 1999 agreed upon the development of a regional environmental action plan (REAP). In March 2000 regional ecological priorities were selected from lists of national ecological priorities. The following regional priorities have been identified for the Aral Sea basin:

- The deficiency of water resources
- The pollution of transboundary water bodies
- Land degradation
- The catastrophic change in river hydrology
- The degradation of biodiversity
- The degradation of mountain ecosystems
- Transboundary air pollution
- The danger of dam collapse

National priorities for Kazakhstan that have not been recognized as regional priorities include urban air pollution, environmental pollution by solid industrial and municipal wastes, the shortage of specially protected natural territories and the pollution of water bodies by sewage water. The official launching of REAP is expected in 2000.

A Special Programme for the Economies of Central Asia (SPECA) has been developed to strengthen their cooperation, and generate economic development and encourage their integration into the economies of Asia and Europe. In 1998, in the Tashkent Declaration, the Central Asian States adopted the Programme. Among the identified areas of cooperation are electrical energy production and distribution, and water management. Tools and frameworks for transboundary cooperation are available in the form of conventions. Of specific relevance to the problems in the Aral Sea region is the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes. It contains provisions for dispute settlement, and promotes the involvement of all transboundary stakeholders. Kazakhstan is in the process of

ratifying this Convention. The next step will be to integrate the Convention into national legislation (see also Chapter 3).

Financing of ASBP

The financing for regional and national programmes in the Aral Sea basin, as well as for the Executive Committee and its branches, will come from member States' dues, international funds and organizations (World Bank and others). In 1994, after a donor meeting for the preparatory phase of ASBP, the World Bank, the EU, the GEF, UNDP, IFAS, Kuwait, Japan, Switzerland, Canada, Italy, the Netherlands, the United Kingdom and Finland committed funds to the tune of US$ 41 million. The payment of constitutional and annual fees of the five participating States of IFAS has not been forthcoming. The lack of payments at the 1994 donor meeting led to delays in implementing the majority of the projects of the Aral Sea Basin Programme. Table 8.2 gives an overview of the fees Kazakhstan was due and the amounts paid to IFAS.

Table 8.7: IFAS fees and amounts paid by Kazakhstan between 1995 and 1999

	Due	Paid up	*Percentage paid* (%)
Initial contribution fees			
Million tenge	5	5	*100.00*
Annual fees for 1995-1998			
Million tenge	782.39	201.16	*25.71*
Annual fees for 1999			
Million tenge	84.18	71.3	*84.70*
Thousand US$	667	566	

Source: IFAS bulletin #6, January 2000.

At the beginning of 1998, the States agreed to change the annual dues to IFAS as follows (percentages of State budget revenues, no longer of GDP):

- 0.3 per cent from Kazakhstan, Turkmenistan and Uzbekistan
- 0.1 per cent from Kyrgyzstan and Tajikistan.

Institutional arrangements

The five Central Asian countries established a number of regional institutions for cooperation, each institution covering part of the management of the Aral Sea basin. The main regional institutions are:

The International Fund for Saving the Aral Sea (IFAS). IFAS was originally established to collect and disburse the member States' contributions and donor money. The five participating countries agreed to contribute 1 per cent of their national GDP to IFAS. Until 1997, IFAS operated in addition to the Interstate Council for the Aral Sea (ICAS), which then dissolved into IFAS. The permanent Executive Committee of IFAS in Tashkent has a rotating chairmanship. Since April 1999, the President of Turkmenistan has been President of IFAS, while the Deputy Minister of Agriculture and Water Resources of Turkmenistan chairs its Executive Committee. The overall objectives of the IFAS are:

- To stabilize and improve the management of the Aral Sea basin's environment
- To rehabilitate disaster zones surrounding the Aral Sea
- To improve the management of scarce water resources in the region
- To build the capacity of local and State institutions in the planning and implementation of regional programmes.

The Interstate Coordinating Water Committee (ICWC). The ICWC establishes water quotas from the Amu Darya and Syr Darya rivers to the member countries. Its decisions must be unanimous and are immediately binding on the five States.

Two interstate water basin management bodies (BVOs) for the Amu Darya and Syr Darya rivers. The BVOs operate hydraulic structures and installations on the rivers in order to deliver water in accordance with the limits set by the ICWC (see also Chapter 7).

The Sustainable Development Commission (SDC). The SDC was established in 1995 and operates alongside ICWC under the IFAS Executive Committee. It focuses on improving the social and economic conditions in the region and restoring the damaged ecosystem. The SDC will be the focal point for coordinating the REAP.

In Kazakhstan, the national coordinator for IFAS is the Water Committee of the Ministry of Natural Resources and Environmental Protection. The Water Committee has responsibility for inter-sector and inter-provincial water allocation, for defining national policies on water quality, and for

protecting water resources. It administers international river systems with respect to water sharing (see Chapter 7). Until the end of 1999, the Water Committee was under the Ministry of Agriculture, with MNREP having only a passive role. In 1998, Kazakhstan appointed a coordinator to overview all projects related to the Aral Sea with the focus on sustainable development. Apparently, only 1 per cent of the US$ 32 million spent under IFAS went to the Sustainable Development Commission.

Measures taken in Kazakhstan

Kazakhstan is downstream of the transboundary water basin, and is to a large degree dependent on the activities of the upstream countries. Countries participating in ASBP do not necessarily share information on the progress in their national and local programmes. This practice may hinder efforts undertaken in neighbouring countries. No national water programme exists, and therefore there is no monitoring of the progress made either. According to the Kazakh branch of IFAS, the Government of Kazakhstan has built 800 large water-pipe systems to enable centralized water supply to 29 settlements, and constructed a hospital with 660 beds and a polyclinic in Kyzylorda. The Water Committee of the MNREP reports on another four projects implemented in the Aral Sea region:

- Water supply improvement in the Kyzylorda *oblast* (pilot project). Financed by a loan from the World Bank (US$ 7 million) and the national budget (200,000 tenge). 7.2 km of 1000-mm pipes have been replaced, the Aralsk and Kazalinsk distribution networks were reconstructed, a pumping station has been reconstructed, and a building was put up for the Kazalinsk water administration.
- The terms of reference for the project "Regulation of the Syr Darya riverbed and the northern part of the Aral Sea" was completed.
- The terms of reference for the project "Water supply, sanitation and public health in Aralsk and Kazalinsk *rayons* of the Kyzylorda *oblast*" was completed. The total cost of this project (US$ 30 million) has been approved by the national government and will be paid by loans and grants from the Kuwait Fund, the German Development Bank (KfW) and the World Bank.
- Under the project "On sanitation and public health in the Kazakh part of the Aral Sea", experimental individual toilets have been placed in settlements and several workshops on hygiene and the use of the toilets have been conducted.

The Aral Sea Region Development and Humanitarian Programme, supported by UNDP, is undertaking three sub-programmes for the Kyzylorda *oblast*:

- The Water Resource Management Programme, a capacity-building programme for water user associations. It will be implemented within the framework of both the National Capacity 21 Programme "Capacity Building of Water Users for Sustainable Development in the Aral Sea Basin" of the Government of Kazakhstan and UNDP, and the "Remote Villages Development Project" funded by the Nordic Fund.
- The Economic Rehabilitation Programme, focusing on micro-credits, small and medium business development and industry rehabilitation. It will be implemented under the UNDP country programme for small and medium-size enterprise (SME) development.
- The Social and Health Programme, aiming at coordinating and supporting UNFPA and UNICEF social and health programmes. These programmes are included in a Kyzylorda *oblast* three-year plan with UNFPA, UNICEF and *oblast* akimat tasks.

The national executing agency is the Investment Policy Department of the Ministry of Economy. The total cost of the revised and updated programme for 1999-2000 is US$ 589,095. UNDP and IFAS contribute around 60 per cent and 30 per cent, respectively. The World Bank contributes another 8 per cent. Non-governmental organizations and communities play a major role in the development and implementation of the programme.

8.4 Conclusions and recommendations

Caspian Sea management

The Caspian environmental problems arise from both man-made and natural causes. To try to solve the problems the five littoral countries are taking coordinated action in the framework of the Caspian Environmental Programme. Kazakhstan has set up all the national institutions required for the

Box 8.2: The Kokaral dyke

The Syr Darya is the main affluent to the northern part of the Aral Sea. Due to the desiccation process, this smaller part is currently connected to the southern part over only approximately 15 km. In 1992, the people in the Aralsk district took the initiative of raising money for the construction of a dam to separate the two seas and keep the inflow of the Syr Darya for the northern part. A sand dyke was constructed which held for about nine months. The rising sea level caused a breach of the dike, but proved the validity of the concept. In 1996, a second attempt to save the northern Aral Sea was made by building a 30-m-wide and 14-km-long dyke. This time, sluices were developed to let water into the southern sea in case of high water levels. Strengthening of the Kokaral dyke with concrete slaps was necessary. In autumn 1998, the Kazakh branch of IFAS started financing the strengthening. Unfortunately, half a year after the strengthening process had started, 3 to 5 km of the dyke was washed away, because of the increased inflow of the Syr Darya.

The results of the Kokaral dyke have been amazing. The sea level rose several metres, the shoreline extended in some places as far as 200-300 metres, dust storms decreased and rainfall increased bringing back bird life and greenery. Due to the increased inflow of freshwater the salinity began to fall, raising the hope of the fishing communities, which resumed their activities on a small scale. The World Bank has decided to finance the reconstruction of the dyke.

implementation of the Programme and fulfilled its duties regarding most of the national reports to the CRTC. It is also proceeding with a national action plan for implementing the Programme. However, the infrastructure for solving the problems does not seem to be in place.

Many of the negative environmental impacts of oil production cannot be tackled due to the absence of an adequate legal framework. A national action plan on preparedness and response to oil spills was adopted in May 2000, but its implementation requires the drafting of new laws (which has started with USAID assistance). There is insufficiently specified legislation defining liability for past environmental damage (see Chapter 1). Environmental assessments and audits that enterprises subcontract to consultants are not up to the required standard and are often unreliable. Consultants are not accredited according to internationally recognized standards, and their competence is not always proven. Technical regulations for drilling facilities, safety regulations and norms of ecological safety regarding oil drilling offshore and onshore are non-existent or incomplete.

Kazakhstan is in favour of the framework convention for the protection of the marine environment of the Caspian Sea, which could play the role of catalyst for the required national legal instruments. The absence of relevant legislation has two major negative consequences on the work of the Caspian Environmental Programme's Kazakh Intersectoral Committee (ICCSOGPP). First, there is no formal basis for demanding access to, and disclosure of, environmental and other relevant information. The information is spread over different ministries, institutes and *oblast* administrations and too often considered as an item for sale. Second, close cooperation between ministries and their local branches, and with *oblast* administrative structures, is necessary as the Programme integrates ecological, social and economic concerns. Today, only the MNREP is involved in the Programme, while neither other ministries nor *oblast* administrations and local branches of ministries can be easily involved. At *oblast* level, the environment is not considered a priority. The Programme thus needs to be legitimated at national level as its implications go far beyond environmental problems and have been recognized as one of the 3 NEAP priority activities (Zone A).

In addition, Kazakhstan has not signed many international conventions, which would have helped to manage the transboundary problems of the Caspian Sea (for details, see Chapter 3). Moreover, as international legislation is not effectively integrated into national legislation, international legal instruments are not optimally used for modernizing the national legal framework.

The enforcement of laws is also a problem. For instance, flaring associated gas is forbidden by law, but is still commonly practised. The consequence is that 10 to 15 kg of pollution per tonne of oil are emitted in the Atyrau region, while similar installations in the Russian Federation emit only 4-5 kg. Where old and new laws co-exist, they are often conflicting. For example, a 1974 law declared the North Caspian Area with the Ural and Volga deltas a State reserve. The industrial use of the wetlands of the Caspian Sea was forbidden, with the explicit mention of oil exploration and production, and the industrial use of bioresources such as sturgeon fishing. The fishing of sturgeon in the Ural River is still forbidden. But the new 1997 Law on Specially Protected Natural Territories contains ambiguous protection provisions and does

not explicitly forbid the exploitation of oil in protected zones.

Recommendation 8.1:
The legal framework necessary for the implementation of the Caspian Environmental Programme should be urgently created and enforced. The framework should specify the obligations of the relevant institutions to participate in the implementation, and should regulate the important coordination requirements for the solution of problems. In particular, the sharing of information between participating institutions should become obligatory, and the funding of the Programme should be specified in detail. Se Recommendation 1.1.

Past and present oil exploitation severely impacts the environmental state of the Caspian onshore and offshore. Four measures have been included in the NEAP to solve the most acute of these problems, and three of them will also be incorporated in the Caspian Environmental Programme, i.e. they might benefit from international funds. Nevertheless, complementary budgeting should be found at national level to permit rapid action. Technological solutions should also be worked out.

Recommendation 8.2:
Companies (State-owned as well as private) involved in oil production should be requested to contribute to the funding of any necessary remedial action. Pilot projects should be financed to clean up past polluted sites and find adapted technology to do it. The possibility of establishing a fund for contributions by the oil industries to finance rehabilitation work should be explored.

Improving public health care in the Caspian Sea region is a key concern. In addition to actions to reduce the impact of pollution from oil production, it also necessitates the upgrading of drinking-water supply and food quality, and mitigating radiation effects. This is the aim of Recommendations 14.1, 14.2, 14.3 and 14.6.

Other key concerns of the Caspian Environmental Programme and the NEAP are protecting biodiversity and mitigating the effects of the rise of the sea level. For this, a broad approach is needed encompassing infrastructure (transport, communications, utilities, housing), economic activities, including the oil industry and agriculture, and land and nature protection. Territorial planning can integrate these sectors. Biodiversity protection would be incorporated in this planning at an early stage, foreseeing the needs for species and habitat protection, and helping ensure that infrastructures and economic activities have a minimal environmental impact. This planning should also anticipate the effects of the rise in the water level.

In the long term, a coastal zone management approach would be a good tool to integrate all these concerns. Recently, the Caspian Environmental Programme has created a thematic centre on coastal zone management (located in the Islamic Republic of Iran). It will provide assistance to littoral countries to implement coastal zone management on their respective coasts. Kazakhstan has already shown interest with a report describing the situation of the Kazakh coastal areas and showing the benefits expected from a coastal zone management approach. For the time being, it seems that a gradual "learning-by-doing" approach is advisable. A logical first step could start with classical territorial planning and mapping. In parallel, the coastal zone management concept and methodology could be tested in one or more selected areas. In particular, cooperation between ministries, essential when implementing coastal zone management, would benefit from a test. Coastal zone management cannot be implemented if there is no specific legal framework, which could also be fine-tuned during the pilot test (see also Chapter 2).

Recommendation 8.3:
A comprehensive territorial planning approach to land use in the Caspian Sea coastal area should be taken. It should include ecological considerations, building upon the inventory work on biodiversity mapping which has been accomplished by the Thematic Group on Biodiversity Protection in Atyrau. Defining the zones of the delta that deserve to be protected could be an appropriate first step. See Recommendations 10.1 and 10.4.

Since 1998, the monitoring and the collection of hydro-meteorological data of the Caspian Sea have been interrupted, since almost all the national monitoring systems of the littoral States have collapsed. In Kazakhstan, only one station is working at present. In addition, the top scientists are leaving administration and research institutions to pursue business opportunities, as most of the time they are no longer paid.

Surveying the evolution of the Caspian Sea ecosystem and forecasting its future are key issues in its rehabilitation management. This means that the monitoring system should be restored urgently

to a sufficient level of functioning and coverage. It should be run by competent scientists, i.e. under conditions that keep them in service, and should be using modern equipment. Remote sensing should be used where possible. The monitoring programme should be defined with its use in policy-making in mind. The ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes could provide useful guidelines in this regard. An accredited laboratory for pollution control, equipped with modern technology and integrated in the regional monitoring network, would be a useful tool for better law enforcement, backing up inspections and informing the public of the situation.

Recommendation 8.4
The environmental monitoring system of the Caspian Sea in Kazakhstan should be restored. Monitoring programmes should be useful to policy-making. Policy programmes should be translated into measurable objectives, and the monitoring system should measure the progress made.

Aral Sea management

The degradation of the Aral Sea resulted from the excessive use of its tributaries to meet irrigation and hydropower needs. So far, large numbers of (environmental) assessments have been made, often resulting in programmes and action plans. Despite the large amounts of money spent, the effects of the Aral Sea Basin Programme remain largely unclear. Due to the lack of cooperation and coordination between the countries participating in IFAS and the international donors, the projects and programmes seem to be scattered. The coordination of activities and the transparency of the programmes, including the establishment of reliable information-sharing routines, seem to be most urgent objectives which will condition the success of efforts today.

Recommendation 8.5:
Kazakhstan should, as a member of the International Fund for Saving the Aral Sea, promote a clearer coordination among international funding organizations and countries. Transparency with regard to both progress and expenditure on the Aral Sea Basin Programme should be a prerequisite for its effective implementation. In addition, communication and information-sharing on local and national initiatives between the participating States should be improved.

In Kazakhstan, the situation is further complicated by the lack of a common national water programme (see Chapter 7). No clear relationship exists between projects and programmes carried out at local and national level on the one hand, and transboundary projects executed at regional level on the other. Projects are ad hoc. A national water programme should also include local projects until ASBP or the Caspian Environmental Programme achieve their long-term goals. The programme should include clearly defined responsibilities, mandates and realistic funding provisions for each project. The Water Committee and Sustainable Development Committee should coordinate the work and measure the progress.

In general, for both the Caspian and the Aral Sea basins, no improvement of the environmental situation can be achieved so long as it is not given real political priority, backed up with commensurate funds. Currently, the State does not devote funds to environmental investments, and by far the largest part of expenditure is from industry (see Chapter 2 for details). The financial burden for the funding of required expenditure in the two basins may be too big to be carried only by the littoral States. However, the commitment of the Government of Kazakhstan to solving the related problems should also be reflected in the allocation of financial resources, possibly after a complete inventory of required actions, including at local level.

Recommendation 8.6:
The political priority for the solution of the Aral Sea and Caspian Sea problems should be reflected in increased national funding for remedial projects, including environmental monitoring, research and the control of air, water, soil and food quality. See also Recommendation 2.1.

Chapter 9

MANAGEMENT OF MINERAL RESOURCES

9.1 Mineral resources: reserves and production

Mineral reserves

Kazakhstan has large reserves of a wide range of minerals and is a major producer of a large number of metals, including copper, iron ore, chromite, lead, zinc, manganese, rhenium, titanium, beryllium, bismuth, cadmium and uranium (Figure 9.1). It also has a significant production of other mineral products, including natural gas, oil, coal, gold, molybdenum, arsenic, barite, phosphate rock and tungsten.

The mineral sector dominates the Kazakh economy, led by oil and gas and non-ferrous metals. The country's extensive mineral resources base represents a great asset for future economic growth. Western investors' interest in this sector is significant, and the scale of some projects is enormous.

Kazakhstan has large iron-ore deposits, including the Sarbaisky, Sokolovsky, Kacharsk and Kurzhunkulsky deposits. They are mainly located in the Kustanay *oblast* in northern Kazakhstan, with total reserves estimated at 17 billion tonnes of ore, of which approximately half can be mined. In terms of reserves of manganese ore, Kazakhstan ranks second in the world after South Africa, with total reserves estimated at 600 million tonnes of ore. Reserves and the production of manganese are concentrated in the Zhezkazgan region, where two principal deposits are located: Zapadny Karazhal and Ushkatyn-III. The total reserves of these two deposits represent 88 per cent of the country's reserves of manganese ore. Both iron and manganese deposits supply the country's metallurgical industry centred in Karaganda and also some metallurgical plants in the Russian Federation.

The country possesses 95 per cent of the total chromium reserves of the Commonwealth of Independent States (CIS), nearly 30 per cent of the world's ore deposits and is the sole producer of chromium in the northern hemisphere. Major deposits are located in the Chromtau region, east of Aktubinsk, in northwestern Kazakhstan.

Kazakhstan is one of the world's major provinces in terms of copper reserves and production, with total reserves estimated at 23 million tonnes of ore. The largest copper deposits are located in the Zhezkazgan, Semipalatinsk and Pavlodar *oblasts*, and in the Balkhash region. Many of them also possess associated zinc, lead, gold and molybdenum mineralizations. The deposits in the Irtysh zone of Rudnoi Altai also contain significant copper reserves, such as the Nikolaevskoe and Orlovskoe deposits, with lead, zinc, gold and silver associated.

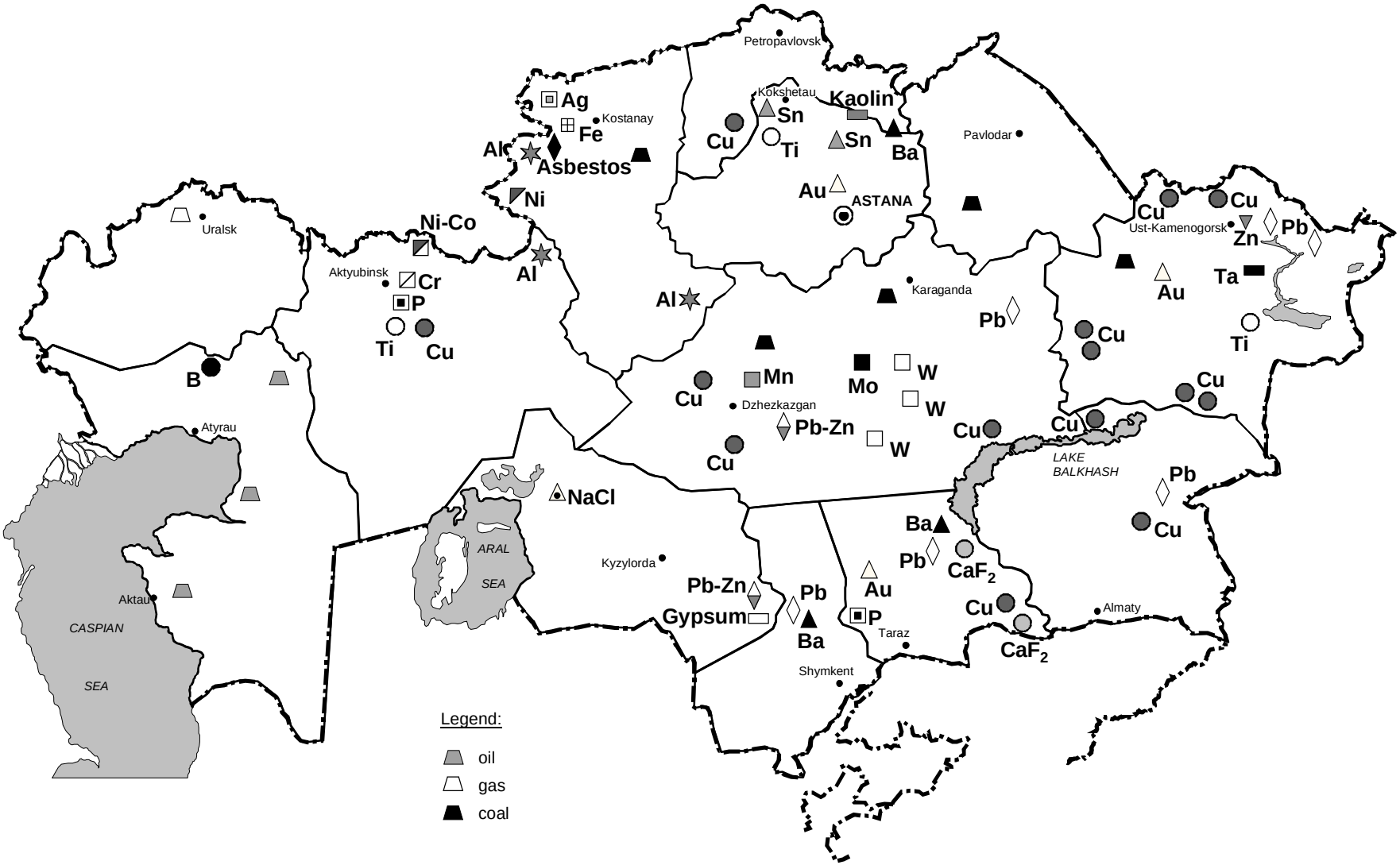
The largest lead and zinc deposits lie in eastern Kazakhstan, in the region of Ust-Kamenogorsk. Ore is mainly extracted from underground mines, with total reserves estimated at 26 million tonnes of zinc and 9 million tonnes of lead.

During the Soviet period, most of Kazakhstan's gold output was a product of non-ferrous metals production. Following the collapse of the Soviet Union, Kazakhstan concentrated its efforts on developing its native gold deposits by attracting foreign investment. Major gold mines are located in north-central Kazakhstan, near the city of Stepnogorsk, and these have been exploited by large companies such as Altynalmas, Bakyrchik, ABC-Balkash. At present, some gold companies have suspended operations or have gone bankrupt due to the drop in world gold prices and the consequent outflow of private investors from the sector. The largest gold deposit is Vasilkovskoye, in the Kokshetau region, with an estimated 382 tonnes of gold.

Kazakhstan has bauxite deposits, which are mined by Aluminium Kazakhstan. The country is also rich in non-metallic mineral deposits used in the production of construction materials, including limestone, quartz sand, clay, soda, asbestos, granite

FIGURE 9.1:

PRINCIPAL DEPOSITS OF THE REPUBLIC OF KAZAKHSTAN



and marble. Kazakhstan has significant deposits of potassium salts, borates, bromine complexes, sulphates, phosphorites and raw materials for the chemical industry. The enormous amounts of sulphur from the polymetallic ores provide the raw material for the production of sulphuric acid and other chemical products with economic value. In addition, 45 deposits of mineral waters have been explored, with proven reserves of 11 million cubic metres per year.

Mining industry

The mineral sector is highly diversified and has become the most important sector of the economy. It accounted for 53 per cent of the total industry structure in 1997, of which the fuel industry and non-ferrous and ferrous metallurgy accounted for 27 per cent, 14 per cent and 12 per cent, respectively. 84 per cent, 70 per cent and 67 per cent of the Atyrau, Kyzil Orda and Mangistau *oblasts'* industry is based on mining.

Kazakhstan's mining industry lost some of its traditional markets with the break-up of the Soviet Union, and is a relative novice in the international marketplace. At the same time, the mining and metallurgical sectors have to face problems related with high energy-consuming technologies, old equipment, the deteriorating quality of extracted ores and the lack of mining development. The dependence on the Russian Federation for transport links to international markets also plays an important role in the country's economy. As a result, from 1991 to 1995there was a sharp decline in mineral output, which affected mainly the production of iron ore and steel, lead, copper, coal, oil and natural gas.

Table 9.1: Mineral output, 1995-1998

1 000 tonnes

	1995	1996	1997	1998
Coal	79,615	73,240	70,174	68,058
Oil (incl. gas condensate)	20,641	22,960	25,778	25,989
Natural gas *(million m^3)*	5,916	6,524	8,114	7,948
Iron ore	14,902	12,975	13,133	9,336
Manganese ore	49	473	402	634
Copper ore	21,592	22,026	31,382	31,044
Zinc-lead ore	5,678	4,768	5,519	4,890
Chromite	2,417	1,103	1,796	1,603

Source: Statistical Yearbook of Kazakhstan, 1999.

Since 1996 the mineral industry output has increased, with some exceptions (Table 9.1). In 1998, iron-ore production decreased to 37 per cent of the 1995 level. According to the State Statistical Agency, in 1999 the extraction of iron ore reached 9.6 million tonnes, a slight increase of 3 per cent over the 1998 level. Kazakhstan's exports are mainly based on mineral products, with metals accounting for 44 per cent of all exports in 1998, which is 15 per cent more than in 1995.

Copper production in Kazakhstan steadily declined from 1991 to the middle of 1995, falling by about 50 per cent. The situation, however, began to be reversed when foreign companies acquired management rights to the country's copper-producing firms. The largest copper-ore producer and processor in Kazakhstan is Kazakhmys (Samsung Deutschland), which incorporated Zhezkazgantsvetmet, Balkhashmys, the Eastern Kazakhstan Copper and Chemical Plant, and the Zhezkent Mining and Processing Plant.

In 1995, after chromium production fell by 55 per cent of Soviet Union levels, KazChrome, the country's largest chromium company, was taken over by Japan Chrome, which now holds 55.2 per cent of the company. KazChrome is located in Aktubinsk and possesses two ferro-chromium alloys plants, Ermak and Asku.

The Karaganda Metallurgical Plant, the largest steel plant in Kazakhstan and the second in the CIS, has been operated by the United Kingdom-based Ispat International since 1995. Ispat-Karmet, as the company is known, has also made a purchase in the coal sector. In 1996, Ispat bought Karagandashakhtugol, which includes 15 coal mines and a coal-enrichment facility.

The Sokolovsko-Sarbaisk iron-ore mining and enrichment plant has been under the management of Ivedon International Company (Iceland) since 1995. Production rose almost fivefold in 1996 and reached the 1991 level. In 1999, the plant produced 4 million tonnes of steel.

Kazakhstan has also developed important mining industrial branches, most of them with direct foreign investments, such as the lead-zinc industry (KazZinc company and Shymkent Lead Plant), the bauxite and aluminium industry (Aluminum

Kazakhstan, which possesses 2 bauxite mines and the Pavlodar Alumina Plant), and the manganese and manganese-titanium industries (Kazakmanganese and Urst-Kamenogorsk Metallurgical Plant).

Mineral fuels industry

Oil and gas. According to Government estimates, Kazakhstan's proven oil reserves are 1.2 billion tonnes, but potential reserves under the Caspian Sea might be enormous. Natural gas reserves are estimated between 1.8 and 3 trillion cubic metres, of which about 1.9 trillion cubic metres are associated with oil or other liquids. The country has many distinct sedimentary basins, many of which are known to contain considerable oil and gas reserves, while others remain largely unexplored. Basins of particular interest are the Pre-Caspian Basin in western Kazakhstan, and the Turgai Basin located in central Kazakhstan.

The Pre-Caspian Basin is an extremely large and deep sedimentary basin. It covers 550,000 sq km, mostly onshore, with 45,000 sq km offshore beneath the Caspian Sea. The major part of this basin lies in Kazakhstan, with minor parts in the Russian Federation, the Islamic Republic of Iran, Azerbaijan and Turkmenistan. The basin is a deeply subsided portion of the Russian platform, estimated to be 22,000 m deep. It is asymmetrical, with the north and west flanks characterized by steep dip and more gentle dip on the south and east. A very thick section of evaporites, mostly salt, was deposited in the basin during the middle Permian (Kungurian). Over 1,000 salt domes have been identified in the Pre-Caspian Basin. Pre-salt and post-salt objectives can be differentiated. Important oil and gas fields from the pre-salt include Tengiz, discovered in 1979, with approximately 6-9 billion barrels of recoverable oil reserves, and Karachanganak, also discovered in 1979, with approximately 1-2 billion barrels of recoverable oil and 4-7 trillion cubic feet of recoverable gas reserves. Post-salt fields include SW Kamyshitovye, with approximately 100 million barrels of recoverable oil, Kenkiak with approximately 170 million barrels of recoverable oil, and Prorva with approximately 300 million barrels of recoverable oil.

The Turgai Basin is an elongate extensional basin filled with Mesozoic and Cenozoic clastics. The southern portion of the basin, referred to as the Araskum petroleum region, is currently the most explored and contains several significant fields, of which the largest is the Kumkol field, discovered in 1984, with approximately 200-300 million barrels of recoverable oil.

The oil and gas industry is the most rapidly developing sector in Kazakhstan. Production in 1998 was around 26 million tonnes of oil and 8 billion cubic metres of natural gas (Table 9.1). These figures represent an increase of 25 per cent over the 1995 oil production level and of 30 per cent over the 1995 gas production level. Kazakhstan intends to produce 80 million tonnes of oil per year by 2005 and 120 million tonnes by 2020. The country has three oil refineries at Pavlodar, Atyrau and Shymkent, which supply population centres in the northern, western and southern areas, respectively. The annual export of crude oil is about 20 million tonnes.

Almost half of Kazakhstan’s production comes from three large onshore fields: Tengiz, Uzen and Karachaganak. In order to develop its production, Kazakhstan has opened its resources to development by foreign companies. International oil projects have taken the form of joint ventures, production-sharing agreements or exploration/field concessions. By far the largest of these is the Tengizchevroil (TCO) joint venture. In 1999, the company produced 190,000 bbl/day, and exported about 170,000 bbl/day of crude oil through the Russian pipeline system, by barge and by rail to the Baltic, and by ship, pipeline and rail to the Black Sea.

To exploit offshore oil deposits in the Caspian Sea, the State company KazakhstanCaspishelf (KCS), a subsidiary of Kazakhoil, joined with six western petroleum companies in December 1993 to form the Offshore Kazakhstan International Operating Company (OKIOC). At present, OKIOC partners are Agip, British Gas, British Petroleum/Statoil Alliance, Mobil, Shell, Total, Inpex, Phillips and BP Amoco. The Consortium completed seismic exploration of the northeast Caspian Sea ahead of schedule and under budget in August 1996. Offshore drilling is expected to conclude in the middle of 2000.

In December 1996, the Governments of the Russian Federation, Kazakhstan and Oman, along with a group of private oil companies, signed the Caspian Pipeline Consortium (CPC) agreement. The pipeline is expected to boost exports of the Caspian Basin’s crude oil. The agreement involved the construction of a pipeline from the Caspian to Novorossiysk in the Black Sea. The first phase of

the project is planned to be finished by mid-2001. Completion of later phases of the CPC project will allow an ultimate capacity of 1.34 million barrels/day.

More than 40 per cent of Kazakhstan's natural gas reserves are located in one field, the giant Karachaganak, an extension of the Russian Federation's Orenburg field. In 1992, British Gas and Agip of Italy won a contract allowing them exclusive rights to develop Karachaganak. However, the development of this field has been hampered by difficulties in processing the output in the Russian Orenburg plant, so a new US$ 600 million gas plant at Karachaganak was planned, with a target date of 2005. In general, Kazakhstan's gas sector lacks infrastructure, especially pipelines, connecting gas-producing areas in the northwest of the country to gas-consuming areas in the south and east. Consequently, Kazakhstan has been forced to export its gas production to the Russian Federation, and to meet 90 per cent of its own natural gas consumption by imports (mainly from Turkmenistan, the Russian Federation, and Uzbekistan).

Coal. Kazakhstan is a major coal producer, consumer and exporter, with more than 100 coal deposits. Coal reserves are estimated at 120 billion tonnes (including about one third of steam and coking coal), of which 50 billion tonnes have been discovered.

The coal industry has a strategic role in the national economy, since up to 80 per cent of national energy requirements are currently covered by coal. Production is centred in the Karaganda and Ekibastuz basins. Karaganda, in north-central Kazakhstan, produces high-quality coking coal. Ekibastuz, in northern Kazakhstan, is the third largest coal basin of the former Soviet Union, producing mainly brown (sub-bituminous) coal for use in power plants. However, the high ash content of coal has limited its attractiveness for industrial use.

According to the Agency on Statistics, coal production in 1998 fell by 15 per cent as against 1995 to 68 million tonnes (Table 9.1); production was 131 million tonnes in 1990. The current decline is mainly due to lower demand for coal in its traditional market-the former Soviet Union. Transport costs for exports are also an issue. For example, Ekibastuz coal costs US$ 2.5 per tonne to mine, US$ 3-5 per tonne to transport to the Russian Federation and around US$ 50 to Rotterdam (the European storage centre). See Chapter 13 for a description of coal industries.

Uranium. Kazakhstan contains 45 per cent of the former Soviet Union's prospected uranium reserves. However, since the break-up of the Soviet Union, uranium production has halved. According to the Uranium Institute, production has increased since 1998, reaching 1,375 tonnes at the end of 1999. The main uranium provinces are Kokshetau, Pre-Caspian (Mangystau), Pre-Balkhash, Syr-Darya, Shu-Ili and Shu-Sarusu, which may hold 439,000 tonnes of uranium reserves (at favourable production cost). Kazakhstan has been attempting to revive its uranium industry by attracting foreign management. The Tselinny complex includes several underground mines, with estimated reserves of 75 million tonnes of ore grading 0.12 per cent uranium, processing facilities and a coal power plant. The complex was under the management of the Canadian company World Wide Minerals. However, the terms of the agreement were not respected and World Wide Minerals no longer runs Tselinny. Kazatomprom is the national nuclear company.

Investments in the mineral sector

Table 9.2: Total investment in the mineral sector, 1996-1999

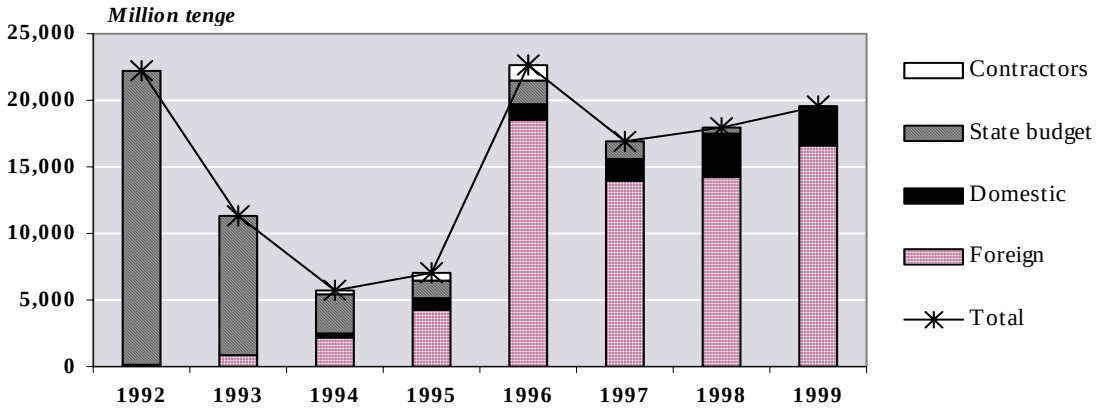
Million US$

	1996	1997	1998	1999
Oil, gas and condensat	922.2	1617.6	2032.6	2129
Coal	42.1	429.2	501.7	207.7
Copper	331.7	358.7	271.2	206.7
Iron, manganese	193.9	361.9	260.9	86.2
Polymetallic ore	130.9	270.1	260.3	185.5
Gold	107.1	114.6	70.3	43.7
Chromite	15	36.6	62.9	30.2
Uranium	22.3	20.8	29.4	25.4

Source: Dzhantureyeva, Elvira. 2000. Results, Problems and Outlook for the Investment Activity in the Mining Sector on the Treshold of the 21st Century. MRK (Mineral Resources of Kazakhstan).

During the past few years, investment in the mineral sector has increased, with investment by foreign companies accounting for an average of 80 per cent. In 1999, however, investment declined (Table 9.2). This was mainly explained by the fall in world prices of oil, gold, copper, coal and other minerals. During the 1996-1999 period, some US$ 6.7 billion were invested in oil and gas production, representing 60 per cent of total

Figure 9.2: Investment in geological prospecting, 1992-99



Source: Dzhantureyeva, Elvira. 2000. Results, Problems and Outlook for the Investment Activity in the Mining Sector on the Treshold of the 21st Century. MRK (Mineral Resources of Kazakhstan).

investment in the mineral sector. Most of this was made by large oil and gas companies, which accounted for 89 per cent of the overall investment, 91 per cent of overall production, 73 per cent of reserves, 75 per cent of tax payments, 96 per cent of social and local infrastructure expenditure, and 84 per cent of expenditure on environmental protection. Large investments were also made in coal and copper production. These sectors make up 10 per cent of total investment in the mineral sector. Investment in gold exploration dropped 10-fold, while investment in production was only halved. The cut in gold mining investment is due to the drop in the gold world price and a consequent outflow of private investors from the sector.

The volume of investment (foreign and domestic) in geological prospecting has fallen sharply (Figure 9.2). In 1996, investment in geological prospecting made up 14 per cent of total investment in the mineral sector, dropping to 5 per cent in 1999. Geological prospecting financed by the State budget accounted for only 1 per cent of budget funds allocated to such operations in 1992. Previously, budget funds provided for geological prospecting depended on the royalties paid by enterprises on their mineral production. With increasing foreign investment in mineral exploration since 1992, the Government sharply reduced the budget allocation for this purpose. Some 60 per cent of the royalties were allocated to geological prospecting in 1996 as compared to only 2 per cent in 1999.

9.2 Environmental impact in the mineral sector

Oil and gas pollution

Kazakhstan's largest oil and gas reserves are concentrated in the Caspian region, with 46 per cent of probable reserves located in the Atyrau *oblast* and 28 per cent in the Mangystau *oblast*. As a result of many years of intensive oil and gas exploitation and refining, the Caspian region is now heavily polluted.

Oil pollution is a real threat, not only to the biodiversity of the Caspian Sea, but also to the whole ecological system. The rising of the sea water level aggravates the regional environmental problems, with the flooding of oil fields in the coastal area. More than 200 oil wells and oil fields were flooded, including the large Kalamkas and Karazhanbas fields. Some oil companies try to prevent flooding by building dykes, which is not efficient and does not prevent groundwater contamination. Leaking abandoned wells around the Caspian coast are also a major environmental issue. Liability for the liquidation of these wells is a subject of debate, and so little has been done to solve this problem.

Soil pollution is also a major environmental issue in western Kazakhstan. Complete neglect of environmentally friendly practices in oil and gas extraction in the past has resulted in severe soil

Box 9.1: The Tengiz oil field

The Tengiz oil field is located in the southeast of the Pre-Caspian basin, Zhylyoy *rayon*, Atyrau *oblast*. It is the largest in Kazakhstan, characterized by high reservoir pressures and temperatures, as well as by a high hydrogen sulphide content. The Tengizchevroil (TCO) joint venture was created in 1993, with Chevron holding a 45 per cent interest. Other shareholders are Kazakhoil (25 per cent), Mobil Corp. (25 per cent) and LukArco (5 per cent). It is expected that investment in the development of the oil field will amount to US$ 20 billion. The company employs 3,100 Kazakhs, who represent 72 per cent of its workforce. In the 1993-1999 period, production increased from 1.3 million tonnes to 9.6 million tonnes a year. Production is planned to rise to 11 million tonnes by 2001. The increasing production level also means higher air, water and soil pollution. According to the Ministry of Natural Resources and Environmental Protection, TCO is by far the biggest polluter in the Atyrau *oblast*, accounting for 44.2 per cent of total air emissions. Its operations damaged 1884.8 ha of land, of which 4.8 ha were recultivated.

Recently, an environmental impact assessment (EIA) of TCO's operations was presented at a public hearing. The public EIA report concluded that the environmental impacts of TCO's operations were insignificant. The national scientific community and NGOs stressed that the results of TCO's environmental impact assessment were not reliable. They insisted on the need to clarify analytical methods and standards used by the contractor company which monitored the environment. They also assumed that the true environmental impact had not been assessed.

Nevertheless, the company states that the environment has been properly monitored in the Tengiz oil field. Present air-quality monitoring is done by 14 stations, which monitor levels of NO_2, CH, CO, H_2S and SO_2 in ambient air. Soils are sampled and analysed quarterly for contaminants at several checkpoints. Groundwater is regularly monitored through the measurement of water levels and sampling in groundwater wells installed around containment ponds, waste landfills and sulphur storage pads. In 1999, TCO spent US$ 105.7 million on environmental protection.

degradation and fauna and flora depletion. About 0.6 million ha of land is degraded due to oil pollution in both the Atyrau and Mangystau *oblasts*. A thick layer of oil in the soil has been observed down to a depth of 8-10 metres. Oil wastes are deposited in special collectors, which are covered with polyethylene and abandoned when their capacity of 2,700 cubic metres is filled. The total volume of accumulated oil wastes is up to 321,000 cubic metres, occupying an area of 132 ha. Outdated transport equipment, mainly old pipelines, also constitutes a source of soil pollution through leakage or spills. Due to the lack of funds, some oil companies do not replace old equipment and accidents can happen. About 5 million tonnes of oil have been spilt by accidents and leakage in western Kazakhstan.

According to the Ministry of Natural Resources and Environmental Protection, lead and zinc concentrations in the soils of oil exploitation and processing areas exceeds MPCs up to 3 times. In the vicinities of solid waste storage sites, pollutants such as sulphur compounds, bromine and boron exceed MPCs 5 to 8 times. The pollution of groundwater with sulphates in these areas is high, exceeding MPCs 15 to 33 times. Furthermore, the active development of the oil industry in the Mangystau and Atyrau regions has led to the radioactive pollution of oil-producing areas and their surroundings. 267 areas of radioactive pollution within the territory of 22 large oil fields have been identified.

During the past years, air emissions have increased as the oil and gas industry has grown. A major cause of air pollution is the flaring of natural gas, about 606 million cubic metres per year. This practice reinforces the greenhouse effect and has negative impacts on soil, flora and fauna. Moreover, respiratory diseases and morbidity in general have increased in oil and gas exploitation areas.

Natural gas flares can be contained with the appropriate technology. The use of associated

Box 9.2: The Uzen oil field rehabilitation project

EBRD has developed and launched a US$ 109 million project to rehabilitate the Uzen oil field. Its main objectives are (i) to help reduce the rate of decline in oil production and generate resources for reinvestment in the field operations, (ii) to promote the reorganization of Uzenmunaigas into commercially viable corporate units so that it can be privatized, (iii) to assist Uzenmunaigas in assessing the impact of past operating practices on the present condition of reservoirs, wells, and the environment of the oil field, and (iv) to contribute to the mitigation of past environmental damage to the field and to the strengthening of Uzenmunaigas's environmental monitoring and management systems and capacity to manage oil field operations.

To date around ten contracts have been initiated to the tune of about US$ 17 million for supply pipes, sucker rod pumps, chemicals, drilling equipment and supplies, and environmental services among other things. The project was interrupted during 1998, but is now being resumed.

Box 9.3: The Atyrau refinery

The Atyrau refinery began operating in 1945. It belongs to the State-owned company Kazakhoil and employs 1,800 people. The refinery runs solely on domestic crude oil from northwest Kazakhstan, receiving feedstock from the Mangyshlak, Tengiz and Martyshinsk oil fields. It currently processes about 190,000 tonnes of oil every month, a 90 per cent increase over last year's average monthly processing capacity. The refinery plans to process over 2 million tonnes of oil in 2000. Now it is operating at less than half capacity, which is 5 million tonnes. With the production decline, air emissions decreased to 21 per cent of the 1995 level. The amount of flared gases totalled 5,137 tonnes in 1999, which is 54 per cent less than in 1996. Nevertheless, emission levels are still high. Of the total 11,753 tonnes of substances emitted into the atmosphere in 1999 by the Atyrau refinery, 75.4 per cent were hydrocarbons and 23.4 per cent sulphur dioxide. The plant needs to be modernized to become more competitive. There is a general lack of new technology, especially in waste-water and air-treatment facilities. So, a rehabilitation project of US$ 450 million has been developed. A Japanese group of investors has agreed to finance the reconstruction. However, an impasse in negotiations with the Government will delay implementation until at least 2001.

natural gas would not just reduce the greenhouse-gas emissions, but also improve the country's energy supply. A US$ 120 million project, funded by the World Bank and Hurricane Kumkol, has been developed to recover associated gases in the Kumkol oil field. Most oil and gas companies, however, cannot afford this technology yet. In 1999, approximately 169,564.7 tonnes of harmful substances were emitted into the atmosphere in the Atyrau *oblast*, of which 35.2 per cent were hydrocarbon, 27.6 per cent carbon oxide, 6.8 per cent sulphur dioxide and 6.2 per cent nitrogen oxide.

Chapter 13 includes a detailed description of the environmental programme of the Karachaganak Petroleum Operating Company regarding its activities in the Karachaganak Oil and Gas Condensate Field.

Mining and mineral processing tailings

General. The tailings of mine waste are usually dumped in heaps, released into ponds, or retained by tailing dams. They disfigure the landscape and are potential sources of dust, hazardous emissions and water pollution. Tailings that remain after extraction and processing are mostly mud and slurries containing a very high proportion of metals and other minerals, as well as residues of the chemicals used to extract them. The finely ground material from processing makes contaminants formerly bound up in solid rock (e.g. arsenic, cadmium, copper, lead, zinc) accessible to water. In tailings containing sulphides (e.g. pyrite), which are common minerals in ore deposits, acidic conditions automatically develop due to the inherent production of sulphuric acid, increasing the migration of contaminants to the environment.

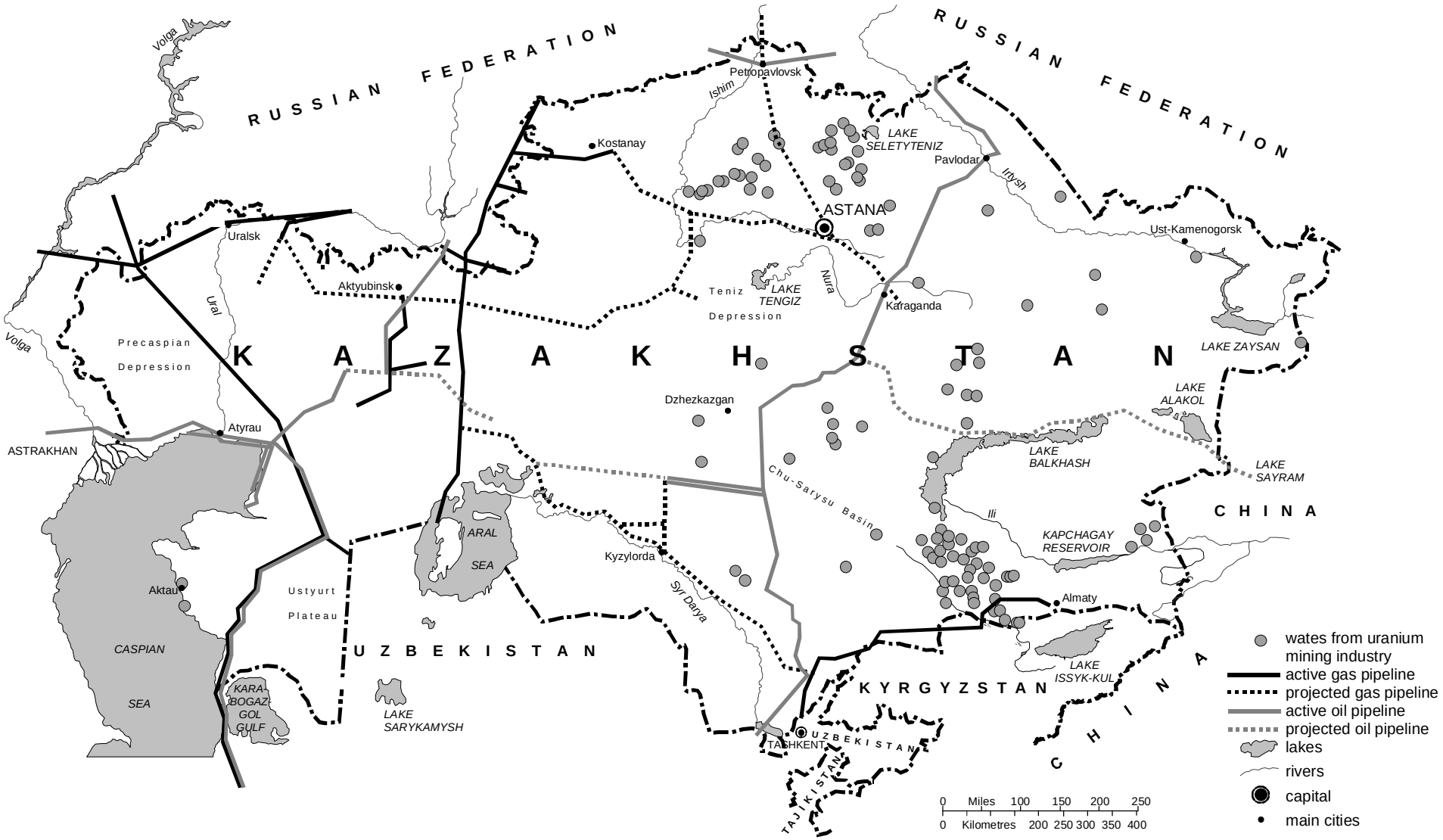
According to the Ministry of Natural Resources and Environmental Protection, about 3.5 billion cubic metres of coal tailings have accumulated in Kazakhstan and they occupy an area of 10,000 ha. Dust and the emission of nxious gases, including carbon monoxide, hydrogen sulphide and nitrous oxides from coal-mine tailings from Karaganda and Ekibastuz constitute a major air quality issue. They also create serious health hazards for the local population. Moreover, combustible material in coal-mining tailings can start a smouldering fire through self-ignition. Radioactive coal tailings are even more dangerous, due to their high radiation levels. In the Almaty region, 15,000 tonnes of radioactive coal material have been stockpiled from a brown-coal mine, officially classified as a rare metal mine (uranium). Coal dust and ash in which harmful compounds are five times more concentrated than in the raw coal can be dispersed by wind and water over a large area and absorbed into both animal and plant tissues.

The non-ferrous mining and metallurgical industry accounts for 26 per cent of total industrial wastes accumulated in Kazakhstan. 5.1 billion tonnes of tailings from the mining and enrichment of non-ferrous metals have accumulated on 14,000 ha, while 105 million tonnes of metallurgical processing tailings are deposited on 500 ha. The difference between these tailing volumes is due to the low level of ore recovery, which generates larger amounts of wastes during mining and enrichment than during metallurgical processing. As a result of inefficient mining operations and tailing management, large areas are currently environmentally damaged, including 43,200 ha in the Karaganda coal-mining region.

Uranium tailings. In general, tailing management is not a common practice developed by Kazakhstan's mining companies, and the result is a severe environmental impact. In the case of uranium tailings (Figure 9.3), the lack of management has additional safety and health risks. They contain

FIGURE 9.3:

LOCATIONS OF URANIUM TAILINGS IN KAZAKHSTAN



radioactive isotopes of uranium and thorium, as well as their decay products, including the radioactive gas radon. See Chapter 6 for a full description of problems with uranium mining and processing.

Air pollution

Mines are potential sources of greenhouse-gas emissions, with methane released from underground and CO_2 produced by energy use. Mining also contributes to air pollution at almost all stages of operations. Dust is given off by open pit operations and by ore crushing and grinding.

Emissions from the ferrous and non-ferrous metallurgical industries are the main sources of air pollution in Kazakhstan, accounting for 30 per cent of total harmful emissions. Smelting (processes by which ore is heated to separate it from the gangue) produces large amounts of air pollutants, such as sulphur dioxide, arsenic, cadmium, lead and other heavy metals. Mineral processing and metallurgical enterprises, such as Ispat-Karmet, Balkhashmys and Zhezkazgantsvetmet, are the largest air polluters in central Kazakhstan.

Despite the overall reduction in air pollution in recent years due to a decline in production, the content of harmful substances in the air remains high, especially in mining and metallurgical centres. In the Urst-Kamenogorsk metallurgical region, the concentrations of benzopyrene exceed MPC up to 11 times and lead 1.7 times. In the Ekibastuz coal-producing region, the concentrations of heavy metals , such as zinc, chrome, lead, nickel, manganese, iron and mercury, in the air are relatively high. Zhezkazgan and Shymkent also have high pollution levels of lead, copper, cadmium, as well as phosphorous in Shymkent.

Effluents

Potential sources of water pollution from mining include drainage from surface and underground mines, waste water from beneficiation, and surface run-off. The discharge of acid mine waters from mine operations is a major water quality issue. The natural oxidation of sulphides through exposure to air and water may produce acidic and metal-bearing solutions that can severely affect watercourses, soil and vegetation, and allow metals to enter the food chain. Mineral separation processes that make use of dangerous and toxic chemicals such as sulphuric acid or cyanide, or organic reagent, can also be serious sources of water contamination if appropriate control systems are not installed. Furthermore, mine waste water contains large amounts of suspended solids or radionuclides originating from the ore itself, from waste material, or from surface installations. They can affect surface water quality as well as aquatic biodiversity.

In addition, subsidence related to variations in the groundwater level is a major issue in the Karaganda coal-mining region, where only 12 out of 26 mines are currently in operation. When a mine is shut down, the water pumping system is also stopped. With the subsequent rise in the groundwater level, subsidence may occur and acid water lakes can be formed.

According to the State Statistical Agency, 143.2 million cubic metres of mining waste water were discharged in Kazakhstan in 1998. Major centres with high water pollution are located in the oil-processing, non-ferrous metallurgy and phosphorus industrial regions.

9.3 Instruments for the management of mineral resources

Policies and strategies

The main policy objective in the mineral sector has been the development of favourable conditions to spur greater foreign investment. Kazakhstan's Foreign Investment Law was adopted in 1994 and revised in 1997. Since then, Kazakhstan has started a programme to restructure the management of its mineral industry enterprises that combined Government ownership, privatization and foreign management. This programme involved the transfer of the bulk of Kazakhstan’s major mining and metallurgical industries to the trust management of foreign companies. In 1996, the Government began privatizing selected enterprises under trust management.

Broad environmental strategies for the mineral sector are laid out in the National Environmental Action Plan (NEAP), the Caspian Environmental Programme and the Strategic Plan UP To 2030 “The Environment and Natural Resources”. Most of the envisaged projects for the sustainable management and protection of mineral resources are included in these three programmes. Implementation has not been scheduled yet, since almost none of them have undergone feasibility studies. General policy directions are given in the

Strategic Plan. Among its priorities are improving the monitoring system in oil/gas-producing regions, developing a new concept of underground resources protection control, and introducing measures to reduce air pollution from non-ferrous metallurgy in Pavlodar and Ust-Kamenogorsk and from radioactive tailings near Aktau. It also aims to introduce cleaner technologies in the mining industry and develop more sustainable techniques for mineral exploitation. The reduction in greenhouse-gas emissions and the improvement of the energy supply have been developed by the "Kazakhstan Carbon Initiative" project, and by a pilot project to use associate gases in the "Prorva" oil deposit (Atyrau *oblast*). The Caspian Environmental Programme incorporated some NEAP projects to reduce oil and gas pollution in the Caspian region, including the evaluation of leakage in flooded oil wells, the creation of an environmental monitoring and pollution prevention system in the northern Caspian Sea, and a pilot project to clean up polluted oil fields in Emba, Atyrau *oblast*.

Legal basis

Kazakhstan adopted a new Law on the Underground resources in 1996. This Law retains the basic licensing and contract regime for granting underground resources use rights established under the old law. As with the previous law, the new one provides that the underground resources is owned by the State. However, the rights to use the underground resources for the exploration, development and extraction of minerals may be granted by a licence issued by the Government and a contract concluded with the Government. Once the minerals are extracted, they become the property of the licence holder along with the right to sell or otherwise dispose of them. The Law on the Underground resources explicitly states that the licence holder must abide by Kazakhstan's environmental and safety legislation. Formerly, environmental provisions in contracts were negotiated between licence holders and the Ministry for Nature Resources and Environmental Protection to provide some standard within which the foreign investor could operate economically.

In 1995, Kazakhstan adopted a new Oil and Gas Law, which was widely recognized as a critical step in attracting foreign investment. The Law was amended in 1999 to introduce provisions for conducting offshore petroleum operations. Among other measures, the Law contains a broad provision covering the offshore construction of oil and gas pipelines, storage facilities and reservoirs, and the discharge and disposal of wastes. Also under the Law, the contractor company has to rehabilitate environmental damage at its own expense. For this purpose, the legislation requires an environmental insurance to cover the costs of the mitigation of environmental impacts.

Regulations and economic instruments

Permits for prospecting and using mineral resources are issued by the Committee of Geology and Underground resources Protection. Nature use permits are granted by the Ministry for Natural Resources and Environmental Protection. They were streamlined in 1999, and now emissions, discharges and waste disposal are included in one permit valid for one year. In addition, mining projects need permits from the Agency on Emergency Situations and the Sanitary and Epidemiological Agency before their final approval by the Ministry of Energy, Industry and Trade.

The regulations which implement the current Kazakh environmental law are based on the old Soviet norms and regulations. They provide for taxes and charges for using mineral resources within permitted limits, and fines for exceeding these limits, as well as pollution charges and fines in function of the harm caused by the emissions and the discharge limits. Two categories of natural resources were identified: national and local, with differentiated taxes and charges. National resources are oil, gas, ferrous and non-ferrous metals and radioactive minerals. Depending on the particular conditions existing at a mining enterprise (e.g. an open pit mine producing many tonnes of waste rock or hazardous waste such as arsenic or radioactive waste), the environmental charges may be onerous.

The contract system obliges mining operators to pay to the State budget a tax on production in the form of royalties and a bonus as a payment for mineral resources use. Payment for environmental pollution goes to the Environmental Protection Funds. About 50 per cent to 80 per cent of these Funds accrue to the State budget, depending of the regional environmental situation. In the east Kazakhstan and Atyrau *oblasts*, 50 per cent of the Environmental Fund is used for local environmental projects.

Besides the insurance to cover liability related to environmental damage and its clean-up, the resource use contract also provides a liquidation fund to ensure the necessary financing of the

liquidation plan. According to the Committee on Geology, the amount established in the contract for this purpose depends on the deposit size and the period of operations, and ranges from 0.1 per cent to 0.2 per cent of taxes. The implementation and enforcement are still weak.

At present, the pricing of mineral resources is determined by world markets. However, State imposes regulated transport fees for the domestic transport of mineral raw materials (oil, coal and metals), and also by customs duties.

Institutional framework

The Committee of Geology and Underground resources Protection is the main institution involved in the management of mineral resources. It is part of the Ministry for Natural Resources and Environmental Protection and has a complex organizational structure, with 5 departments and 16 sub-departments and a staff of 81. The main subdivisions of the Committee include the Departments of Monitoring of Groundwater and Dangerous Geological Processes, of Mineral Resources Management, of Economics and Standardization, of Geological Prospecting, of Development of the Raw Material Basis, and the State Commission on Mineral Reserves. The Committee of Geology and Underground resources Protection also has regional bodies (GUMR) under its authority, in Kokshetau, Ust-Kamenogorsk, Almaty, Aktubinsk and Karaganda. The Committee's main function is to ensure the sustainable use and the protection of mineral resources, through monitoring, expertise and control over compliance with the Law on the Underground resources. It also grants permits for mineral exploration and exploitation and is responsible for the State accounting of mineral resources.

The preparation and development of investment programmes in order to establish a contract for mineral exploration and exploitation is the main task of the Agency on Investments. Some divisions of the Ministry of Energy, Industry and Trade are also involved in mineral resources management, including the Department of Heavy Industry, in charge of mining and metallurgy and nuclear energy issues.

The National Centre for Mineral Raw Materials Complex Processing is a major scientific and technical institution involved in developing cleaner technology for mining and metallurgy. Among its current projects are the development of a cleaner recovery process for gold and the use of methane from coal mines. The Centre includes the State Industrial Ecology Research and Production Corporation "Kazmechanobr", the Institute of Mining (Almaty), the Chemical Metallurgy Institute (Karaganda), the Non-ferrous Metallurgy Research Institute (Ust-Kamenogorsk) and the Joint-stock company "Kazchermetavtomatika" (Karaganda). Other research institutions are the Kazakhstan Institute for Mineral Resources (KazIMR), the Kazakhstan Scientific Geological Institute (KazSGI) and the Kazakhstan Research Institute for Geological Exploration (KazNIGRI).

In addition, the Intersectoral Committee on Caspian Sea and Oil and Gas Pollution Problems was created for the national implementation of the Caspian Environmental Programme, under the coordination of the Ministry for Natural Resources and Environmental Protection.

Monitoring

The State monitoring and control of mineral resources is performed by the Committee of Geology and Underground resources Protection. Within the Committee, the Department of Monitoring of Groundwater and Dangerous Geological Processes monitors groundwater and hazardous exogenous and endogenous geological processes. The network for groundwater monitoring consists of 16 hydro-geological units controlling the water level, temperature, chemical composition and regime in natural conditions. It includes one laboratory per *oblast* and a central laboratory for the whole country. Currently, these laboratories are not well equipped and can perform only simple analyses.

The 5,560 observation points are distributed in 365 posts around the country. Only 49 per cent of observation points and 63 per cent of posts are operating. They are unevenly distributed, sometimes leaving important pollution areas without any monitoring. For example, in the Atyrau oil and gas-producing region, there are 13 observation posts with 254 observation points, of which at least 30 per cent are not working at present. Moreover, the observations are not carried out regularly, and are currently reduced to a minimum. Samples for water-quality analysis used to be collected quarterly, but were reduced to once a year in some *oblasts*. Sampling for water level and temperature used to be done 5 times a month.

At present, these analyses are performed twice a month.

The monitoring of hazardous exogenous and endogenous geological processes, such as karst formation, landslides and erosion, has stopped due to a lack of funding. Only earthquakes are still monitored in the south.

Information systems

The Republic's Geological Fund registers all the information related to geological exploration, geological and topographic maps, and the State balance of mineral resources. The information stored totals more than 46,000 documents in paper form. Since 1997, the documents admitted for storage have been in both paper and electronic form.

The State cadastre for mineral deposits consists of a periodically updated information system covering the quantity and quality of mineral resources, the economic and geologic estimation of deposits and their exploitation conditions, and the state of the environment and hydrogeology.

In 1999, the Ministry for Natural Resources and Environmental Protection started using a computer system for the management of mineral resources. It aims to integrate data on mineral deposits and other cadastres, as land, water, air, fishing, hunting and forests, which could be easily available to decision-making. A central database of mineral resources has recently been developed. It includes databases for oil refining and mining enterprises, a geological and geophysical survey, accounts of reserves, licences, and a map of investment programmes. Two information systems are currently used for database management: the American "Finder" and the French "Petrovision".

The Department of Statistics on Underground resources Use at the MNREP collects information on mineral resources exploration and use, including production, exports, taxes, payments, environmental expenditure and investment. For this purpose, a report on the fulfilment of contract/licence conditions by underground resources users was developed and introduced in 1996. Based on the report, a database has been created, providing quarterly information on every mining operator. In addition, there is an Informational and Analytical Centre which gives information and assistance to investors interested in exploring and developing the vast mineral wealth of Kazakhstan.

9.4 Conclusions and recommendations

The main objectives of the mineral sector's current policy have led to the harmonization of Kazakhstan's interests with those of foreign investors. Increasing investment in the mining industry has obviously pushed the transfer of advanced technology and management, improved the country's economic and social standards and helped to cover the State budget deficit by taxes and other payments. However, mining remains inherently problematic from an environmental point of view. Although its direct environmental impacts on the whole seem well understood, the relevant authorities may not always rise to the occasion by formulating environmental regulations and then enforcing them.

The environmental issues facing the Kazakh mining industry are the result of many years of weak regulatory control, with other priorities more pressing than the long-term environmental management of mines. So current mining regulations need to be updated on the basis of international environmental management practices and standards to keep pace with the country's industrial development. In addition, the lack of adequate enforcement mechanisms hampers the implementation process. This can be illustrated by the contract system, which foresees an environmental liquidation fund without providing the mechanisms to implement it. Another important point that requires special attention in the country's mineral legislation is the liability of the parties in cases of environmental damage by mineral exploration and exploitation operations, and its evaluation procedure. This seems to be a priority, since there have been repeated accidents involving oil spills into the Caspian Sea, and the chances of accidents and leaks will increase with the construction of the Caspian pipeline and the development of offshore petroleum exploitation. Moreover, the establishment of an efficient system for emergency response, containment and clean-up after oil spills also seems to be necessary.

Recommendation 9.1:
The current legal and regulatory basis for the sustainable management of mineral resources should be improved and strengthened, in particular the oil and gas regulations. Special attention should be paid to the introduction of effective

mechanisms for implementation and enforcement, specifically economic mechanisms. See Recommendation 1.1.

The promotion of cleaner production in the mining industry plays a key role in the effective and environmentally sound management of mineral resources. Today, efficiency and environmental performance are brought together in the concept of cleaner production. As the mining industry is a large consumer of electricity and other resources, any technologies that reduce electricity consumption indirectly reduce impacts on land, water and air. The introduction of new technology to improve environmental performance in mining, mineral processing and the disposal of mining wastes is in its infancy in Kazakhstan, although some progress has been made in the past years with the establishment of a cleaner production centre. Research and development in this field need to be directed at all areas of mining enterprises, so as to produce mineral products by techniques and processes that have less of a short-term environmental impact, are safer for personnel and society, and cut cost. Therefore, the use of cleaner technologies in mining is a key to reducing waste at source.

Recommendation 9.2:
The introduction of new technology to improve environmental performance in mining should be encouraged by all possible means. Financing support for the establishment of cleaner production centres in each of the principal mining regions of the country should be considered. See Recommendation 5.2 and 11.3.

Both technology and management practices have major implications for environmental performance. An environmental management system (EMS) should cover all company activities, from exploration to post-closure monitoring. Properly applied, it can ensure good environmental performance, improve community relations, reduce costs and lower the risk of legal liability. It can also be a major internal tool to verify whether the company is complying with EIA-determined regulations. In recent years, some large mining companies in Kazakhstan have adopted formal environmental management and have produced reports on their environmental performance. However, many companies are at an earlier stage of development, and much has to be done to improve the current management of mineral resources. In addition, there is a lack of incentives for the accreditation of companies providing environmental monitoring to mining operations. The credibility of reports is sometimes questionable, making it difficult to assess the real environmental impact. The Government should encourage mining associations to develop environmental policies, guidelines and a code of practice, and reinforce corporate responsibilities. The code should include the formulation of a broad environmental policy, guidelines for environmental reporting, the auditing of compliance, accreditation, community consultation and risk management. The adoption of, and compliance with, the code can be encouraged through market instruments.

The development of environmental management in mining requires parallel training on the subject. The urgency behind the sustainability debate now makes it important that new graduates entering the mining profession have a good understanding of the changing environmental agenda, and of the management tools and systems needed to address it. There is also a need to give employees at every level the knowledge and skills required to work in new, more "prevention-oriented" ways.

Recommendation 9.3:
A full environmental management system (EMS) developed according to international environmental management standards (ISO 14000 series or equivalent), should be made a prerequisite for the granting of mining leases. The establishment of a code for environmental management in mining should be encouraged. Environmental management in mining should be adopted as an important part of the basic curriculum of mining schools, and of other educational establishments training professionals for mining and gas industries and environmental training for mining professionals at all levels is strongly advised.

The preparation of the NEAP started in 1997 and represented an important step towards the country's environmental protection. Since then, it has identified several priority projects, covering many areas of environmental pollution by the mining, processing and metallurgical industry. Some projects developed by the NEAP were embodied in both the Caspian Environmental Programme and the Strategic Plan for the Environment and Natural Resources until 2030. However, project implementation has been hampered by the lack of mechanisms and infrastructure. Meanwhile, environmental problems are worsening, in particular oil and gas pollution around the Caspian Sea. These problems are of high concern and require immediate action. In addition, inventorying

the large volume of mining and processing tailings, including radioactive tailings, has not been included in the country's strategic policy. The lack of tailing management, along with the huge area that is environmentally damaged by mining, creates major problems that require specific measures to mitigate environmental impacts. The Government has initiated special projects to investigate uranium and coal tailings, but their development and implementation are delayed due to financing problems.

Recommendation 9.4:
All priority projects included in the National Environmental Action Plan concerning the prevention or elimination of environmental pollution by the mineral sector should be implemented as soon as possible. A broad programme for the management of existing mining tailings, including hazardous and radioactive tailings, should be developed, financed and implemented. See Recommendation 6.4.

The monitoring of mining activities and their impacts is a major environmental management tool. Monitoring can be carried out from the mineral exploration phase to the reclamation of sites after mining shutdown, but the greatest need for continuous monitoring occurs during the production phase. The monitoring programme built into the permit will demonstrate whether the regulations are complied with. Therefore, environmental standards and quality control must be clearly specified in the regulations as a basis for effective law enforcement. The resulting ecological reports on physical impacts or emissions submitted to the relevant regulatory agencies may encourage companies to improve their performance.

At present, the monitoring carried out by the Committee on Geology and Underground resources Protection is reduced to groundwater and earthquake monitoring. Hazardous natural geological processes are not currently monitored. The Committee of Geology and Underground resources Protection has prepared a plan to optimize the groundwater-monitoring network. According to the plan, 30 per cent of observation points of the State network are not working, and about half of them should be liquidated. Other observation sites should be created in areas that are not well covered by the network. To better monitor dangerous geological processes and optimize the current groundwater monitoring, increasing the concentration in mining regions, every effort should be made to find the required funds. Laboratory equipment, analytical techniques and standards also need modernizing.

Recommendation 9.5:
Mining operations should be monitored according to international environmental standards and regulations. The introduction of an effective system of State monitoring producing reliable environmental information should be seen as a matter of urgency. In this framework, the monitoring plan developed by the Committee of Geology and Subsoil Protection should be implemented as it is.

Kazakhstan has a great mineral potential. Its economy is mostly based on the mining industry, reflecting the importance of the efficient management of mineral resources. The current institutional basis for the management of mineral resources is very complex and needs to be streamlined. In this framework, the restructuring of the Committee of Geology and Underground resources Protection should be critically considered. Its main responsibilities and tasks must be reviewed. To make geological exploration and monitoring more efficient, and to reinforce control over compliance with the country's mineral regulations, a specialized body might be needed.

Recommendation 9.6:
The creation of a geological survey for underground resources is a priority for the improvement of mineral resources management. Technical assistance, an integrated information system and staff training are essential tools to reach this objective.

Chapter 10

NATURE AND FOREST MANAGEMENT

10.1 Selected aspects of the state of nature

Ecosystems

There are five types of landscape in Kazakhstan's plains (forest-steppe, steppe, dry steppe, semi-desert and desert) and seven in the mountain areas (nival, mountain meadow, forest, forest-steppe, steppe, semi-desert and desert). There are four large mountain systems: Western Tien Shan (the mountains of Karatau and Western Tien Shan), Northern Tien Shan, Kazakhstan-Dzhungar and the Altai ranges. The mountains significantly affect the adjacent plains, where special inversion types of the ecological systems are concentrated, such as the foothill deserts in the south of Kazakhstan.

Forest steppe. This zone occupies a vast territory in the oblast of North-Kazakhstan. Forests cover 0.7 million hectares. They have a meliorating and soil protecting effect on the adjacent steppe areas. The steppes are rich in various types of grass. The sub-zones of the southern, slightly humid and moderately warm forest steppe, and the moderately dry kolochnaya forest steppe can be distinguished clearly.

Steppe. The steppe zone occupies 110.2 million ha or about 28 per cent of Kazakhstan and is subdivided into 3 sub-zones: the moderately dry and warm zone of feather grass and various other grasses, the moderately dry and warm zone of tipchakovo and feather grass, and the dry, moderately hot wood and feather grass zone. The steppe zone has been transformed mostly by human activities. Large-scale ploughing of the land in the period of virgin land cultivation (1954-1960) led to the destruction of most of the main types of steppes.

More than 38 million ha of land have been ploughed in the steppe zones. These include bout 90 per cent of the rich feather steppes and various grass valley steppes, 50-60 per cent of the dry steppes in the plains, 30 per cent of the low-hill steppes and 10-15 per cent of the small hill steppes. The remaining steppe lands in these sub-zones (stony, complex steppes on saline soils) have been significantly affected by overgrazing. The feather grass steppe has been invaded by typchakovyi (*Festuca valesiaca),* avstryisko feather grass (*Artemisia austriaca),* weeds and various grass communities.

Steppes rich in grass with carrots, red feather grass *(Stipa zalesski),* endemic Korzhinskyi feather grass *(comm. Stipa korshinskyi),* oat (*Aneurolepidium ramosum, Avenastrum sp.)* and meadow steppes, shrub ecological systems, sparse pine tree forests on the granites, birch tree forests and black alder thickets (*comm. Betula pendula, comm. Alnus glutinosa)* are rare or threatened and need protection.

Desert. Desert ecological systems cover about 124.6 million hectares. Unique plants are present along the periphery of the mountainous ranges. Ephemeral communities of semi-shrubs with high grasses (savannahoids) are spread over the plains which surround the Western Tien Shan and Karatau mountains. Five sub-zones can be clearly distinguished within the desert zone: the northern dry and moderately hot zone; the medium (northern turan) very dry, hot desert; the southern very dry, hot desert; dry foothills and very hot deserts; and the very dry desert of the foothills.

Vegetation in the northern deserts is dominated by worm woods *(comm. Artemisia)* and good pastures. In the vicinity of wells, farm animals graze these areas extensively, as well as areas adjacent to wintering settlements and along the cattle routes. In the mid- and southern desert ecosystems *(comm. Artemisia sp. + Anabasis salsa +Ephemeretum),* especially in the western part of Kazakhstan, besides overgrazing, vegetation losses are due to anthrogenic impacts and the road network. The plants of the sand deserts, such as haloxylon *(Haloxylon)* forests, psammophyte *(Calligonum, Astragalus* and others*)* shrubs and psammophyte worm woods *(Artemesia arenaria, A. albicerata, A.*

songarica) deserts, were destroyed because of their vulnerability to anthropogenic impacts like grazing. The haloxylon *(comm. Haloxylon)* forests have also significantly suffered from firewood collection. The heaviest destruction of plant cover occurred in the foothill zones. The original ephemeral wormwood deserts have practically disappeared. These regions now contain irrigated farmlands and are extensively grazed. They have been populated since ancient times.

The haloxylon forests occupy more than 5 million hectares and are included in the forest resources. Their mixtures of sandy acacia (*Ammodendron bifolium, connollyi),* boyalysh *(Salsola arbuscula),* grebenshik *Tamarix hispida, T. ramosissma),* zhuzgun *(Calligonum leucocladum, C. aphyllum, C. caput medusa, C. eriopodum)* and astragal *(Astragalus sec. Ammodendron)* are widespread. The black haloxylons in the Kyzylkum, western part of Betpakdala, in the middle of the Sarysu river, the lower reaches of the Ili river, and in Moinkum all are of great significance. The white haloxylons (*comm. Haloxylon persicum comm.)* contain the best pastures all year round. Their cutting for fuelwood results in soil erosion. The Zaisan haloxylon (*Comm. Haloxylon ammodendron),* the endemic spireantus communities (*Spiraeanthus schrenkianus)* and endemic systems of the sands of astragal (*Astragalus cognatus),* zhuzgun (*Calligonium pavlovii),* kopeechnik *(Hedysarum scoparium),* white waxed worm wood (*Artemisia albicerata)* are rare in the desert and need protection.

Mountain ecosystems. The mountain ecological systems extend over an area of more than 18.6 million ha (about 7 per cent of the territory of Kazakhstan) and contain over 30 plant communities, dominated by woodland, shrubland and grasslands. Among them there are fir-tree plantations, silver fir groves, larch forests, deciduous trees including apple, apricot, birch and other communities like the dog-rose communities, barberries archa, and *Ephedra equisetina, Festuca valesiaca, Kobresia capilliformis,* subnival zone cryophyte plants and rare "films" of glacier algae.

The mountain ecological systems have the highest biological diversity, endemism and economic value. The most significant of them there are the Northern Tien Shan group, including Dzhungar Alatau, Ketmen, Zailiyskyi Alatau, Kungey Alatau and the eastern part of Kyrgyz Alatau, the western Tien Shan group including the ridges of Karatau, Karzhantau, Pskemskyi, Ugamskyi, Talasskyi and the western part of Kyrgyz Alatau, the mountains of the Altai group, and the Saur ridge.

The highest diversity of ecosystems is found in the nival zone. The Altai ecological systems are characteristic of the mountains of Southern Siberia and cannot be found anywhere else. They have typical Siberian flora and fauna. The neighbouring ridges of Saur and Tarbagatai constitute the transition to the real Central Asian mountain range – Tien Shan and Dzungar Alatau.

Despite their inaccessibility as compared to the lowlands, the territories of the mountainous ecosystems have experienced significant anthropogenic impact: from agriculture (mainly overgrazing and wood-cutting, to a lesser extent haymaking), from infrastructure and industries (roads, mining, construction), and recreation. The ecological systems in the foothill valleys have suffered the most. They have been destroyed to a large extent.

Water and coastal ecological systems. There are many shallow saline lakes among Kazakhstan's 48,000 small and large lakes. Their shores are virtually deprived of any flora and are not attractive for game waterfowl. However, the islands in these lakes are ideal for the nesting of colonial species of sandpipers, seagulls, terns and even such rare birds as the pink flamingo (Lake Tengiz). The other lakes, especially in the steppe zone, have thick reed beds (*Phragmites australis),* providing shelter for numerous waterfowl, not only during the nesting period, but also during moulting at the end of summer, and during spring and autumn migrations. Being located on the migration routes of waterfowl from Siberia to the Caspian, and from Asian and African wintering grounds, these lakes have a strategic importance for the management of game birds. Two lakes in central Kazakhstan-Lake Kurgaldzhinskye and Irgiz-Turgai Lake-were recognized in the 1970s as water and marsh sites with international significance as waterfowl habitats and are Ramsar sites.

Willow and poplar forests grow in the valleys of the rivers in the steppe zones. They alternate with the various types of meadow and water and marsh systems. Forest communities in the river valleys of the desert zones comprise poplar and lokh, willow and grebenshik thickets. Reed beds occupy large areas along the lakes. Uncontrolled haymaking, burning, incidental pasture, the uncontrolled use of water from reservoirs for irrigation, ploughing of

the floodlands and other practices contribute to desertification.

The ecosystems of specific forests, meadows and saline soils in the river valleys and lakesides are marginal zones in the steppe and desert zones. Willow and poplar forests include spots of meadow or marsh plants. In the deserts grow the willow (*Salix)* and lokh-turanga (*comm. Populus diversifolia* and *Elaeagnus angustifolia)* tugai forests, with thickets of grebenshik (*Tamarix)* and chingil *(Halimodendron halodendron),* and meadow cereals, including reed ecological systems. Along the lakesides the marsh and meadow plants are replaced by the complex ecological systems of the saline soil meadow and steppe, and deserted ecosystems of the halophyte type.

Floodlands occupy 6 million ha. There are 2.2 million ha of highly productive water meadows, of which 1.3 million are floodlands. These lands suffer from the lowering of the water table, the drying-out and salinization of soils, the degradation of meadow plants (the worsening of agro-biodiversity, crop yield decrease, the transformation of haymaking lands into pastures) and the loss of biological diversity. Changes in the composition of meadow plants are particularly dramatic in the flood zones of the Ili, Syr Darya and Chu rivers, where highly productive reed communities have almost disappeared.

In the steppe zone, the highest cenotic diversity is that of the meadow marshes, with water and marsh plants. With a reduction or loss of surface flooding, the meadow plants become steppe-like. The meadow plants are declining everywhere as a result of the reduction in river flow, and meadows are gradually vanishing. The coastal ecological systems have an economic potential for haymaking, agriculture and recreation. The riverside meadows and tugai ecological systems cross the sub-zones of deserts and steppes. There are rare and endemic ecological systems, which require protection and include turangovniki (*comm. Populus)* and ash tree forests *(comm. Fraxinus sogdiana).*

The water and marsh ecological systems undergo significant fluctuations in water levels and salinity. Many of them periodically dry out. The basin ecological systems can be distinguished for their native ichthyofauna, waterfowls and their nutritional basis (benthos, plankton, algae, and water coastal plants). The ichthyofauna of the water ecological system is represented by over 100 species. In the majority of the basins, native species have been partly replaced by acclimatized types (the Aral Sea, Balkhash-Ili and others). The avian fauna includes about 130 species of waterfowl (43 game birds, about 20 fish-eating, including 19 rare and vanishing ones). The average annual number of waterfowl totals over 60 million.

An inventory of the biological diversity of the forest-steppe and steppe zones, desert and mountain ecosystems is almost finished now, and the same task for water and marsh ecological systems still has to be carried out.

Flora

Table 10.1: Number of threatened phytobiota species , by category of threat

Taxa	Total number of species	Recorded in the Red Book	Categories					
			I	II	III	IV	V	VI
Equissetophyta	8	-	-	-	-	-	-	-
Bryophyta	about 500	4	-	-	4	-	-	-
Polypodophyta	35-36	2	-	-	2	-	-	-
Lycopodophyta	5	2	-	-	2	-	-	-
Pynophyta	26	2	-	-	2	-	-	-
Magnoliophyta	about 6000	362	3	38	248	55	2	4
Algophyta	about 2000	6	2	2	1	1	-	-
Lichenophyta	485	4	-	-	-	2	2	-
Fungi	about 5000	22	-	4	17	1	-	-

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. Kokshetau, 1999.

Kazakhstan's flora includes 14-15,000 species. Complete inventories of vascular plants and mushrooms have been drawn up. There is no complete information on mosses, lichens or seaweed. The diversity of flora as well as its specially interesting features increase from west to east in the plain areas of the steppes and deserts, and from northeast (Altay) to southwest (Western Tien Shan, Karatau) in mountainous areas. More than 6,000 species of vascular plants, around 500 mosses, 485 species of lichen, more than 2,000 species of seaweed, and about 5,000 species of mushrooms are registered.

The 2nd edition of Kazakhstan's Red Data Book is under preparation. It includes 404 plant species, i.e. an increase of 101 species over the first edition. The distribution of species is *Lycopodophyta-2, Polypodophyta-2, Bryophyta-4, Pynophyta-2, Magnoliophyta-362, Algophyta-6, fungi-22, Lichenophyta-*4 (Table 10.1). Thus, 6 per cent of vascular plants and 0.6 per cent of the lowest plants are included. Classification is in accordance with IUCN categories.

14 per cent of vascular plants species are endemic. In particular, there are 10 endemic monotype sorts: *Physandra, Rhaphidophyton, Pseudoeremostachys, Pseudomarrubium, Botschanzevia, Cancriniella, Spiraeanthus, Pterygostemon, Pastinacopsis, Niedzwedzkia.* In general, the flora of the highest plants in Kazakhstan was generated from subtropical vegetation of eocene, mezophyll-forest oligocen flora, and ancient Mediterranean neocene flora, including primal myocene-pleocene steppes. A number of representatives of past epochs were preserved as relicts. They are: *Spiraenthus schrenkianus, Rhaphidophyton regelii, Echinops saissanicus, Zygophyllum potaninii,* etc (eocene); *Betula turkestanica, Juglans regia, Malus sieversii, Sorbus persica, Populus talassica,* etc (oligocene); *Iris scariosa, Rheum nanum, Allium polyrrhizum,* etc (myocene-pliocene).

Among the micro-flora, 4.8 per cent of the species are endemic. Especially high endemism is typical of spherpside mushrooms, where there are 3 endemic sorts and 124 endemic species (12 per cent of all spherpside mushrooms).

Kazakhstan's flora represents a substantial economic interest. Long-term research revealed more than 20 species of valuable tanning plants. The stocks of dry roots of these species exceed 200,000 tonnes. There are major food plants, and the forestry organizations collect up to 300 tonnes of fruit from apple-trees, hawthorn bushes and apricot trees. Among the 450 species of known aromatic plants, at least 70 are economically promising. Basic medicinal plants (80 per cent) are widespread in the mountains of Zailiiski Alatau, Ketmen, Kungey and Terskey Alatau, Jungar Alatau, Kirghiz Ridge, Boraldaitau, Altay and Tarbagatai. The existing resources of *Ephedra equisetina Bunge* allow a harmless harvest of up to 700 tonnes of dry raw material of *Glycyrrhiza glabra L., Uralensis Fisch.*, which can be exported.

Forests

Forests covered 4.2 per cent of the national territory in 1998. The main forest areas are the mountains of Alatau and Tien Shan, and the flat lands and low hills of northern Kazakhstan. The total forest land is 26.4 million ha, of which forests cover 11.4 million ha. Over 1.3 million ha have been afforested. Mountainous forests are distinguished from those in the plains, including those in deserts and intra-zonal areas. In terms of species composition, Haloxylon (5 million ha) is dominant, followed by pine forests (384,000 ha), birch groves (900,000 ha), fir forests (384,000 ha), aspen forests (296,800 ha), larches (175,000 ha), spruce forests (168,000 ha), cedars (43,000 ha), etc

The forests of the forest-steppe zone contain mainly birch forests (*Betula pendula, B. pubescens*) with mixtures of aspen (*Populus tremula*) and willow (*Salix sp.sp.*). The forests in the steppe zone are situated in lowlands, where birch (*Betula pubescera*) and aspen (*Populus tremula*) predominate. In the forests on sandy soils, pines (*Pinus silvestris*) are dominant. Bottomland forests are often oak woods (*Quercus robur*), maple forests (*Acer tataricum*), elm trees (*Ulmus laevis*), and willow forests (*Salix sp.sp*) have been degraded by the infringement of water. Riparian woodlands of poplars (*Populus diversicola, P. Pruinosa,* and *P. Talassica* in some places), Russian olive (*E. aeagnus angustifolia*), sometimes willow (*Salix sp.sp.*), tamarisk (*Tamarix sp.sp.*) and ash (*Fraxinus sogdiana*) grow along the rivers.

Deciduous woods predominate in the lower belt of the Altai mountains. They are mixed with coniferous fir (*Abies sibirica*), pine (*Pinus sibirica*), and larch (*Larix sibirica*). The areas occupied by spruce (*Pica obovata*) are insignificant. In Saur, larch forests are dominant with occasional spruce (*Picca schrenkiana*). Considerable areas of coniferous forests have been degraded due to logging and fire.

In the low mountains of the northern Tien Shan and Dzhungar Alatau, some maple (*Acer semenovi*) grows. Higher in the mountains, apple-trees (*Malus sieversii*), thornapple (*Crataegus songorica*,, etc) and aspen forests (*Populus tremula*) are found. Mid-mountains are covered with spruce (*Picca schrenkiana*) and meadows, there is juniper in higher altitude forests (*Juniperus pseudosabina, J. sibirica*) and alpine meadows.

The mountain forests of the western Tien Shan are characterized by widespread juniper forests (*Juniperus turkestanica, J. semiglobosa, J. seravschanica)*. The forests of walnut (*Juglans regia*), apple (*malus sieversii*), poplar (*Populus talassica*), birch (*Betula talassica*), willow (*Salix sp.sp*.), as well as relict species (*Juglans regia, Malus kirghisorum, Aflatunia uimifolia, Ptistacia vera, Exochorda tianschanica, Abelia corymbosa*), are subject to heavy degradation and exhaustion.

Trees are felled for timber in all forests, except in the reserves and inaccessible forests. Annual felling amounts to about 700,000 m^3. Most of the timber is processed by State forestry and hunting enterprises , with their more than 130 sawmills and timber-processing workshops. They produce more than 300 types of products, including 80,000-100,000 m^3 of saw-timber.

In addition, 4-5 tonnes of fir-wood oil, more than 2,000 tonnes of game meat, 1,000 tonnes of melons and gourds, up to 30,000 tonnes of hay, and 20,000 tonnes of honey are produced from forest land. Haymowing (330,000 ha), livestock grazing (2,960,000 ha), the collection of fruits, cedar nuts (more than 1,300 tonnes) and herbs (up to 15,000 tonnes) take place. Forests are used for recreation, research and hunting. The use of forest resources is summarized in Table 10.2.

Table 10.2: Use of forest resources, 1997

Wood cutting *(1 000 m^3)*	552.2
Wood cutting for care and sanitary purposes *(1 000 m^3)*	280.0
Harvesting wild fruit and berries *(tonnes)*	46.5
Harvesting medicinal raw materials *(tonnes)*	7.6
Grass cutting *(tonnes)*	29,000

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. Kokshetau, 1999.

Table 10.3: Hunting quotas of commercial animal species, 1998

Animal species	Quotas	
	Number	*% of population*
Elk	131	5.5
Red deer	367	5.9
Roe-deer	2,021	7.5
Saiga	40,000	6.7
Wild hog	1,162	10.8
Siberian ibex	900	6.2
Musk deer	15	5.0
Bear	65	5.0
Marmot badger	89,800	5.9
Muskrat	54,170	25.8
Russian sable	500	20.0
Cock-of-the-wood	300	8.8
Pheasant	16,500	14.4

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. Kokshetau, 1999.

The habitats of about 75 per cent of commercial animals are connected with forests, so poaching is a serious problem. Professional, amateur and sports hunting are possible, their duration and procedures being regulated by special provisions. Hunting quotas of the major commercial species are set by Government resolution (Table 10.3).

Fauna

The inventory of Kazakh fauna has been completed for vertebrates only, and general reports have been issued for separate classes: "Reptiles of Kazakhstan", 1956; "Amphibia of Kazakhstan", 1959; "Birds of Kazakhstan", 1960-1974; "Mammals of Kazakhstan", 1969-1985; "Fishes of Kazakhstan", 1986-1990. There are 835 species of vertebrate animals (Vertebrata) on Kazakh territory, including 178 mammals, 489 birds (396 nesting species), 49 reptiles, 12 amphibia, 104 fishes and 3 cyclostomata species. The taxonomic diversity of vertebrates is shown in Table 10.4.

Table 10.4: Taxonomic diversity of vertebrates

Classes	Groups	Families	Sorts	Species	Subspecies
Total	**40**	**132**	**398**	**835**	**808**
Mammals	6	33	89	178	244
Birds	18	60	214	489	449
Reptiles	2	13	25	49	35
Amphibia	2	6	7	12	9
Fishes	11	19	61	104	71
Cyclostomata	1	1	2	3	0

Source: Biodiversity in Central and Eastern Europe. (A sampler with national biodiversity status information from 22 CEE and NIS countries), produced for Intergovernmental Conference "Biodiversity in Europe". Riga, Latvia, March 20-23, 2000.
National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity of the Republic of Kazakhstan. Kokshetau, 1999.

The pressure of human activities has reduced the number and habitats of many animal species . This phenomenon is best illustrated by the Red Data Book. Its January 1998 version includes 125 species (or about 15 per cent) of vertebrates and 99 species of invertebrates, of which 85 species are insects. 40 mammals are included in the Red Data Book, as are 56 birds, 10 reptiles, 3 amphibians and 16 fish species.

The most threatened mammal species are some ungulate animals, mountain rams (especially Karatau, Kyzylkum and Altay sub-species) and predatory species, particularly of the Felidae family (cheetah, karakal, barkhan cat, snow panther, Turkestan lynx, persian otter). Among the endangered birds are bustards, predators, especially large falcons, and some waterfowl. The fish of the Aral and Caspian Seas and invertebrates (commercial species of butterflies and bugs subject to export for collectors) are also included.

It is considered that 50,000 species of invertebrates live in Kazakhstan, including at least 30,000 insects in 550 families and 28 groups. There are at least 10,000 bug species; butterflies and hymenopterans total 5,000 each,, etc Invertebrates are negatively affected by many aspects of economic activities.

About half of all mammal species are of the *Rodentia* group (82 species), among them endemic species of special conservation interest for Kazakhstan, such as the *Selevinia betpakdalensis* and, in Western Tien Shan, the *Marmota menzbieri*. Among the 33 originally hunted mammals are first of all ungulate animals (elk, boar, roe, saiga, Siberian mountain goat (tau-teke, maral)) and predatory species (wolf, fox, corsak, badger, lynx, bear, wolverine, sable, steppe and forest polecat,, etc). Many of these species have ceased to be hunted and are now recorded in the Red Data Book. On the other hand, the *Saiga tatarica* is an ancient animal, which had been on the verge of disappearance at the beginning of the 20th century, but has been saved. Currently, the number of saiga (*Saiga tatarica*) totals 700,000-750,000, of roe deer (*Capreolus pygargus*) 30,000, of wild hog (*Sus scrofa*) 10,000, of Siberian ibex (*Capra sibirica*) 20,000, and of Siberian stag (*Cervus elaphus*) 15,000 individuals. The available stocks of these animals allow the withdrawal of about 10-15 per cent of their number without danger to the species.

Many wolves (*Canis lupus*) and jackals (*Canis aureus*) have appeared in the reserves, their numbers reaching 100,000 and 50,000, respectively. Controlling the numbers of these predators is important not only for agriculture in Kazakhstan, but also for the conservation of rare and game species. In western Kazakhstan, the number of beavers (*Castor fiber*) is on the increase (2,500-3,000), and they are starting to cause damage to bottomland forests along the River Ural. The number of muskrats (*Ondatra zibethica*), on the contrary, has fallen considerably. It is unlikely that their numbers will increase in the future. Under current circumstances, the most realistic way of increasing the muskrat population is captive breeding and half-wild breeding.

While knowledge about Kazakhstan's endemic birds is incomplete, many steppe birds are typical only of Kazakh territory, like *Melanocorypha yeltoniensis*, which elsewhere is only found in a small area on the right bank of the River Volga, as well as *Anthropoides virgo* and *Chettusia gregaria*. More than 140 bird species are hunted. The most important group is waterfowl (43 species), including geese (*Anser*), ducks (*Anas*) and coots (*Fulica atra*). In water bodies, about 7-8 million birds nest and 8-10 million or more migrate. Annual catches are maintained at levels of 2.0-2.5 million.

The second most important game birds are representatives of the order *Gallinaceae* (capercaillie, hazel grouse, black grouse, ptarmigan, tundra, grey and bearded pheasant, ular, quail). There are 35 species of predatory birds-eagles, buzzards, falcons, harriers, hawks, snake-eaters, wasp-eaters, griffins, vultures,, etc Unfortunately, almost half of them (all large eagles, falcons and other carrion eaters) are recorded in the national Red Data Book, including the golden eagle –the State emblem of Kazakhstan.

Of 12 amphibian species, the lake frog (*Rana ridibunda*) and the green toad (*Bufo viridis*) are collected for research by medical institutions in Kazakhstan and elsewhere. Though 250,000 individuals are collected annually, the number of lake frogs is not decreasing and their distribution is gradually expanding. The green toad (*Bufo viridis*) is the most numerous. Over 8,000 individuals are collected annually.

The Central Asian turtle (*Agrionemus horsfieldi*) is a commercial reptile species. In the past, as many as 180,000 individuals were collected, reducing the population substantially in the south and southeast. Therefore, since 1984, only 40,000-50,000 individuals have been collected. Over-harvesting also threatens poisonous snakes, *Agkistrodon halys, Vipera berus, Vipera ursini*, which are caught for the production of antidotes and for other medical uses.

The ichthyofauna of Kazakhstan has undergone a marked transformation as a result of the mass acclimatization of alien species. For several decades, 32 new species were introduced in reservoirs, i.e. more than 25 per cent of the current ichthyofauna, and in a number of bodies of water there are more new settlers than local fish. For example, in the Talas River there are 13 alien species against 8 aboriginal ones.

The most valuable of Kazakhstan's ichthyofauna is the sturgeon of the Caspian Sea. In the Ural river, their last natural spawning area, 5 species of sturgeon breed. They used to provide an annual production of 20,000 tonnes of fish, which is now reduced, at least, tenfold. Currently, the decline in the reproduction of sturgeon and fine-mesh fish in the northern Caspian region, disturbances in the habitats of marine animals, in particular the seal, and reduced financing of nature-protecting measures are causing great alarm. In 1998, two new sturgeon-breeding plants started operating in the Atyrau region. In 1999, during the piscicultural season, they released into the sea 5,349,000 juveniles of white sturgeon, sturgeon and stellate sturgeon.

The Ural-Caspian region is the largest fisheries area in Kazakhstan, including the eastern delta of the River Volga. Its valuable fish species include the white sturgeon, stellate sturgeon, sturgeon, bream, carp, pikeperch, Caspian roach (vobla), asp, catfish and other fine-mesh fish. The River Ural is the only river in the Caspian basin whose run-off has not been completely regulated in its lower reaches, so that some of the natural spawning grounds have been preserved.

10.2 Main threats to nature and protection

Anthropogenic influence on biological diversity

The peaks of human influence on biodiversity in 1965-1970 were due to an increase in industrial and arable lands, in 1990-1995 to the growth of urban land and disturbances from economic structures, including a mass reduction in the water supply to pastures, non-regulated grazing and haymaking, dereliction of arable lands (about 0.5 million ha), and the conversion of rangeland to mowed pastures (20 millions ha). Human activities directly and indirectly influence biodiversity. Direct influence is related to the withdrawal of resources from the natural environment, the substitution of agriculture for natural ecosystems, or their destruction by the construction of dwellings, industrial constructions or infrastructure. Indirect influence is exerted through all types of pollution, the regulation of rivers and the transformation of lands.

Direct impacts. The construction of urban and industrial objects and the increase in arable lands withdrew more than 65 million ha from the natural habitats of flora and fauna species and ecosystems. Pastures occupy 132.6 million ha (plains –43.7

million, hills 29.8 million, mountains 9.4 million ha). Excessive grazing heavily disturbs the balance between the withdrawal of forages and the rate of their growth. Norms for industrial cattle loading of pastures in some areas were exceeded 2 to 6-fold. The changes of the structure of businesses, and new patterns of ownership, together with deteriorating infrastructure, resulted in the complete destruction of pastures around wells, in inhabited areas and in places with year-round pastures. Only 25 per cent of pastures are in an acceptable condition.

A significant reduction in haymaking areas (down from 8 to 5 million ha) has resulted in the need to make hay on pastures (20 millions ha), causing their exhaustion. In cases of improper haymaking, the species structure of meadows and the typological diversity of ecological systems are simplified, their stability and self-restoration mechanisms are damaged.

There isno control over the collection of medicinal, edible, decorative or technical plants. Stocks of many of them have not yet been determined. The supply of medicinal herbs, fruits, roots, including rare and disappearing species of plants (20 species), or of industrial and export importance (liquorice, soap root, santonin,, etc), has grown over recent years.

The shooting of animals and fishing harvest part of their populations. With regulated withdrawals, an annual, sustainable harvest may achieve 2,500 tonnes of meat, 200,000 skins and 25-30 tonnes of horns from large animals: saiga, elk, roe,, etc Fur animals, birds and fish are now harvested without any general planning or monitoring. Poaching is a special biodiversity risk factor for many small, rare and endemic species.

The redistribution of species and the appearance of new ones, including competitive interrelations, occur with the introduction of cultural species and exotics into arable lands, and in urban parks and gardens. Data on the structure of newly introduced and indigenous weed species are practically absent. Weed species can play a certain role in the restoration of biodiversity of ploughed land, but the natural process of restoration lasts at least 15-25 years.

The greatest damage to ichthyofauna stems from the cumulative influence of three major factors: acclimatization, anthropogenic disturbances of the hydrological systems (in particular, regulation of rivers), and irrational fishing. Of all aboriginal forms of *Schizothorax argentatus* in Lake Balkhash, only the mountain river form is preserved. Their Ili and Balkhash passage forms have disappeared. The Aral salmon, the Syr-Darya spadenose and other fish are on the verge of disappearance. The Aral thorn and Balkhash perch populations are also disappearing.

The use of forests and their resources in the Republic is the most controlled business. The total stocks of wood and norms for felling are determined for forestry businesses, but there is practically no accounting of biodiversity losses. The biological diversity of forest ecosystems surpasses all others: there are more than 700 species of plants, including 68 species of trees, and many economically valuable plants and animals. The significant wood stocks (370 millions m^3) are not equivalent in terms of growing ability and need regulations that respect the conditions of forest ecosystems.

Fire causes enormous damage to forest resources (Table 10.5).

Indirect impacts. The impacts of indirect industrial influence are no less significant than the direct impacts, and they also cover large areas. The oil and gas industry is the first place industry in terms of volume of investments. In the main oil and gas extraction and oil refinery regions, backward technologies and outdated equipment are being

Table 10.5: Forest fires, 1995-1998

	1995	1996	1997	1998
Forest fires ***(Number)***	1,320	1,003	2,257	1,053
Forest area affected by fires ***(ha)***	212,540	12,861	216,950	16,300
Damage caused by forest fires ***(Millon tenge, current prices)***	283.1	24.0	897.3	70.7

Source: Statistical Yearbook of Kazakhstan 1999. Statistical compendium.

used. They are responsible for accidents and oil leaks. A total of 194,000 hectares in West Kazakhstan is polluted by more than 5 million tonnes of oil.

The situation around the Caspian Sea has become a major problem for Kazakhstan. As a result of oil and gas exploitation and extraction, the Caspian region is exposed to high levels of environmental pollution. Increasing water levels flood oil extraction sites, endangering biological diversity and biological resources. Endemic seals inhabit this sea, and shallow waters, overgrown with reeds, shelter large numbers of waterfowl, providing them with breeding and wintering grounds. The sturgeon population is reducing due to a decrease in the diversity of the benthic fauna and plankton and is affected by high levels of phenol concentration. The commercial fish catch has fallen 10-fold over the past 10 years.

The practice of flaring associated gas inflicts significant ecological and economic damage. Increased background heat and the oxidation of components of the environment around flaring have negative impacts on soil, vegetation, and animals in adjoining areas, and also contribute to the greenhouse effect. The flooding of hundred of oil wells is a threat for the whole environmental system of the Caspian Sea.

Among the most widely known regional environmental problems is the Aral Sea catastrophe (see Chapter 8). Expert estimate that several tens of thousands of tonnes of salt are blown out annually, and deposited on the surrounding territories. But the scale of other environmental problems in this zone is just as important. The runoff of the large transboundary river Ili has been reduced, due to the inefficient use of water resources, extensive water losses and increasing water abstraction from the river upstream. As a result, Lake Balkhash is believed to face the same fate as the Aral Sea.

The impacts of nuclear tests and radioactive pollution of the environment on biodiversity can be seen on 6 per cent of the area of the Republic. In addition to the direct destruction of biota in these areas, a negative influence is observed from dropped fragments of rockets, and leakage of rocket fuel. The exploration of the consequences of radioactive pollution is continuing (see also Chapter 6).

Large roads, electric transfer lines, dams, irrigation canals and reservoirs have a significant, often discounted, indirect influence on biodiversity.

Area and species protection

Reserves and national parks occupy 16,262 sq. km or 0.5 per cent of Kazakhstan. Together with limited protection territories (game reserves, natural monuments), this percentage increases to 2.1 per cent. The State nature reserves currently include 9 reserves, 6 national parks, 58 zakaznikov of national importance, and 25 natural monuments. The existing 8 reserves (area of 0.8 million ha) basically represent the mountainous ecological systems of Tien Shan and Altay (Aksu-Jabagly, Alma-Ata, Markakol, West-Altay), and steppe lakes with very small steppe areas (Kurgaljin and Naurzum). To some extent, deserts (Ustyurt and

Table 10.6: Natural reserves

Reserve name	Year established	Area (km^2)	Main landscapes
Aksu-Jabagly	1926	854	Mountain forest
Almatynskyi	1961	733	Mountain forest
Barsakelmeskyi	1939	300	Deserts
Kurgaldzinskyi	1968	2,589	Lakes, meadows
Markakolskyi	1976	750	Mountain forest, lakes
Naurzumskyi	1931	870	Lakes, steppes, forest
Ustyurtskyi	1984	2,230	Desert
Westernaltaiskyi	1992	561	Mountain forest
Alakolskyi	1998	123	Wetland
Total		**9,010**	

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity . Kokshetau. 1999.

Barsakelmes) are covered. Sandy deserts and ecosystems that are widespread and limited to Kazakhstan only (the cold-moderate deserts of Betpak-Dala, Balkhash) are practically not protected. Mountain steppes, bushlands, fruit forests, fir tree forests and highland ecological systems are partly protected. Natural reserves are listed in Table 10.6, together with some of their characteristics.

Reserves protect 49 per cent of the flora of higher plants (including 27 per cent of the species included in the Red Data Book); 78.6 per cent of all mammal species (among them 22 “Red Data Book” species, or 61 per cent of the total number of endangered mammals); 87.4 per cent of nesting bird species (including 39 “Red Book” species or 76.5 per cent of their total number); 63.2 per cent of reptiles (including only 3 per cent of the endangered species).

Table 10.7: Planned reserves

Reserve name	Area (km^2)	Main landscapes
Betpacdalinskyi	6,000	Desert (loami)
Dzgungarskyi	2,520	Mountain
Ermentauskyi	400	Steppe
Zaisanskyi	950	Desert, water, mountain
Karatauskyi	400	Mountain (relict)
Kentskyi	445	Small hills
Kizylkumskiy	1,050	Deserts (sandy)
Pribalkhashskyi	2,100	Delta, sands, turanga
Syntasskyi	1,890	Steppe and forest
Syrdariynskyi	298	Tugai-deserts
Tarbagataiskyi	319	Mountain forest, steppe
Turgaiskyi	1,830	Wetland

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. Kokshetau. 1999.

The figures on the representativeness of nature reserves in terms of endangered species reflect the insufficiency of reserves in the deserts and semi-deserts of Kazakhstan. The reason for this situation was basically the absence of scientifically substantiated planning. Currently, the MNREP is developing a new "Scheme for the development and location of specially protected natural territories" (see Table 10.7). The establishment of new reserves will increase the area of protected territories in Kazakhstan by 1.885 million ha (0.7 per cent of the State territory), and also improve the representativeness of the protection of landscape and the biological diversity of the country.

The "Bayanaul" and "Kokshetau" national parks represent the highland forests of the Kazakh hilly area, and they include large freshwater lakes (see Table 10.8). The "Altyn-Emel" park, located on the southern slopes of the Jungar Alatau, is the habitat of the dzeren gazelle (more than 3,000 animals), the mountain goat tauke and a re-introduced koulan population. The "Ile-Alatau" park is located on the northern slope of the Zailiiski Alatau Ridge; it includes landscapes from dry steppes up to alpine meadows and mountain glaciers. The national parks are now in the process of establishment, and many of their parameters do not yet correspond to their final purpose.

There is one State reserve in Kazakhstan: the northern part of the Caspian Sea, intended for the conservation of the biological diversity of the aquatic ecosystems and the most valuable resources of sturgeons, the *Acipenseridae* family. Unlike the nature reserves, this zone is not an institution, as it has no infrastructure nor staff for rangers, or for administration.

Limited protection territories have considerably larger areas and represent larger landscapes of the Kazakh territory. The State zakaznikovs and natural monuments examples. Among the zakaznikovs, zoological (39), botanical (17), botanical-geological (1), and combined (2) reserves can be distinguished. They occupied an area of 5,761 sq. km in 1994.

The wetlands of international significance in terms of habitat of waterfowl are represented by three lake systems: Tengiz-Kurgaldhzinskaya, Irgiz-Turgaiskaya and the Alakol lakes.

Protected natural monuments are unique objects of both live and inert nature and, as a rule, occupy insignificant areas. This status has been assigned to 25 objects occupying an area of 62 sq. km.

Forest conservation, rehabilitation and use aim at preserving the major woodland ecosystems: *Pinus silvestris* in the Kazakh low hills and the River Irtysh region, coniferous forests in the Saur and Altai regions, dark coniferous and wild fruit forests in the Dzhungar Alatau and the mountain systems of the northern Tien Shan (*Picea chrenkiana*, *Abies sibirica*, *Malus sieversii*, *M., kirghisorumm*, *Armeniaca vulgaris*), and the remains of juniper

Table 10.8: The national parks of Kazakhstan

Name	Year established	Area *(ha)*	Main landscapes
"Altyn-Emel"	1996	209.6	Desert (stony, loamy)
Bayanaulskyi	1985	50.7	Small hills (lakes, pine tree forests)
Ile-Alatauskyi	1996	181.8	Mountains (pine tree forests, uplands)
"Kokshetau"	1996	135.8	Forest and steppe (lakes, pine tree forests, steppe)
Karkaralinskyi	1998	95.1	Small hills (lakes, pine tree forests)
Total		**673.0**	

Source: National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. Kokshetau. 1999.

forests, broad-leaved and xerophytic forests in the western Tien Shan.

The establishment of forest reserves in the lower reaches of the rivers Ural and Emba would be reasonable, particularly in the highly productive plantations of turanga (*Populus diversifolia*) or black poplar (*Populus nigra*). The establishment of reserves in the Aktyubinsk *oblast*, including the Mugodzhar mountains, with numerous species of willows (*Salix*) and *Populus* mixed with *Betula pendula* and various shrubs, is also necessary. An insufficient number of forest reserves has been established in the arid zone in the south and southeast of Kazakhstan, in the foothills and mountains of Dzhungar and Zailiiskyi Alatau. The creation of genetic reserves in the following forest regions requires special attention:

- On the Ustyurt Plateau: plantations of Haloxylon aphyllum mixed with numerous representatives of zhuzguns, including endemic zhuzguns (*Calligonum cristatum*) and other shrubs
- In Priaralye (Aral region): plantations of *Haloxylon persicum*, *Halimodendron halodendron*, numerous representatives of the genera *Salix, Tamarix* and others
- In the Kzylorda *oblast*, including the valleys in the lower reaches of the River Syr Darya: plantations of *Populus* and *Haloxylon* with inclusions of *Ephedra strobilacca*, *Salix hyperifolia* and other shrubs
- In the Betpac Dala desert and the northern Pribalkhashye sandy steppes: plantations of *Haloxylon aphyllum* with mixtures of *Spiracanthus schrenkianus*, *Ephedra inyermedia*, *Anabasis*, *Tamarix*, *Atraphaxis* and others
- In the Moiyn Kum sand in the plantations of *Haloxylon aphyllum*, *Populus pruinosa* with mixtures of *Calligonum dubjanskyi*, *Ephedra lomatolepis*, *Arthrophytum bakchaschense*, *Astragalus brachypus*, *Dendrostellera arenaria* and other shrubs
- In the sands of Tau Kum, Sary Ishik Otyrau, tugai along the rivers Ili, Karatal, Aksu and Lepsy in the plantations of the numerous species of *Populus*, *Haloxylon*, *Salix*, *Calligonum* and others
- In the sand massifs of the Zaisan region in the eastern Kazakhstan *oblast* in the plantations of *Haloxylon ammodendron*
- In the foothills, mountains and upland zones of Dzhungar and Zailiiskyi Alatau (the richest in terms of floristic composition), with numerous rare and vanishing, endemic fruit trees and shrubs of the genera *Malus*, *Armeniaca*, *Rosa*, *Berbeuris* and others, widespread *Picea schrenkiana*, and juniper in the higher zone of the forest.

To preserve biological diversity, 53 forest genetic reserves are specified with an area of 38,500 ha, situated mostly on small hills, the Altai mountains and the coniferous forests of Priirtyshye (the Irtysh River basin) covering the main forest types and trees in Kazakhstan. Nevertheless, forest reserves are lacking in the west of Kazakhstan, where the highly productive pure plantations of *Quercus robur* or those mixed with *Ulmus laevis* and *Populus tremula* grow in the floodlands of the River Ural, and in the arid southern and southeastern zones.

Out of 178 mammals, 140 (78.6 per cent) are protected in 9 existing reserves. Twenty-two of these species, or 61.1 per cent of the list of

endangered mammal species, are included in the Red Data Book of 1991. The desert species are poorly protected, since there is only one reserve for the vast zone in its western part (Ustyurtskyi) plus a small reserved island, Barsakelmes, in the Aral Sea, which is currently suffering an ecological disaster. Even *Saiga tatarica* is not protected reliably enough, in spite of the fact that it is available in four reserves, for there is not a single reserve with sufficient area for breeding.

Thirty-seven mammal species (21.1 per cent), including 12 of the Red Data Book, are completely unavailable in the reserves. These are *Desmana moschata*, *Martens martens* and *Mustela lutreola* inhabiting the valleys of the River Ural, and *Spalax giganteus* inhabiting the sands of the Volga-Ural region.

Many of the typical representatives of the desert theriofauna, such as *Cardiocranius paradoxus*, *Salpingotus crassicauda*, *S. pallidus*, *S. heptneri*, *Phodopus roborovskii*, *Lagurus lutens* and even *Selevinia betpakdalensis*, endemic in Kazakhstan, are outside protected territories. The endangered endemic species of Western Kazakhstan, *Marmota menzbieri*, lives only a few kilometres from its south-western range.

Mammals not included in the Red Data Book, and not present in reserves are such typical desert inhabitants as jerboas: *Alloctopodius bobrinskoi*, *Pygerethmus platyurus*, *P. zhitkovii*, *Paradipus ctenodactylus*, *Eremodipus lichtensteinii*. The sole sea mammal, the *Phoca caspica* seal, is only present in part of the reserve of the northern Caspian Sea. Reliable protection for this species would require a real marine nature reserve (perhaps an interstate area).

A small number of endangered bird species inhabit sufficiently large protected areas. But the following bird species are insufficiently provided with protected territories: *Pelecanus crispus*, *Platalea leucorodia*, *Plegadis falcinellus*, *Otis tarda*, *Chlamydotis undulata*, *Otis tetrax*, *Ibidorhyncha struthersii*, *Pterocles orientalis* and other birds included in the Red Data Book.

Individuals of 31 reptile species (63.2 per cent of the herpetofauna of Kazakhstan) are recorded in the reserves of Kazakhstan. Out of 12 amphibian species inhabiting Kazakhstan, the reserves record only six. Only 23 out of 104 fish species (22.1 per cent) are reported in the waters of reserves and this is attributable to the insufficient number of reserves that specialize in hydrocenosis conservation.

10.3 Policy priorities, institutional arrangements and management instruments

Policy priorities

Kazakhstan ratified the Convention on Biological Diversity in 1994 (see Chapter 3 for details). In addition, the conventions on combating desertification, on cultural and nature world heritage, and on the international trade in endangered species are also relevant to its priorities in nature management. In general, the Parties to the Convention on Biological Diversity are obliged to improve their strategy for the use of nature after assessing the biodiversity status and identifying dangers to species and ecosystems resulting from anthropogenic impacts. The Convention aims not only at the protection and sustainable use of nature and the environment, but also at the rehabilitation of biological diversity: there has been a significant loss of resources through land degradation in over 60 per cent of Kazakh territory.

The National Biodiversity Strategy and Action Plan (NBSAP) on biodiversity conservation and sustainable use was developed and approved in 1999 as one of the components of the NEAP/SD. The Strategy was issued on the occasion of the accession of Kazakhstan to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The main goals of the NBSAP are as follows:

- Assessment of the status of biological diversity and its conservation in situ
- Expanding the genetic fund (gene pool), including agricultural crop varieties and animals and ensuring the genetic independence and biological security of the country
- The identification and elimination of threats to species, ecosystems and biodiversity
- The ecological rehabilitation of damaged ecosystems
- An increase in awareness of biological issues and the need for a balanced use of nature among local populations and non-governmental organizations
- The development of the legal framework for the balanced withdrawal and conservation of bioresources

- The improvement of the coordination of activities for the management of biological diversity issues

Two of its 27 priority projects ("The creation of a network of specially protected wetlands of international importance, in compliance with the Ramsar Convention" and "The preservation in situ of mountain agro-biodiversity") have obtained grants from GEF. The preparation of the second project is already completed and the implementation of the first is under way.

The NEAP/SD includes four priority projects relating to biodiversity protection:

- The extension of forest areas for the restoration and conservation of biodiversity and biocenosis
- The improvement of the fire surveillance system in coniferous forests (East Kazakhstan *oblast*)
- The development of the system of specially protected natural territories, including the preparation of the national cadastre of unique nature objects as part of the Cadastre of the World Cultural and Natural Heritage
- The organization of environmental and resource monitoring of forests.

In the Caspian Sea region, some projects and programmes are being implemented to solve developmental and environmental problems (see Chapters 3 and 8). The main role will be played by the Caspian Environmental Programme, which has a biodiversity protection component. The Bonn Convention on the Conservation of the Migratory Species of Wild Animals has been determined as being of significance to Kazakhstan. The Convention's secretariat and GEF have developed the project on "The Conservation of Migration Corridors for the Siberian Crane". Work on drafting the Governmental Resolution on adherence to the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) has been initiated.

The forest fund consists of all managed forests and is owned solely by the State. The main objective of forestry in Kazakhstan is its sustainable use. Related goals are the regulation of the use of the forest as a function of ownership. The main objectives of forest protection are:

- The prevention of forest fires, their timely detection and elimination
- Protection from illegal felling, damage, fraud and other violations
- The timely detection of pests, diseases and their control
- The control of observance of hunting regulations and fighting against poaching.

All the forests in Kazakhstan have a protective nature. Depending on their ecological, genetic, and socio-economic functions, as well as their location, the forests are divided into two protection groups. Forests in the first group include:

- water-protective forests (protected strips of forests along rivers, lakes, reservoirs and other bodies of water)
- other protective forests (anti-erosive forests, strips of forests along railroads and motorways of national and regional importance, belts of coniferous forests, "kolkovye" and "bairachnye" steppe forests, those in the desert, semi-desert, steppe, forest-steppe and low-forest mountainous forests, which are of significant importance for environmental protection)
- sanitary and recreational forests (urban forests and forest parks, forests in green zones around cities, forests in the first and second belts of the sanitary protection of water sources and forests in the sanitary protective zones of resorts)
- the forests of specially protected natural territories (forests in State nature reserves, State national natural parks, State natural parks, State forest natural monuments, State reserve zones, especially valuable forest territories, forests of scientific importance, nut forests, fruit-bearing plantations, sub-alpine forests).

Forests of the second group include forests growing in the mountain areas, forests of limited importance for forestry, forests for the preservation of nature-protective functions of which a limited regime of forest use is required. Felling in forests of the first group aims at improving the state of the timber stand, and the ecological, water-protective, protective, genetic, recreational and other useful properties of forests, which, at the same time, help to make the most efficient use of stocks of mature trees. Felling in forests of the second group aims at rehabilitating forests with commercially valuable tree species, enabling their exploitation.

Afforestation and reproduction of the species and forms of plants and animals in the forest biocenosis

aim to increase forest cover, prevent erosion and improve the ecological situation.

Legal framework

The Forest Code was adopted in 1993. The Law on Specially Protected Natural Territories is the core legal instrument for biodiversity protection. It was adopted in July 1997. Thirteen types of protected natural territories constitute the State nature reserve fund:

- State nature reserves, including biosphere reserves. Besides implementing a strict management regime, the reserves enable long-term and diversified studies on biodiversity issues. "Nature Annals" are kept, in which the major indicators of the status of all components of protected ecosystems are annually registered.
- State national nature parks. They are protected natural territories. They have the status of a nature protection institution and are separated into zones depending on their protection regimes, for the multi-purpose use of natural, historical and cultural complexes and objects of special ecological, recreational, scientific or other importance. Different zones on the territory of State national nature parks may include zones of the reserve regime, of regulated economic activities, of regulated tourism and recreation, of limited traditional economic activities, or of administrative and economic purpose. The core reserve zone occupies only a small part.
- State nature parks.
- State nature monuments. They are protected objects with a regime aiming at their conservation, in their natural shape. Land users, under whose responsibility they have been placed by the authorities, ensure the protection of the nature monuments.
- State reserves. There is one State reserve in Kazakhstan: it is the northern part of the Caspian Sea and is intended for the conservation of the biological diversity of aquatic ecological systems. This zone is not an institution, i.e. it has neither infrastructure nor staff.
- State 'zakazniks'. They are defined as a protected natural territory with a specific (ordered) protection regime, regulating economic activities in such a way that they conserve and reproduce one or several objects of the State nature reserve fund. The zakazniks lands are not withdrawn from use, and protection is implemented in the course of economic activities, by restricting the scope and time of various types of activities.
- State zoological parks.
- State botanical gardens.
- State dendrological parks.
- Forests of specially protected territories.
- Water bodies of special State significance or specific scientific value.
- Wetlands of international importance (Ramsar sites).
- Parts of marshes which are of special ecological, scientific, cultural or other value.

Specially protected natural territories are established according to the national and regional development plans of the network of protected areas. A decision on the establishment of a specially protected natural territory and its category is made by the Government of Kazakhstan, or by local executive bodies, provided there is also a recommendation made by a commission of experts, supported by the central executive body on nature protection. The recommendation has to establish the usefulness of the proposed protected territory for nature research, as well as its technical and economic feasibility.

The specially protected natural territories are owned by the State and jointly financed from the State budget, from environmental protection funds, from special funds for specially protected natural territories, from sponsoring and other sources. The withdrawal of land, water, forest and underground resources from specially protected natural territories is not allowed.

A number of laws and codes regulating nature use have been enacted in Kazakhstan. Among the decrees are some on nature protection and sustainable use, i.e. the list of animals which can be hunted, of the decree on unified minimal payments for the withdrawal of wild animals by citizens and legal persons, the rules on fisheries and on the withdrawal of other aquatic animals.

Institutional arrangements

The central executive organ for the protection of the environment is the Ministry of Natural Resources and Environmental Protection. The Ministry implements the laws and resolutions of the President and Parliament and cooperates with other ministries and departments. The Ministry is

concerned with the management of nature reserves and the organization of State inspection of specially protected natural territories. In addition, it carries out environmental inspection, organizes environmental expertise of plans for the development and location of specially protected areas, administers the State cadastre, and maintains international links and cooperation. The MNREP is also in charge of coordinating and controlling the implementation of the Convention on Biological Diversity. It established a Joint Committee, which is composed of governmental and non-governmental agencies involved in environmental protection, for this task.

Other bodies of the MNREP implement governmental supervision in their specific areas of competence:

- The Committee for Forestry, Fishing and Hunting
- The Agency on Land Resource Management
- The Committee for Water Resources
- The Committee for Geology and Underground Resources Protection.

The main institution responsible for sustainable use and biodiversity conservation is the Committee for Forestry, Fishing and Hunting, with its 16 territorial Administrations for Forest and Bioresources, as well as the following State enterprises: 'State forests' for forests, 'Kazfish' for fish, 'Ohotzooprom' for wildlife, and the administrations of Specially Protected Natural Territories. Under the Department of Central State Inspection, there are *oblast* offices of the State Control for Flora and Fauna.

Other ministries and agencies outside the Government manage specially protected natural territories, set up nature protecting services and provide State control of their activities, organize the preparation of proposals for setting up specially protected natural territories and conducting State expertise, as well as other activities within their jurisdiction.

Local legislative and executive bodies are responsible for the consideration and coordination of the development and location of specially protected natural territories and their organization under their jurisdiction. They implement State control of the activities of local specially protected territories within the limits of the territorial administration system and according to legislation. Local representative bodies approve expenditure on environmental protection from the local budgets and environmental expertise funding. Furthermore, they control compliance with environmental expertise and environmental standards, and inform the public about the results of environmental expertise.

Local executive bodies – *oblast* and city *akimats*-enforce the legal terms of nature use, establish charges for environmental pollution (in cooperation with the central executive body), and for the conservation and renewal of natural resources, provide for recreation, implement and develop environmental protection and the use of natural resources, and construct facilities for environmental protection. They may suspend any activities when the law is violated.

General management and the coordination of scientific research in specially protected natural areas are conducted jointly by the bodies responsible for nature protection and for science and technology.

The main executive body for the management and use of forests is the MNREP. The State forest enterprises, establishments and organizations manage forestry. However, management rights for individual forest sites can be transferred to other legal and natural persons as well. Such assignments can be made by *oblast* administrations for their territories, with the approval of the State forest management body. Special authorities of the local executive bodies control forest fires, pests and diseases at local level.

Selected management instruments

Depending on the category of specially protected natural territories, the legal regime prohibits or regulates their use for commercial or other purposes. A limited commercial use of the objects of the State nature reserve fund can be permitted for scientific, educational, cultural, ecological, recreational or other aims, provided that the protection regime is maintained and there is no adverse effect on the natural objects.

Reliable and timely information about specially protected areas is required primarily for the evaluation and prognosis of the state of nature in the territory, for State control and the solution of disputes over the use of the territories. The State cadastre of nature protection is meant to satisfy these and other information needs. The basis of the State cadastre is the State inventory of specially

protected natural territories, which includes data on the status of these territories, their geographic location and borders, their internal zoning, regimes of protection and use, as well as other data relating to the nature reserve fund.

Payments, subsidies and other regulators are used to stimulate the rational and effective use of nature. Current legislation establishes three types of payments:

- Payments for the use of natural resources (see Chapter 2 for a description)
- Payments for environmental pollution (see Chapter 2 for a description)
- Payments for the conservation and renewal of natural resources.

In theory, the main goal of payments for the conservation and renewal of natural resources is reimbursing budget expenditure for implementing these activities. A new procedure for consolidating payments for natural resources in the budgets of different administrative levels was introduced in 1999. As a rule, allocations to the regional and local budgets are used for purposes other than the conservation and renewal of natural resources. See Chapter 2 for details.

An extensive network of scientific research institutions and experimental stations exists in Kazakhstan. The institutions are engaged in physiological-biochemical and genetic research, including the creation of brands patented plants and hybrids of plants. The Ministry of Agriculture, the Ministry of Science, the Academy of Sciences and the Kazakh Customs Service have developed and implemented measures to prevent the introduction of alien species in Kazakhstan, so as to prevent damage to both terrestrial and water ecosystems. The Ministry of Agriculture, the Ministry of Science and the Academy of Sciences are at present also developing measures for the conservation of the country's genetic fund, and for the reintroduction of indigenous species of domestic animals and relict species of agricultural plants. The measures will also aim at agricultural production techniques that would protect agro-biodiversity.

The State forest management bodies keep the State forest cadastre and State forest inventory on the basis of materials submitted by forest organizations, inventories and surveys. The tasks pursued in forestry management include:

- Dividing forests into groups and categories of protection
- Determining the age of trees and the rotation of felling
- Establishing a system of felling and reproduction of forest resources
- Establishing forest protection measures
- Other organizational and technical measures.

Forest use is subject to permits (licences, logging tickets, orders or forest cards). The following uses can be made of forest lands:

- timber felling
- turpentine production
- production of secondary forest products (bark, sap, tree leaves,, etc)
- incidental use (mowing and cattle grazing, the storage of sawing tools and the collection of medicinal plants, wild fruits, nuts, mushrooms, berries and other food products, the placing of hives and apiaries)
- use for cultural, recreational and research purposes
- the use of forest for the needs of hunter farms.

There are restrictions on forest use in forests in certain protection categories, as follows:

- In the forests in specially protected natural territories, forest parks, urban forests, forest and park green zones, forests in the first and second belts of zones of sanitary protection of water resources and of resorts, State forest strips, anti-erosive forests, especially valuable forest territories, prohibited strips of forests along rivers, lakes, reservoirs and other water bodies (with the exception of flood land deciduous forests), as well as in the specially protected sites, logging, extracting turpentine, and the storage of secondary forest materials are prohibited.
- Cattle grazing and the production of non-timber forest products for commercial use,, etc are prohibited.
- Trees can be felled in the designated wood-cutting areas and in mature stands only.
- The extent of logging is determined on the basis of established norms on felling, forest management, necessary sanitary felling and felling connected with the rehabilitation of low-value forest plantations.
- The felling of trees in forests that are the habitats of valuable animal species is permitted only after coordination with nature protecting

authorities. No felling is allowed if it leads to the destruction or degradation of the habitats of rare and vanishing animal species.

Ecological expertise and coordination with executive bodies, State forest managing bodies and other parties concerned are a precondition for the development of any object affecting the state of forest. Mining, cabling, the laying of pipes or other communication links, blasting operations, drilling and other activities in forests which are not related to forestry and forest use are to be coordinated with executive bodies, State forest management bodies and other parties concerned.

The forestry activities of the State forestry enterprises, institutions and organizations, as well as the maintenance of State forest management organs, are financed from the State budget. Payments for the use of forest resources were introduced in the 30s to ensure forest rehabilitation in the former USSR – forest taxes depended on the tree composition of a forest, the region, the remoteness from means of transport, and the quality of the timber. The system of forest payments was constantly being improved and has been applied until the present time. The required adaptation to the market economy is under way.

The Academy of Sciences, jointly with the MNREP and the Committee of Forest and Hunting of the Ministry of Agriculture, developed the Programme on the conservation and balanced use of biological diversity of Kazakh forests, with emphasis on the conservation of the diversity of wild fruit and nut forests in the south and the southeast.

10.4 Conclusions and recommendations

A new environmental policy was begun in 1989-1990 in Kazakhstan. Regarding biodiversity management, Kazakhstan set sustainability objectives for its development, and signed up to major international conventions. The State political programmes therefore sent clear signals to the effect that nature and natural resource protection was high on the agenda, and that biodiversity was seen as an important objective for governmental action. The requirements of the international conventions that Kazakhstan has ratified – in particular of the Convention on Biological Diversity-are in line with the country's strategic goals, but their implementation depends on the existence of economic, political, legal, and institutional prerequisites. Many of these prerequisites are in place.

Improving the management of nature use with a view to protecting biodiversity is one of the objectives. Under current conditions of economic and environmental destabilization, the implementation of a sparing, optimally balanced regime for the use of nature and natural resources, and the reproduction or renewal of withdrawn biological resources are important. The authorization, enforcement, monitoring and control of nature use are carried out mainly at local level. The local authority and responsibility for the organization and implementation of environmental measures should benefit from a completed legal, economic and institutional framework. Strengthening links between national and local authorities is necessary through the joint development of solutions to environmental problems and their inclusion in local programmes and plans.

The conservation and reproduction of biological resources, and the standards for and volumes of their withdrawal from nature should be based on the recommendations and developments of research organizations, monitoring, and the regulations of international agreements and conventions. Adequate research programmes are needed. Also required are measures to raise public awareness. A comprehensive inventory of flora – including the genetic resources that are useful for agriculture-and the use of plants is necessary. The higher plants include many useful medicinal, fodder, technical, edible, decorative and other species. If they are to be used, it is necessary to implement an improved collection and harvest system, as current methods risk unnecessary destruction of the resources.

Also needed is an inventory of human pressures on biodiversity in all administrative areas and specific industrial sites. The inventory should be used to draw management conclusions for present land use. Available data indicate that known polluted grounds are in most cases not used or used only partially, but exceptions do exist. The extensive development of agricultural production has left traces in the form of land degradation and the impoverishment of landscapes. 60 per cent of the country is subject to desertification, reducing soil fertility and the efficiency of stockbreeding and plant growth. During 40 years of ploughing virgin and fallow lands, wind and water erosion has caused the loss of 1.2 billion tonnes of humus. Intensive development of irrigated farming as well as water runoff in arid climatic conditions have contributed to water deficits in the basins of small and large rivers, such as the Ili, the Syrdaria, the

Ishim and others. The Aral Sea disappeared within one generation. A similar catastrophe can happen to Lake Balkhash.

Such measures, together with the enactment of appropriate legislation and the ecological education of the population would help to improve a large number of activities that are potential threats to biodiversity conservation and nature in general. Among the practices that most need promoting are (a) rational, non-exhaustive grass-cutting, (b) grazing practices that do not deplete forest and zoological resources, and (c) care in the collection of wild relatives of domesticated plants and animals, of which Kazakhstan is rich and which are an invaluable source of the genetic fund. Particular attention should also be given to the conservation of biodiversity, including the sturgeon populations in the Caspian Sea, during the early dynamic development of the oil industry in that area.

Recommendation 10.1:
The progressive implementation of a comprehensive management system for both nature use and biodiversity conservation should aim at (a) the completion of the legislative framework (particularly with the development of legal instruments regulating sustainable use and protection of nature components, especially plants) and an increased level of local and regional management responsibilities, (b) the adequate programming and funding of relevant research activities, and (c) the improvement of nature use practices with the help of public awareness campaigns and education efforts. The systematic improvement of information on all species present in the country, their possible use, their habitats and the most important threats to their conservation should be seen as a precondition for the implementation of such a management system. See Recommendations 1.4, 1.5, 8.3, 12.1 and 12.3.

The mass ploughing of virgin lands, intensive cattle grazing (especially in high-risk zones-deserts and steep mountain slopes), the construction of industrial objects, roads and pipelines, explosive works, etc, together with the non-regulated hunting and stocking of animals, have resulted in the progressive exhaustion of the Republic's animal world. Since the middle of the 20th century, Kazakhstan koulan species and Turan tiger, Tugai deer and, probably, cheetah, have disappeared forever from Kazakh territory.

The rehabilitation of species that are on the brink of extinction is crucial and timely. This need includes the white stork (*Ciconia ciconia*), great bustard (*Otis tarda*) and Menzbier's marmot (*Marmota menzbieri*). A number of rare species may turn into valuable game species, namely the Middle Asian gazelle (*Gazella subguturosa*), the arkal (*Ovis ammon*), the mouflon (*Ovis vignei*), the onager (*Equus hemionus*), the pin-tailed sand grouse (*Pterocles*), as well as the saiga. To conserve mammals, the creation of reliably protected areas in various types of deserts (sandy, loamy, loess, detritus and stony, saline soils), characterized by their own animals, is crucial. Special attention should be paid to the western region, including the valley of the River Ural, and the wetlands also require more prominent protection efforts.

Species protection appears to be insufficient. Not all endangered species enjoy the protection of their habitats. Only two out of nine regions of high species endemism are protected. Information on many species and areas important for their conservation is incomplete or missing altogether, so that reliable assessments of their status are precluded.

So the existing protected territories are not capable of fulfilling nature protection tasks. As a result, a concept for the development of the network of protected natural territories has been drawn up and submitted for review to the Government. It provides for the expansion of the protected territories through forest and soil genetic reserves and nature parks. With an increase in the number of reserves by 24, of game reserves by 117, and of national parks by 8, the total area of protected territories should increase to 124,800 sq. km.

The mountainous ecological systems of Tien Shan and Altai are represented most satisfactorily in the protected territories. The ecological systems of the steppe lakes are less well represented. The ecosystems of steppes are practically unrepresented. The situation is even worse for deserts and semi-deserts. Covering more than half of Kazakhstan, deserts are to be found only in small parts of two reserves.

Recommendation 10.2:
The protected area system should be made more representative of all the typical ecosystems in the country, and afford reliable protection for the total number of endangered species. The protected area categories should also be harmonized with internationally accepted practices. The ecosystems of deserts and semi-deserts, wetlands and other aquatic ecosystems and their native species seem to

be in particular need of protection. The introduction of alien species, in particular into aquatic ecosystems, should be strictly controlled. Special research efforts are required to improve the knowledge of species, habitats and biodiversity.

Kazakhstan is short of forests. The NEAP/SD recognizes that the expansion of the forest area would be of great ecological and socio-economic importance. Forests are affected by forest fires and pests, leading to economic losses. The decrease in the funding of forest management also curbs forest rehabilitation. On the other hand, the economic crisis also relieves pressure on forest, by reducing agricultural and other economic activities, and natural rehabilitation has started in land abandoned by previous activities. Such lands could often be used for afforestation.

The conservation of mountainous agro-biodiversity requires conservation of valuable fruit tree forests: apple, plum, pistachio and walnut. These species are characterized by rich intraspecific diversity, being a source for the formation of cultured varieties and valuable for improving the quality of cultured plants. Fruit tree forests are primarily located in the Almaty, and east and south Kazakhstan regions.

A data bank has been created on species and variety composition of cultures and animals in agricultural centres for the conservation of the gene pool. It would appear reasonable to provide for the centralized maintenance of germoplasm in the corresponding research institutions of the Academy of Sciences.

Recommendation 10.3:
The establishment of new forest reserves and of genetic reserves in the regions that are insufficiently endowed with them should be considered. The extension and centralization of gene banks of economic species should be considered. Measures to protect forests from pests and fires should be strengthened. Afforestation should be considered as a major aim for forest management and appropriately funded.

The biodiversity situation around the Caspian Sea has become a major problem since the region is exposed to high levels of pollution. Increasing water levels, the overuse of bioresources and the possible flooding of oil extraction sites also endanger biodiversity. The Sea boasts 90 per cent of the world's sturgeon stocks. Moreover, endemic species such as the endemic seals inhabit the Sea, and shallow waters overgrown with reeds shelter large numbers of waterfowl, providing them and migratory birds with breeding and wintering grounds. At present the sturgeon population is dramatically decreasing due to reduced benthic fauna and plankton, and to high levels of phenol pollution. There have been repeated accidental oil spills into the Sea. The risk of further such accidents is likely to increase with growing oil extraction and transport. Therefore, the provisions foreseen in the Caspian Environmental Programme for biodiversity protection should be fully implemented in a timely manner. This implementation requires a valid monitoring system, which should be established and equipped with sufficient funds.

Recommendation 10.4:
A reliable monitoring network of the biodiversity in marine and coastal ecosystems of the northern Caspian region, which would provide the information required for effective nature protection, should be urgently established. See Recommendation 8.3.

Government expenditure on environmental protection is low in the Euro-Asian context-it seems to amount to no more than US$ 0.5 per person per year. About 70 per cent of State-sector expenditure for nature protection is planned from local sources. But the decentralization of responsibilities is rarely supported by sufficient financial resources. As a result, there is excessive fragmentation of capacities and responsibilities. It is therefore important that an equitable balance should be defined and enforced between declared State priorities and the financial means available for their implementation. This equitable balance should in particular take the devolution of environmental protection tasks and functions into account by endowing local and regional administrations with sufficient funding flexibility. Such flexibility may also benefit from the more systematic promotion of ecological tourism at local level.

The objectives of the national strategy for the conservation and sustainable use of biological resources require continuous updating in response to the development of special issues. Action plans with definite deadlines should be developed accordingly.

Recommendation 10.5:
The implementation of the declared objectives for biodiversity conservation should be supported by

sufficient funds, distributed equitably among the administrative levels that are responsible for implementation. Action plans including biodiversity conservation measures should frequently be revised and upgraded. The measures included should progressively be associated with deadlines and funding provisions. A control mechanism for the implementation of the measures should be created.

PART III: ECONOMIC AND SECTORAL INTEGRATION

Chapter 11

INTRODUCTION OF CLEANER TECHNOLOGIES IN INDUSTRY

11.1 Main characteristics of the industrial sector

Industrial structure

In Kazakh industry a few branches predominate:

- The fuel industry (oil, gas, coal);
- Metal mining, the metallurgical industry and metal processing; and the
- Processing of agricultural products (food industry).

As shown in Table 11.1, the three main branches together count for approximately 80 per cent of the total industrial contribution to GDP, and more than 50 per cent of the industrial workforce. Among other important branches are the chemical and textile industries.

Table 11.1: Main industrial branches* in Kazakhstan, 1998

	Value of production		Number of employees	
	million Tenge	*%*	*1,000*	*%*
Total*	**641,038**	***100***	**707.8**	***100***
Fuel industry	160,712	*25*	66.0	*9*
Mining, metallurgy etc	193,752	*30*	224.4	*32*
Food industry	166,148	*26*	90.0	*13*
Other branches	120,426	*19*	327.4	*46*

Source: Statistical Yearbook of Kazakhstan, 1999.

* Excluding production and distribution of electricity, gas and water.

The data from the Statistical Yearbook also indicate that the relative number of large enterprises is much more important in Kazakhstan than in other transition countries (as well as in many western countries). SMEs are reported to account for only approximately 8 per cent of the GDP in Kazakhstan. It is the policy of the Kazakh Government to promote the development of SMEs by privatization and streamlining the regulatory system, but despite many improvements SMEs are still burdened with high transaction costs due to licensing and taxation. Moreover, financing new investments is in general an even more difficult problem for the SMEs, as they are often considered to be risky businesses.

The location of industries corresponds to the location of sources of raw materials. The eastern part of Kazakhstan (Pavlodar, Karaganda and Ust Karmenogorsk) is rich in metals and therefore has a high concentration of large enterprises, primarily concerned with non-ferrous metallurgy, metal processing and the production of basic chemicals. The region also contains large forest areas and timber processing plants and the impact of regional industry on pollution of drinking-water basins, air emissions etc. is enormous. In the National Environmental Action Plan, the region has been selected as a priority activity zone (see zone B in Figure 2.1).

Central Kazakhstan too has a wealth of natural resources including coal and metals, and large mining, metallurgy and chemical plants are also found here (see Chapter 9). In the northern area, agriculture and agro-industrial plants are important, as well as the mining (coal, iron, copper bauxite and gold) and metal processing industries. Western Kazakhstan is also rich in oil and gas resources (Caspian Sea). The main industry is oil extraction and the refining of petroleum products, but production of ferroalloys and mineral fertilizers is also important. The Caspian Sea region is another prioritized zone (zone A in Figure 2.1) due to air pollution and spills from the oil industry. The southern part of Kazakhstan is mainly a farming area and is characterized by food processing industries. Mining of phosphorite and production of phosphorous fertilizers has also been an important industrial activity in the region, but today plants are either shut down or running at a very low capacity (zone C, Figure 2.1).

The Ministry of Energy, Industry and Trade (Department of Heavy Industry) list of "Large enterprises under supervision of the Ministry" comprises mining, metallurgical and chemical plants. The location of these enterprises are shown in Figure 11.1.

Trends in sector development

From 1991 to 1997 the overall volume of production declined considerably, but in more recent years the situation seems to have stabilized. In general, industry functions far below its full capacity and according to information from various sources it may be said that:

- Cement factories, many chemical plants, galvanizing plants and dairies are working at 10-25 per cent of capacity;
- Metal processing utilizes 50 per cent of its capacity; and
- Mining, metallurgy and oil extraction are functioning at 70-80 per cent.

Current oil production extracts approximately 1 per cent per year of total reserves compared with 5-8 per cent in other countries, implying a high growth potential for the oil sector.

Although Kazakhstan has privatized many enterprises, most of the large (>1000 employees) and important enterprises still remain under majority State ownership, the State-owned enterprises accounting for about a third of GDP. Even in cases where the State has only a minority holding, the State representative on the board can still block certain decisions. For more information on the privatization process, see Chapter 1.

The relative level of foreign direct investment in the industrial sector of Kazakhstan is substantially higher than that of neighbours such as Russia, Uzbekistan and Azerbaijan, and in the years 1994-1997 the level of foreign investment increased. The main reason was the strong foreign interest in the extraction of mineral resources, especially oil and non-ferrous metals, and approximately 80 per cent of foreign investment was in these branches. The level of foreign investment in industry, however, is only a fraction of that in many Central European countries such as Poland and Hungary.

No special measures seem to have been taken to use privatization as a way of promoting the introduction of cleaner technologies. Cleaner production requirements are not normally written into the privatization contract.

Emissions and emission control

The industrial sector is dominated by highly polluting industries. Air pollution from the fuel industry and metallurgical processes, hazardous waste from mining and from chemical production and waste water from mining and the food industries are examples of sources known to cause severe impacts on the Kazakh environment. Even though Kazakhstan seeks to promote the development of light industries, heavy industries will undoubtedly remain the most important for some time to come. While a more detailed presentation of media pollution is included in chapters 4 to 9, a few overall figures can be given for easy reference to illustrate the need to reduce impacts from industry:

- Accumulated solid industrial wastes amounts to about 3 billion tonnes by 1998. Most of the toxic waste derives from non-ferrous metallurgy in the eastern part of Kazakhstan and is disposed in non-secured sites;
- More than 200 million cubic metres of polluted waste water are discharged into surface reservoirs;
- More than 2 million tonnes of pollutants are emitted into the air from stationary sources, including emissions from power plants.

The consumption of freshwater for industrial purposes has decreased by nearly 30 per cent from 1995 to 1998. Since the percentage of recycled water within industry has been relatively constant (around 60 per cent of total industrial water use), this reduction is due to a general decrease in production. The same pattern is seen in air emissions and waste water: the emissions have decreased due to the economic depression, but the number of pollution abatement measures has not changed significantly since 1991.

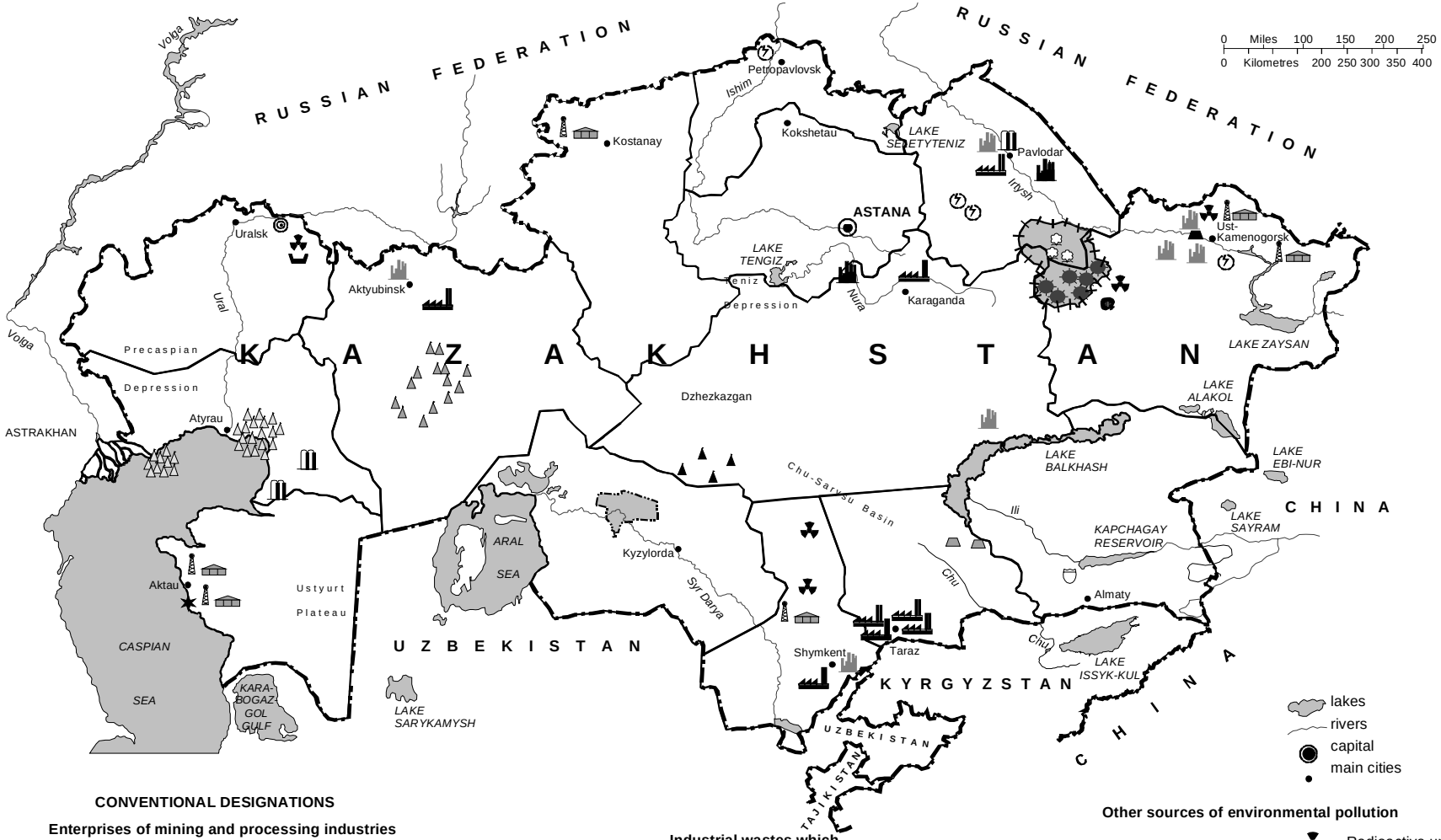
Policy objectives and instruments for the introduction of cleaner technologies

Law on Environmental Protection and Law on Ecological Expertise

The Law on Environmental Protection introduced the principle of cleaner technologies specifying the ecological requirements for operating industrial objects in its art. 55: "The use of industrial

FIGURE 11.1:

MAP OF LOCATIONS OF ENVIRONMENTALLY HAZARDOUS FACILITIES WHICH POLLUTE THE ENVIRONMENT



CONVENTIONAL DESIGNATIONS

Enterprises of mining and processing industries which pollute the environment

- Mining-enrichment and processing of non-ferrous and precious metals
- Non-ferrous metallurgy
- Ferrous metallurgy
- Chemical and mining-chemical processing
- Oil processing
- Extraction of carbohydrogen raw materials
- Pits and mines of uranium ores
- Pits and mines of non-ferrous metals

Industrial wastes which pollute the environment

- Solid radioactive wastes
- Solid industrial wastes
- High toxic wastes
- Oil and oil shore wastes

Other sources of environmental pollution

- Thermal power stations and energy combinats
- Purificating installations
- Sites for open nuclear explosure tests
- Sites for underground nuclear explosure tests
- Nuclear installations, reactors
- Radioactive underground reservoirs
- Cosmadrom "BAIKONUR"
- Semipalatinsk polygon
- Wells in the flooded zones
- Oil wells

objects should take place in consideration of established ecological requirements and with the use of environmentally friendly technologies" and "In operating these objects, low-waste and non-waste technologies and processes should be introduced". Similar expressions can be found in article 48, on the ecological requirements of project planning.

The core legislative arrangement governing the application of these articles is the system of ecological expertise, based on the Law on Ecological Expertise and related regulations (see Chapter 1). According to this system, all new enterprises or activities should introduce efficient materials and energy-saving technologies and production processes, use natural resources rationally, process and use production waste, treat all sewage waters effectively and give priority to their reuse rather than their discharge, and guarantee the implementation of efficient measures to combat air pollution.

Ecological expertise is linked to other expertise systems, e.g. "Expertise on construction/ building" (Ministry of Energy, Industry and Trade) and the special requirements related to permits for the use of natural resources. It is not clear to what extent the conclusions from other systems of expertise are taken into account in the ecological field. Ecological expertise is the prerogative of independent licensed experts, but the licensing of experts is only tentative and, taking into account the lack of guidelines, it is likely that the level of expertise on cleaner technology issues will often be insufficient.

Ecological audits

The Law on Environmental Protection provides that ecological audits of existing enterprises and activities fulfil a similar function to that of EIAs for new activities (see Chapter 1). According to the draft regulation, ecological audits should only be carried out in cases where the environmental impacts are clearly unacceptable (in other cases, non-compliance would be sanctioned by the imposition of fines). Moreover, the core element of the audit is emission measurement – and not cleaner technology assessment.

Even though the Law on Environmental Protection provides the framework for setting cleaner-technology requirements, it seems that in practice the regulation imposes much stricter requirements on enterprises investing in new technologies than on those that choose to 'repair' outdated ones. Given the present economic situation, it is understandable that stricter requirements should be imposed on new enterprises than on existing ones. However, if no cleaner-technology requirements are imposed on existing enterprises at all, there is a risk that outdated technologies are kept alive and unnecessarily high emissions of pollutants continue. MNREP should therefore incorporate cleaner-technology assessments in the regulation on ecological audits (Law on Ecological Expertise, art. 15, subpara. 2).

Some audits have already been carried out. In Pavlodar Oblast, the following audits were planned for 1999/2000: JSC Aluminium of Kazakhstan, TOO AES Ekibastuz, JSC Razrez Vostochnyi, JSC Razrez Severnyi, TOO Razrez Bogatyr, and JSC PNPZ, PTES-2,3.

Voluntary agreements

In July 1999, MNREP issued a decree on voluntary agreements between enterprises and authorities. The primary purpose was to ensure simplified inspection procedures. Instead of having a large number of inspections by different institutions (e.g. concerning the environment, health, fire, etc.) the enterprises will undergo not more than one comprehensive inspection per year. In exchange, they will have to implement a number of State environmental control recommendations, improve their internal monitoring procedures and report emission levels regularly to the regional authority.

In Kazakhstan, a voluntary agreement includes no environmental targets, contrary to the practice in many countries in Western Europe. As of the end of February 2000, 147 agreements had been signed. It is too early to draw conclusions on the effects of this initiative, but there seems to be a good chance that such agreements will improve the enforcement of environmental regulations.

Specific programmes

Since 1999, one of the priority tasks listed among a number of cleaner technology projects in the NEAP has been the introduction of resource-saving technologies. The core group of projects is entitled "Reduction of solid waste". The main projects include:

- Industrial waste-water minimization, including prevention of waste-water generation. Establishment of four regional

Cleaner Production Centres (CPC's) pilot projects;
- To draft a Governmental resolution "on establishing the Republican Centre for Cleaner Production", a national coordinating CPC;
- To draft regulations on "independent environmental audits and licensing" and on "environmental insurance of activities associated with waste".
- To adopt a resolution on "organization of the activity of CPCs" in regions.

Other projects of importance for the introduction of cleaner technologies are a project on regeneration of fuel at Pavlodar Oil Refinery, and a project on reuse of production waste at the JSC Ispat-Karmet enterprise.

The project to establish regional CPCs (the "CPC project") is definitely the most important seen from a cleaner technology point of view. The overall objective of the project is to reduce the negative impact of industrial emissions of polluting substances of all kinds by minimizing their generation at industrial enterprises. The project duration is estimated for 1998-2000, and the total budget required is estimated at US$ 3.1 million. According to the schedule of priority measures of the MNREP for 1998-2000, about 15 per cent should be funded by the national budget, another 15 per cent by local budgets and the rest by foreign investments or grants. The planned activities and their present status are as follows:

- A *National CPC* has been established as foreseen in Almaty (in the year 2000), as a unit in the Information and Analytical Centre of Geology, Ecology and Natural Resources under MNREP. The unit has two employees, but no money has been forthcoming, and the activity level related to CT projects is low.
- *Establishment of regional CPCs in Pavlodar, Ust-Kamenogorsk and Karaganda*: No governmental funding has been provided to support this project. Nevertheless, the CPC in Pavlodar is established with partners from the private business sector and large local industrial enterprises. This CPC has worked with CT projects since 1996. The CPCs in Ust-Kamenogorsk and Karaganda appear to exist only on paper.
- *Organization of regional workshops to promote cleaner production*: A national workshop on cleaner production was held in November/December 1999. The main result of the workshop was to encourage the MNREP and other relevant authorities to implement the CT projects included in the NEAP. No regional workshops have so far been held. The next CP workshop is to take place in Ust-Kamenogorsk in September 2000.
- *Creation of CP working groups at 10 large enterprises* : At the time of the EPR Review Mission, four working groups were said to be "under establishment", one of which would deal with Environmental Management Systems and Occupational Health and Safety issues and another with CP in enterprises.
- *Conducting environmental audits at 10-15 selected enterprises*: Nothing indicates that such audits have been carried out as a part of this project.
- *Implementing 4-5 demonstration projects on waste minimization at enterprises*: No demonstration projects have been implemented within this project.

Only few elements of the relevant NEAP projects have been implemented. The CPCs need increased financial support and expect this to come mainly from the MNREP. During discussions on this issue with officials from the MNREP departments that should be involved in the project, the following was very clearly stated:

- Cleaner production issues are no longer among the highest priorities of MNREP;
- CPCs will not get any support for the time being;
- CT projects will only be supported if most of the financing is available from private sources.

Another programme related to cleaner technologies was carried out in 1993 -1998 by the "National Centre for Mineral Raw Materials Complex Processing". This programme was called "Complex use of raw materials on the basis of resource-saving technologies in the mining and metallurgical sectors". The major part of this programme was related to reducing waste generation and raw material use by enterprises. A similar programme covering 1999 – 2003 has been launched, but again budgets are limited and private funding must be sought.

Financial instruments

Payment for the use of natural resources and for emission of pollutants is a basic element in the regulation of the environmental performance of industry. The system of fees and fines has the potential to promote the implementation of cleaner technologies, and some examples were found where high fees had actually led to this. But in general, this has not, or not yet, been the case in Kazakhstan, due to several factors:

- It is very difficult for most enterprises to find funding for new technologies, and they choose to pay charges and fines, or to reduce production levels instead;
- In many cases, fees and fines do not reflect the real damage caused to the environment, or special arrangements can be made with the authorities.

Issuing of "green" subsidies to enterprises that implement more advanced measures for environmental protection (e.g. cleaner technologies) is a possibility according to the Law on Environmental Protection. While the idea of subsidies could encourage enterprises to implement cleaner technologies, the LEP does not indicate which criteria to use to determine whether subsidies should be given or not.

11.2 Institutions for the promotion of cleaner technologies

Ministries and agencies

The policy and programmes of the MNREP have been presented in section 11.2. Other ministries that deal with cleaner technology issues are:

- *Ministry of Energy, Industry and Trade (MEIT).* Besides MNREP, MEIT is the leading ministry for the promotion of cleaner technologies within industry. MEIT still owns or controls a large number of industrial enterprises where it carries out project or technology assessments as well as inspections. According to the Department of Heavy Industries, MEIT has its own "Cleaner Production Centres", covering the mining and metallurgy, nuclear and bio-technology sectors (5-7 centres all in all). MEIT intends these centres to become the basis of future cleaner technology projects. MEIT has initiated several CT projects, but due to lack of funding dissemination of developed technologies is difficult. Two examples of projects are the evaluation of membrane technologies to eliminate the use of mercury at the Pavlodar Chemical Plant, and the development of a waste-reducing technology for metal processing plants. There is no systematic coordination between MNREP and MEIT on cleaner technology programmes and projects, either at ministerial level, or between centres.
- The *Ministry of Economy/Agency of Strategic Planning* reviews ecological assessments and decides which projects the Government should support. While ecological assessments only concern new activities, the Agency of Strategic Planning priorities are an important indicator of the emphasis the Government actually places on the promotion of cleaner technologies.
- The *Ministry of Science and Education* finances technical institutes and R&D laboratories and some of the cleaner production projects carried out at these institutions. However, these activities do not at present appear to contribute substantially to the promotion of cleaner technologies in Kazakhstan.

Industrial organizations and enterprises

As in most transition countries, the independent industrial organizations in Kazakhstan are not very strong. A national "Union of Producers and Enterprises" exists as well as a number of branch organizations (e.g. within the mining and oil industries), but it seems that none of these bodies plays an important role in promoting cleaner technologies. However, delegates from oil organizations (Kaz. Petrol Association and OKIOK) attended the cleaner production workshop of November/December 1999.

Environmental Management Systems complying with ISO 14001 or similar international standards have not been implemented in Kazakh industry. Even where foreign investors own the enterprises, environmental management is normally not prioritized, since there is no focus on this issue either by the authorities or the customers. Foreign investments in oil and mining companies could promote cleaner technologies in these important sectors, and some of the multinational oil companies (e.g. Mobil Oil) are organizing workshops, setting up working groups at enterprises, etc. But within the mining sector

generally, promotion of cleaner technologies does not seem to be an important issue, even though foreign investors own most of the enterprises.

Although awareness of the benefits of cleaner technologies appears generally to be quite low in industry, a number of projects have been carried out at enterprise level (without external financing). One example is the Pavlodar Oil Refinery, where the consumption of freshwater has been reduced by 80 per cent (2 million m^3) within three years through the introduction of recycling technologies and good housekeeping. The annual savings amount to roughly 40 million tenge.

Cleaner production centres-technical institutes-consultants

The Cleaner Production Centres established according to the NEAP project were planned to be the key institutions in promoting cleaner production. For lack of financial support, only a few projects have been implemented, although a large number of projects have been prepared. Only the CPC in Pavlodar, with a staff of six, seems to be fairly successful. It has completed cleaner technology projects and auditing in several enterprises: JSC Pavlodar Oil Refinery, JSC Aksu Ferroalloy Factory, JSC "Aluminium of Kazakhstan, and JSC Pavlodar Chemical Plant. The Centre was also involved in the "Energy efficiency and air pollution" component of the umbrella project covering 15 priority NEAP projects in the north-eastern part of Kazakhstan. A project on waste-water minimization of galvanic production in the "Pavlodar Machine Building Plant" is expected to start this year, financed by the ECOLink programme.

Besides the CPCs foreseen in the NEAP, about 10-20 technical institutes and consultants deal with cleaner production issues, among other services. The largest and most important is probably the National Centre for Mineral Raw Materials Complex Processing. This Centre carries out the programme on "Complex use of raw materials on the basis of resource-saving technologies in the mining and metallurgical sectors". The Centre covers six institutes sited in Almaty, Karaganda and Ust Kamenogorsk. Among them, the State Research and Production Corporation of Industrial Ecology (referred to as "Kazmechanobr") and the Cleaner Production Laboratory have experience in the development of cleaner technologies. The following are examples of projects:

- Development of membranes for treatment and recycling of galvanic waste water, reverse osmosis etc.;
- Development of waste minimizing anion-cation technology for gold extraction;
- Improvement of efficiency and recycling of cyanide at JSC Altynalmas (gold mine);
- Development of micro-organisms for oil spill clean-ups. This project has not been implemented, because foreign investors do not use Kazakh technologies;
- Substitution of lead in gasoline.

The Centre also plans to establish cleaner production units in the institutes in Karaganda and Ust Kamenogorsk. If the Government programme of establishing independent regional CPCs in the same cities is not revived, these units could take over some of the tasks, especially those that are more technical.

The Kazakh Agency of Applied Ecology (KAAE) in Almaty is one of the consultant companies with cleaner technology experience, especially of projects within the oil industry. KAAE recently presented a report to the MNREP on cleaner technologies in the oil, energy and food industries. This report is at present evaluated in MNREP, and the plan is to use it in future ecological assessments in these sectors.

Other institutions dealing with the development of cleaner technologies are the Engineering Academy, the National Technical University and two technoparks. The overall consulting resource base for cleaner production issues available in Kazakhstan is sufficient for extending the cleaner production activities in the country. A common complaint from the technical institutes and consultants active in this area, however, is that in the environmental projects so far implemented, the experience and knowledge of the local consultants has not been taken sufficiently into account.

International organizations

Besides the World Bank, UNDP and TACIS which supported the NEAP development, only a few organizations have been active specifically in the field of cleaner production:

- USAID has been the main (and almost the only) international contributor to specific cleaner production projects. Since 1996, the World Environmental Centre (WEC) has

been implementing the USAID Replicable Waste Minimization Programme for the Central Asian Republics. As a part of this programme, demonstration projects on waste minimization were implemented at two large industrial enterprises in Pavlodar. In 1999, USAID followed up on this initiative by establishing the ECOLink programme, where two stages of grant, US$ 5,000 and US$ 50,000, are given to projects within one of the three categories: "cleaner production", "water quality management" and "global climate change". The following demonstration projects have benefited from the Waste Minimization Programmes (nos. 1 and 2) and the new ECOLink programme:

1. JSC Pavlodar Chemical Plant, 1996-1997: Waste minimization. Investment: US$ 83,000, yearly savings: US$ 642,000.
2. JSC Pavlodar Oil Refinery, 1996-1997: Utilization of oil waste. Investment: US$ 11,400, yearly savings: US$ 680,000.
3. United Technologies Company (snack food company), Talgar, 1999: Waste-water minimization. Establishing of EMS (ISO 14001). Grant: US$ 49,550.
4. JSC Pavlodar Machine Plant, 1999: Waste-water minimization in the galvanic shop. Grant: US$ 5,000.
5. Ispat Karmet, Temirtau, 2000: Coalbed methane recovery from coal mines. Grant: US$ 5,000.
6. Altynalmas Corporation, Almaty, 2000: Water quality management in gold mining. Grant: US$ 5,000.
7. Atyrau Dairy Factory, Atyrau, 2000: Emissions reduction at the refrigeration facility. Grant: US$ 4,541.

- Within the framework of UNEP, a roundtable on Cleaner Production was held in Almaty in November/December 1999in which OECD, the World Bank and TACIS took part. About ten enterprises or associations participated in the event, which also received support and participation from MNREP and MEIT, local authorities and technical institutes.
- The OECD EAP Task Force that was created in 1993 in order to assist CEE and NIS countries to implement NEAPs includes environmental management in enterprises among its main priorities. The OECD EAP Task Force was a driving force behind the preparation of the Policy Statement on Environmental Management in Enterprises in CEEC/NIS, adopted at the Aarhus Ministerial Conference and OECD is considering further support for cleaner production programmes and projects.

Other organizations and/or programmes are concerned with cleaner production, but not as their main purpose. An example is the EPIC (USAID) programme on GHG emission reduction that includes a project on utilizing coal waste from the company AO Ispat–Karmet. General information on international cooperation is included in Chapter 3.

11.3 Conclusions and recommendations

Between 1991 and 1997, emissions from industry decreased as a result of declining production levels. Economic development has now stabilized however, and an increasing level of investment may be expected. But if future development of the country is to be sustainable, it is essential that cleaner industrial production be achieved without delay.. The NEAP well reflects this need although the budgets for cleaner technology projects are small compared with those for other issues such as cleaning up past pollution. Nevertheless, by attaching high priority to the establishment of regional CPCs, the Government has shown its commitment to the long-term strategy of implementing cleaner production.

Industry in Kazakhstan is dominated by large and very large enterprises, primarily within the heavily polluting sectors of mining and processing of metals, oil extraction and processing, and food production. In most industrial sectors, the technology is outdated, and there has so far been only a very limited focus on technologies for pollution prevention and control. As a consequence, enormous investments are needed in cleaner technology, but the underlying situation is still favourable in several respects. First of all, the structure of the industry indicates that significant results can be achieved by focusing initially on a few of the large and heavily polluting sectors. Furthermore, most of the investments needed appear to be financially viable. Finally, significant results can also be achieved by low-cost investment.

The industry and its associations do not seem to prioritize cleaner production issues. In a market economy, cleaner production ought to be looked upon as an integral part of the business plan, and

industrial associations should assist their members to gain understanding of cleaner technology, environmental management, funding etc.

Recommendation 11.1:
The Ministry of Natural Resources and Environmental Protection, together with the Ministry of Energy, Industry and Trade and other interested institutions, in cooperation with the industrial associations and individual enterprises, should promote the conditions for enterprises to become more involved in cleaner production issues.

The cleaner technology approach is introduced in the Law on Environmental Protection as well as in the Law on Ecological Expertise. The laws for promoting cleaner technologies are thus well in place. The intentions of the law, however, have not been enforced, mainly due to the absence of a well-defined regulatory system, including the necessary enforcement measures. There are no practical guidelines available on how to introduce the application of cleaner technologies into project documentation, and how to utilize cleaner technology documentation when performing an ecological evaluation. The impression gained from interviews with officials from ministries and local departments as well as with consultants during the EPR Review Mission is that cleaner technology issues do not normally play an important role in expert ecological assessment.

There is no integration of approval of industrial projects with the determination of emission limits and with inspection. This separation does not promote the introduction of cleaner technologies. Limit values should be based on the Best Available Technology (BAT) approach, not on norms that do not reflect the development of new technologies.

Further weaknesses are the lack of guidelines on environmental audits and lack of know-how among inspectors and environmental auditors of cleaner production possibilities. The idea of having independent audits at existing enterprises is good, especially in the case of large enterprises whose practices give rise to a number of significant impacts. These enterprises, in cooperation with the authorities, need to develop an environmental action plan that includes a prioritized list of impacts, the measures planned to reduce them, and the deadlines for their implementation. The ecological audits could provide a good basis for developing such action plans. Training within industry of environmental managers as well as independent auditors and inspectors is a necessity for the Ecological Audit system, if it is to become a promoter of cleaner production.

The "polluter pays" principle, if introduced, for example, by imposing fines for exceeding pollution or nature use limits, could in principle favour cleaner production, but in the present economic situation in Kazakhstan it is more likely to lead to the cutting back of production volumes and/or give rise to special pricing arrangements between enterprises and the authorities. Furthermore, the environmental taxes paid by industry differ from oblast to oblast, and hardly reflect the real damage caused to nature.

The new initiative on voluntary agreements between enterprises and authorities on simplified inspections and improved self-monitoring and reporting will probably promote cleaner production or at least improve law enforcement and reduce corruption. Voluntary agreements can also promote the introduction of cleaner production. Firstly, because team inspections reduce the risk of personal arrangements and secondly, because a single coordinated set of requirements to be fulfilled within a reasonable period of time is easier to build into a business plan than a steady flow of different requirements.

Recommendation 11.2:
The permitting system for enterprises should be changed in order to integrate the assessment of applied technologies with the setting of emission limit values. Regulations on the appropriate consideration of cleaner technologies in environmental assessments and on the performance of environmental audits should be established as a matter of urgency. The strengthening of economic incentives – like the revision of relevant taxes and fines – could become an effective instrument for the introduction of cleaner production. Consideration should be given to making voluntary agreements on simplified inspections and improved self-monitoring and reporting an instrument for the promotion of cleaner technologies, particularly in selected enterprises polluting the environment. See also Recommendation 2.4.

Cleaner production has a high priority in the NEAP and several CP projects were planned for the period 1998-2000. The most important is the project on establishing one national and four regional Cleaner Production Centres (CPCs) as well as a number of CP demonstration projects and working groups involving representatives of the industry along with the authorities. Implementation of this project

would be a very good kick-off for the CP work in Kazakhstan. The results would be clearly visible and the experience gained would provide a good basis for the future work of CPCs and industry.

There seems to be some (tacit) competition between the MEIT and the MNREP regarding cleaner production centres and the primary responsibility for the promotion of cleaner technologies. In a market based economy it is a strength to have centres closely related to the industry as well as more independent centres. Nevertheless, it is important that MNREP, MEIT and the other institutions involved coordinate their priorities and programmes, thereby avoiding the duplication of work and ensuring an optimal dissemination of results.

The Government, however, has not prioritized the implementation of this project. The CPC project will clearly not be implemented unless private funds are forthcoming. At the same time, experience shows that it is very difficult for the CPCs to raise funding from private sources as long as benefit from CT cannot be sufficiently demonstrated. Thus, there is a high risk that the CPCs will not be promoting agents for CT for some time to come, leaving the country without coordination and systematization of cleaner technology projects and know-how. Only one of the planned CPCs seems to work on an acceptable level and that is due entirely to private initiatives.

Other institutions such as technical institutes and local consultants deal with CP projects and in this way fulfil some of the tasks of the CPCs. Nevertheless the Government should speed up the programme on establishing regional CPCs to ensure the strengthening and focusing of experience. But even if the Government is not willing to implement the NEAP project on CPCs, it should at least clarify the future of the centres that have already been planned.

Recommendation 11.3:
The Ministry of Natural Resources and Environmental Protection should speed up the National Environmental Action Plan project aiming at the establishment of Cleaner Production Centres. The respective work should be undertaken in cooperation between all institutions currently involved in cleaner production initiatives, notably the Ministry of Natural Resources and Environmental Protection and the Ministry of Energy, Industry and Trade *See Recommendation 9.2.*

Very few CP demonstration projects have been implemented in Kazakhstan, and hardly a handful had international support. But the local know-how needed for implementation of demonstration projects (such as CPCs to the extent that they are active, technical institutes, and consultants) is certainly available, and such institutions should play an important role in future demonstration projects to ensure the further development of CP experience in the country.

The main reason for the low level of demonstration activity is therefore the lack of funding, but insufficient awareness in industry is another important problem. A large-scale CP demonstration project within selected sectors such as the oil, mining and metallurgy sectors is needed to lift the level of activity together with awareness. Funding of this project should be a combination of grants (to pay for local consultants, workshops and a minor part of the enterprise investments) and soft loans (to pay for the major part of the enterprise investments). Branch organizations should also be involved to stimulate the interest and the dissemination of results, and local CPCs, technical institutes and consultants should work closely with the enterprises in defining the necessary CP measures in each enterprise. International organizations already active in the field of cleaner production (e.g. OECD, UNDP and USAID) should consider contributing to the funding of such a project.

Recommendation 11.4:
The Ministry of Natural Resources and Environmental Protection should initiate and support a cleaner production demonstration project within selected priority sectors as a matter of great importance. The demonstration project should in particular include the introduction of Environmental Management Systems and low-cost investments by the participating enterprises.

Only a small percentage of the environmental fees and fines collected from industry are redirected to industry. The argument is that the enterprises should be able to raise finance from other sources, but in practice this is very difficult and implementation of the provisions for “green” subsidies foreseen in the LEP is complicated by the absence of implementing regulations. There is therefore an urgent need for transparent and independent funding of industrial environmental projects. This funding should primarily support cleaner technology projects and could secondly

support treatment technology projects. It is important that the required funding arrangements attract foreign investors and donors, and establish close cooperation with all possible financing mechanisms. (See also Chapter 2, in particular Recommendation 2.2.)

Chapter 12

AGRICULTURE AND DESERTIFICATION

12.1 The agriculture and food sectors

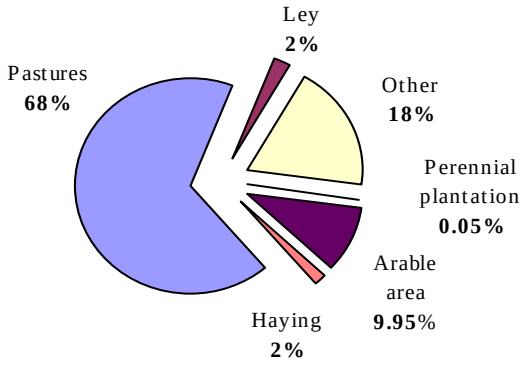
Basic characteristics and agricultural regions

Agriculture is Kazakhstan's second most important economic sector after industry. But while the proportion of rural residents to the total population has remained constant in recent years, the share of agriculture in GDP fell from 15.0 per cent in 1994 to 11.5 per cent in 1997 and to a figure around ten per cent in 1999. This means that per capita income in rural areas is decreasing and is now much lower than that in the industrial zones and urban centres.

Five agricultural regions can be distinguished: the cattle-breeding zone within climatic limitations, the cattle-breeding and fruit-growing zone, the rice-growing zone, the cotton-growing zone and the agro-economic zone under urban influence. The cattle-breeding zone is vast and can be divided into five sub-areas, defined by natural conditions and sectors of livestock production. These are:

- Crop-cattle sub-area
- Cattle-crop sub-area
- Fine-fleeced sheep-breeding sub-area
- Meat-fat sheep-breeding sub-area
- Astrakhan sheep-breeding sub-area

Figure 12.1: Agricultural land use



Source: Ministry of Agriculture, 1998.

The tables and figures in this chapter describe the natural and productive conditions of each sub-area.

The *cattle-breeding and fruit-growing zone* specializes in the production of industrial crops, together with large pastures for sheep- and cattle-breeding (Tables 12.1, 12.2). There is no predominant soil type in this zone: chernozems, chestnut soils, piedmont soils, etc. can be found. The *rice-growing zone* includes systems of rice production in the lower valleys of the river Syr Darya (Table 12.3). The *cotton-growing zone* joins favourable regions for growing cotton, fruit and grapes (Table 12.4).

The stretch of suburban farms around centres of consumption can be classified as a separate agro-economic zone. This zone occupies 3.6 million ha of agricultural land, of which 0.7 ha is arable and 0.15 million ha is irrigated for intensive production.

Land use and yields

Kazakhstan has implemented economic reforms and privatization with the government gradually withdrawing its support from agriculture. The first consequence of these processes has been a new distribution of land. The changes in land use can be seen in Table 12.5 which shows the strong increase in the number of private farms at the expense of agricultural enterprises and organizations.

Personal households on 0.32 per cent of the utilized land produce a large proportion of the output among all types of farms and landowners. Most outputs produced by the household plots are animal husbandry products, while in agricultural enterprises and private farms, production is mainly plant-growing. Animal husbandry produces 58.6 per cent of the value of total agricultural output, the most important sectors being animal breeding (27.4 per cent) and dairy products (24.3 per cent). Yields in all agricultural sectors have suffered a severe reduction: in 1986-1990

Table 12.1: Characteristics of the cattle-breeding sub-zones

	Surface			Climate		Geomorphology	Soils
	Total	Arable land per inhabitant	Arable land	Agroclimatic index	Annual rainfall		
	(million ha)	*(ha/inhab)*	*(million ha)*		*(mm)*		
Crop and cattle sub-area							
North-Kazakhstan, Aktyubinsk, Karaganda and Akmola Oblasts, Northwest Kazakhstan, Kostany							
	32.8	51	14	2,250	300	Moderate arid steppe	Black and dark-chestnut
Central Aktyubinsk, northern East-Kazakhstan, central Kostanai, central and south-eastern part of West Kazakhstan, east and south-west of the Akmo city of Karaganda.							
	56	2.5	8.8	2,690	250	Dry steppe	Dark-chestnut and chestnut soils
Fine-leeced sheep breeding							
Southwest of West-Kazakhstan, central and southern East-Kazakhstan, part of the Almaty Oblast close to Lake Balkhash							
	30.8	..	4.6	2 800-3 500	150-200	Semi-deserts and deserts	Light-chestnut and brown chestnut
Meat-fat sheep breeding							
Central part of Kazakhstan							
	38.3	..	2.7	3 200-3 900	100-200	Semi-deserts and deserts	Light and black chestnut
Astrakhan sheep breeding							
Caspian depression	31.4	..	0.8	3 500-4 000	100-150	Deserts	Light and black chestnut

Source: Statistical Yearbook, 1999.

Table 12.2: Characteristics of the cattle-breeding and fruit-growing zone

Surface			Plot features	Climate		Geomorphology	Soils	Products
Total	Arable land	Pastures		Agroclimatic index	Annual rainfall			
(million ha)					*(mm)*			
South-east of Kazakhstan								
15.4	2.3	12.0	Intensively irrigated	2 100-3 800	200-350	Foothills and mountain valleys	Varied	Beet, tobacco, grape, grain, forage for sheep and cattle breeding

Source: Statistical Yearbook, 1999.

Table 12.3: Characteristics of the rice-growing zone

Surface		Plot features	Climate		Geomorphology	Soils	Products
Total	Arable land		Agroclimatic index	Annual rainfall			
(million ha)				*(mm)*			
Kzylorda							
11.6	11.6	Irrigated large farms	3,800	120	Lower valley of the river Syr Darya	Grey and brown soils	Rice, sheep and cattle breeding

Source: Statistical Yearbook, 1999.

Table 12.4: Characteristics of the cotton-growing zone

Surface		Plot features	Climate		Geomorphology	Soils	Products
Total	Arable land		Agroclimatic index	Annual rainfall			
(million ha)				*(mm)*			
South of the Kazakhstan Oblast							
2.2	0.2	Farms mainly irrigated	4,400	220	Middle section of the Syr Darya	Grey and brown soils	Cotton, fruits and grapes

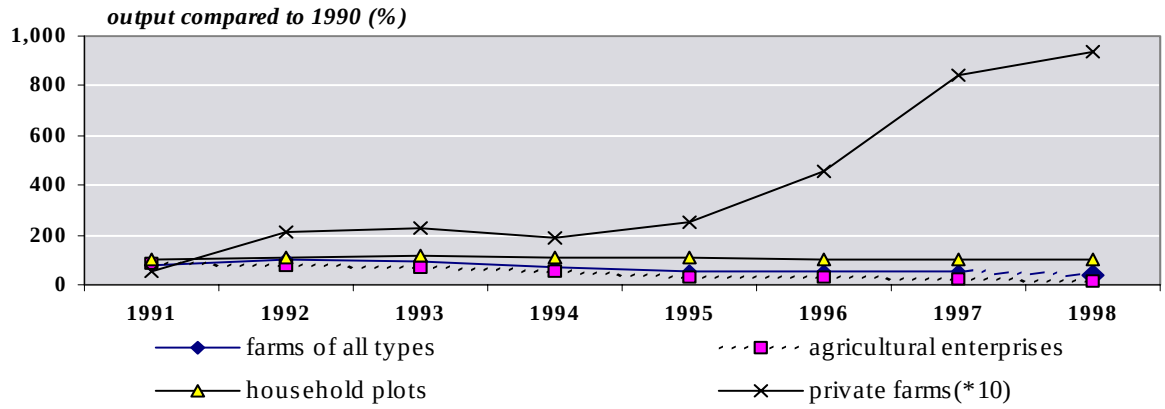
Source: Statistical Yearbook, 1999.

Table 12.5: Evolution of land use by type of holding, 1995-1998

	1995	1996	1997	1998
Total land used *(1 000 ha)*	**195,150.1**	**181,121.1**	**149,405.4**	**130,382.4**
as % over land used area				
Agricultural enterprises and organizations	*92.93*	*88.69*	*81.14*	*77.47*
Private farms	*6.82*	*11.06*	*18.58*	*22.2*
Personal use of households	*0.25*	*0.25*	*0.28*	*0.32*
Personal subsidiary plots	*0.14*	*0.14*	*0.15*	*0.18*
Collective and personal gardens	*0.11*	*0.11*	*0.13*	*0.14*

Source: Statistical Yearbook, 1999

Figure 12.2: Agricultural output by type of holding, relative to 1990, 1991-1998



Source: Statistical Yearbook, 1999.

grain production decreased to 49 per cent of the average ; yields of sunflower were down to 56 per cent, and potato production dropped to 74 per cent. As shown in Figure 12.2, however, production on private farms increased sharply.

Kazakhstan's production of industrial crops includes cotton (coarse-fibroid variety with an average yield of 2.9-3.0 t/ha), sugar beet (60-80 ha producing 1.1-1.3 million tonnes), oil crops (sunflower and rape seeds with a yield of oil of 1.2-1.5 t/ha; 121,000 ha under cultivation in 1997), flax seeds and white mustard seeds with a yield of 0.6-0.8 t/ha.

The average potato yield varies from 7.8 to 11.8 t/ha. These low yields result from the lack of fertilizers and irrigation. With appropriate cultivation methods, it is possible to reach 14.0-18.0 t/ha without irrigation and 25.0-30.0 t/ha with irrigation.

The most commonly grown vegetable crops are cabbages, tomatoes, cucumbers, carrots, onions, and red beets. , In response to the high demand and high prices of vegetables family farms and households are extending the areas where vegetables are grown. The yields have remained constant in the last decade: 70.0 t/ha for cabbage, 45.0-50.0 t/ha for carrots, 33.0 t/ha for tomatoes, and 50.0-70.0 t/ha for red beets. At the present time, vegetables are still not cultivated under plastic, and the capacity for storage is undeveloped, which results in important fluctuations in market prices.

In southern Kazakhstan fruit and grapes are cultivated with seed-fruits (apples, pears and others) covering 70 per cent of the planting area. Stone-fruits (plums, peaches, apricots, cherries, sweet cherries, etc) occupy 20 per cent, and nut plantations (filberts, almonds, walnuts, pistachios) and berries take up to 10 per cent.

Livestock production in Kazakhstan includes cattle, sheep and goats, pigs, horses and poultry. Table 12.6 shows the pattern of livestock production in recent years.

Table 12.6: The evolution of livestock and poultry, 1994-1999

Thousand head

	1994	1995	1996	1997	1998	1999
Cattle	9,346.6	8,072.9	6,859.9	5,424.6	4,307.1	3,957.9
of which:						
Cows	3,687.2	3,396.7	3,045.0	2,546.6	2,109.6	1,952.8
Sheep and goats	34,208.1	25,132.1	19,583.9	13,679.0	10,384.3	9,556.4
Pigs	2.445.2	1,982.7	1,622.7	1,036.4	879.0	891.8
Horses	1,776.6	1,636.0	1,556.9	1,310.0	1,082.7	986.3
Poultry	49,600	32,700	20,800	15,400	16,000	17,000

Source: Statistical Yearbook, 1999.

Table 12.7: Availability of machinery, 1994-1998

Thousand uni

	1994	1995	1996	1997	1998
Tractors	196.2	170.5	142.4	108.1	64.2
Grain combines	70.9	61.9	53.9	42.2	24.9
Cotton combines	2.3	2.0	1.9	1.6	0.6
Fertilizer dispenser	8.0	6.7	4.4	3.0	2.2

Source: Statistical Yearbook, 1999.

Agricultural machinery

More than half of the agricultural machinery is more than ten years old and as it was mostly produced in the former Soviet Union spare parts are now too expensive, particularly for family farms where much less machinery is available. In northern regions, there is 0.5-1 tractor per family farm, in the southern region the ratio is even lower: 0.1-0.8 tractors per farm. The availability of machinery in 1994-1998 is presented in Table 12.7.

Food industries

The lack of investment in the food sector does not allow for improvement and modernization of the agro-industry. The production of meat and milk however, satisfies domestic demand. There are 48 meat factories (slaughtering and processing), mostly located in cities, with a production capacity of around 2.5 thousand tonnes daily. There are 147 dairy factories operating in the country with a total production capacity of around 8.6 thousand tonnes per shift. Neither sterilized nor concentrated milk products are manufactured.

Because of the logistic difficulties entailed in its transport and storage, fresh produce such as vegetables and fruit requires prompt selling in local markets. Fruit produced domestically satisfies 18 per cent of the local demand and supplies 26 per cent of the nutritional needs of the population. Investment in processing and packing lines is needed in order to guarantee the supply of fresh products.

There are 160 grain mills with a total capacity of 4.8 million tonnes, equivalent to twice the domestic requirements. Most of the mills are outdated and need substantial technological improvements. There are more than 300 grain elevators in the country with a total capacity of 10 million tonnes, but the installations are old and need urgent maintenance.

12.2 Environmental problems of agriculture

The Republic of Kazakhstan experiences a wide variety of environmental problems related to agriculture. Some of the most important problems such as humus depletion in northern areas, pollution of soil and water from the use of fertilizers and pesticides, or secondary salinization are primarily a heritage from the former Soviet period. However, after a transition period of ten years, most of these problems have not been solved and new problems have arisen. The specific challenge posed by desertification will be discussed later in this report.

Problems related to land use and production techniques

The old planning system of the former Soviet Union included the extensive exploitation of virgin steppes, and created a large area of over 35 million ha of arable lands. Of these, almost 14 million ha have been abandoned in the last ten years. The current National Programme of Land Use Change promotes the reuse of 10 of the 14 million ha, of which nearly 2 million will be cultivated and more than 7 million converted into pasture.

While land remains State property according to the constitution, beginning in 1991, most of the State farms were privatized. One of the major problems of privatization, however, is related to the availability of machinery (tractors and combine harvesters, see Table 12.7). The loss of economic resources also affected the use of qualified technicians, as the agrotechnicians often lost their positions. The loss of these human resources can be considered to be one of the most important

obstacles to improvement of the efficiency of the agrosystems.

Problems of irrigation and salinization

There are 2.35 million hectares of irrigated arable lands (about 10 per cent of all arable land), located mainly in the south and southeast regions. The irrigated crops (rice, cotton, corn and tobacco) are cultivated in the lower valley of the river Syr Darya, where rainfall ranges between 120 and 220 mm, implying a deficit of rain requiring compensation by irrigation. Of the total, 76 per cent of the irrigated land uses surface irrigation systems, while 24 per cent use other systems such as artificial rain. In addition, only 4 per cent of the irrigated land has been provided with a drainage system, necessary in order to avoid salinization.

The problem of salinization is one of the most important environmental problems due to its irreversible character. A distinction should be made between salinization from natural salt and salinization induced by irrigation. The second is mainly caused by deficient agricultural planning or practices, like the use of water bearing a high concentration of soluble salts, inappropriate irrigation technologies, the lack of drainage, or poorly drained soils. Unfortunately, due to the present lack of monitoring of the quality of water for irrigation and in salinized areas, quantification of the extent of the problem in Kazakhstan is not possible, but nearly all the irrigated areas should be considered to be facing a serious risk of salinization.

Problems from the use of chemicals

For economic reasons, over the last ten years the use of fertilizers and plant-protection agents has decreased. The new ownership conditions and the fragmentation of plots do not permit farmers to undertake the necessary expenditure. The use of mineral fertilizers in 1996 reached only 2.1 per cent of the 1990 level, and for organic fertilizers only 4.7 per cent. As 99 per cent of the crops are produced without fertilizers or plant-protection agents, yields are highly dependent on the natural conditions. In 1998, however, the use of nitrogenous fertilizers increased.

A particular problem that arose recently was the plague of migratory locusts that affected more than 2 million ha of arable lands, requiring specific insecticides. A 10 million dollar programme funded by a credit from the Asian Development Bank is being used to combat the plague.

12.3 Desertification

Extent of desertification

Deserts are natural ecosystems, usually characterized by the absence of vegetation cover, due to certain climatic or soil conditions. From this point of view, a great part of the Republic of

Table 12.8: Main causes of desertification in Kazakhstan

Main causes of desertification	Quantification
Agricultural activities	17 million ha affected by soil erosion 1.2 billion tonnes loss of humus
Irrigation	1 million ha risk of secondary salinization
Mining and industry	Polluted areas from mining 194 thousand ha of oil polluted areas (West Kazakhstan)
Forest fires (1997)	200 thousand ha
Overgrazing (1990-1996	10 millions ha of pasture degradation
Others (catastrophes...)	Aral and Caspian Seas, Semipalatanisk (2 million ha)
Desertified areas	**66% (179.9 millions ha)**

Sources: National Environmental Action Plan for Sustainable Development, 1999. Cadaster of Polluted Areas (Agency of Land Planning). UNDP, 1997.

Table 12.9: Major environmental implications of desertification in Kazakhstan

Main causes of desertification	Responsible factors	Environmental problems
Agriculture	Land privatization Changes in management system	Soil depletion, loss of humus Loss of soil fertility Loss of agrobiodiversity
Irrigation	Inappropriate irrigation schedule Lack of drainage	Decrease of productivity Changes in land use Soil and water pollution
Mining and industry	Mining management	Soil pollution Groundwater pollution
Forest fires (1997)	Forestry policy	Loss of biodiversity Soil erosion
Overgrazing (1990-1996	Livestock management Forestry management	Loss of biodiversity Water pollution

Source: National Action Programme to Combat Desertification.

Table 12.10: Distribution of desertification by oblast

Oblast	Main causes of desertification	Desertification degree
Akmola	Agriculture, drought	Moderate
Aktobe	Overgrazing, drought	Moderate with the centres strong
Almaty	Forest cutting, overgrazing, drought	Strong
Atyrau	Overgrazing, oil extraction, drought	Moderate to Strong
East Kazakhstan	Industrial pollution, unregulated run-off, forest cutting	From moderate to strong depending of the area
Karagandy	Overgrazing, mining, agriculture	Moderate, in the centre strong
Kostanai	Forest cutting, agriculture, drought	Moderate
Kyzylorda	Irrigation, overgrazing, unregulated run-off	Strong, in some areas moderate
Mangistau	Mining, oil extraction, overgrazing	Strong
North Kazakhstan	Agriculture, forest cutting	Moderate
Pavlodar	Agriculture, industrial pollution	Moderate
South Kazakhstan	Irrigation, overgrazing, forest cutting	Strong, in some areas moderate
West Kazakhstan	Industrial pollution, overgrazing	Moderate to strong
Zhambyl	Overgrazing, forest cutting	Moderate to strong

Source: National Action Programme to Combat Desertification.

Kazakhstan can be regarded as a desert or semi-desert, particularly the southern regions of the country and other parts that present a moderately arid type of climate. Desertification can be defined as the degradation of the land in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. It is accompanied by a reduction in the natural potential of the land and a decrease in surface and ground water resources.

In Kazakhstan, almost 60 per cent of the territory corresponding to this definition is considered to be at high risk of suffering the effects of desertification processes. The causes of desertification in the country are listed in Table 12.8, and the environmental implications in Table 12.9.

Although desertification is a general problem throughout the country, its causes and its impacts

are closely related to land use (see Table 12.10). Desertification processes are particularly serious in the south of the country, where the natural ecosystems, i.e. desert and semidesert, show lower resilience than other ecosystems such as steppes or forest.

One major problem related to desertification in Kazakhstan is the difficulty of monitoring its causes nationwide, a problem for which, unfortunately, because of the size of the country, the lack of specific programmes, inappropriate technology, absence of research programmes in the field etc. no solution is presently in sight. Some international groups, such as ISPRA (providing European Union assistance), or cooperative missions from the United Kingdom or Italy, monitor desertification with remote sensing techniques, but they report only partial data for the country. In addition, the reliability of the available data is questionable.

Agricultural land use and desertification

The recent evolution of agriculture in Kazakhstan has been a major factor contributing to desertification. At the time of the former Soviet Union, wide stretches of virgin lands in the northern part of the country were cultivated for the intensive production of wheat and in other areas other crops (rice, cotton, fruit). After the collapse of the Soviet Union in 1991, 14 million hectares of cultivated land were abandoned, and no effort was made to control or rectify soil erosion. This situation caused the depletion of the humiferous layer of the soil, to a greater or lesser degree, through wind and water erosion. The loss of humus to date is estimated to be about 1.2 billion tonnes. From a total area of 17 million hectares of affected soil (14 million ha of abandoned arable land plus 3 million ha of other arable land), almost 12 million are exposed to mainly wind erosion, and 5 million to mainly water erosion. In addition, crop rotation was inappropriately practised during the Soviet era, as there was no utilization of leguminous species which could have improved nitrogen fixation, the organic carbon cycle and the formation of soil aggregates. The evolution of the derelict areas now depends on the resilience of the ecosystems concerned. It is possible that large parts of the northern areas will become steppe.

Secondary salinization and desertification

The problem of secondary salinization of irrigation water was discussed above, as were the problems of disaster areas like the Aral and Caspian Seas and Semipalatinsk. However, it is necessary to mention the problem of wind-blown salt, a process that begins after secondary salinization. Once salt has moved to the upper layer of the soil, it is carried by the wind to other areas. The Aral Sea basin is an example of this process. It is estimated that several tens of thousands of tonnes of salt are moved every year, in many cases by sand and salt storms, a serious phenomenon at the local level. To establish priorities in the fight against salinization, monitoring of the problem should begin without delay.

Desertification due to overgrazing

Overgrazing is a common cause of desertification in arid environments and has been well studied in other parts of the world such as the sub-Sahelian areas. Overgrazing appears when there is an imbalance between the amount of livestock and the primary productivity of the pastures. New trends in the use of livestock in Kazakhstan in the past ten years (see Table 12.11) brought a sharp decrease in the number of cattle and poultry.. This crisis was accompanied by a change in the livestock management system: once the Soviet Union had collapsed, livestock passed into private hands and there was a tendency to halt the traditional migratory movement of animals. As a consequence, the overall grazing diminished. But far from what might have been expected, as the numbers of livestock decreased, desertification processes due to overgrazing increased locally. In the southern *oblasts*, because of the fragility of the ecosystems, overgrazing may well be causing damage to the ecosystems that is irreversible and should be regarded as a priority for remedial action.

Mining and desertification

Mining activities can generate desertification in different ways. Mining waste, on many occasions, is characterized by unusual values of pH, electrical conductivity and the presence of pollutants such as heavy metals. Most of the mining waste disposal processes do not provide for rehabilitation programmes, which results in the proliferation of wide areas where mining wastes were discarded, and which are exposed to wind and water erosion, with a serious risk of pollution of water bodies**.** According to the register of polluted areas kept by the Land Planning Agency, 57,547 hectares of land previously used mainly as dumpsites etc. were closed in 1999.

Another cause of desertification occurs after oil extraction. Oil fields tend to be abandoned once they are exhausted, and no rehabilitation measures are undertaken. This problem is particularly acute in the Caspian Sea basin.

Others causes of desertification

In southern *oblasts*, the local population cuts a particular plant species, *Haloxylon persicum* in sandy deserts or *Haloxylon aphylum* in other deserts, for fuelwood. These plants play a crucial role in the desert ecosystem, as their root system prevents the dunes from moving. In other cases, people cut trees of river forests or protection belts. While in certain regions, this is allowed by the authorities, revealing a gap in legislation and forest management policies, the cutting increases the risk of floods and desertification and has a devastating effect on fragile ecosystems.

12.4 Institutions, policies, priorities and management

Responsible institutions

Although the Ministry of Agriculture is the main governmental policy and management administrator for the sector, other institutions share some responsibilities or interest. Such other institutions include the Ministry of Natural Resources and Environmental Protection (notably its Water Management and Forestry and Fisheries Committees), the Committee on Privatization of State Property, the Strategic Planning Agency, the Ministry of Industry (particularly via the management of food industries), international cooperation institutions and NGOs.

The principal responsibility for the implementation of the National Strategy and Action Plan to Combat Desertification (NSAPCD) falls on the Ministry of Natural Resources and Environmental Protection, but other governmental institutions such as the Ministry of Agriculture and local administrations share similar objectives and tasks. The main agencies involved in the fight against desertification are the Forestry, Fishery and Hunting Committee, the Committee on Water Resources, and the National Environmental Centre. In addition, UNDP, the World Bank and UNCCD (United Nations Convention to Combat Desertification) provide technical and/or financial assistance and NGOs also collaborate..

Policies and strategies

The National Programme for the Development of Agricultural Production 2000-2003 includes growth perspectives for agriculture. The main objectives of the Programme are:

- To provide economic growth in competitive branches of agricultural production;
- To stabilize the main types of agricultural plant and animal production.

Both rice and cotton production are considered to have a potential for growth. Consequently, the programme foresees the implementation of water supply projects, facilities for increasing the efficiency of the crops, creation of a select rice seed production, improvement of the quality of rice and cotton processing, and the redistribution of profits. Rice and cotton production are concentrated in the southern *oblasts*, in which the major problems of salinization and desertification are also encountered.

Livestock trends, however, are not considered favourable, because of the decreases of production, export possibilities, product quality and production efficiency. Only poultry production by private household farms is showing a profit. The main related objectives of the Programme include:

- Reduction of costs in poultry farming;
- Restoration of the pedigree base.

Some of the agricultural projects depend on international funds such as the Country Assistance Plan of the ADB (2000), which includes a Programme of Farm Sector Development in east Kazakhstan (US$ 50 million loan) and the Locust Management Emergency Project, including environmental monitoring of the use of pesticides.

The World Bank policy considers agriculture to be a priority sector. Several projects are being implemented, such as an irrigation and drainage project (functioning since 1996 in 11 *oblasts*, and including 15 specific projects, financed by a loan of US$ 80 million). The objectives of the project are to increase the efficiency of water use, reversing the declines in production from salinity and waterlogging, and increasing productivity. The Agricultural Post-Privatization Assistance Project (amounting to US$ 15 million, extending to 2002) seeks to promote the development of privatized

Table 12.11: Actions of the National Strategy and Action plan to Combat Desertification.

Short- term	1. Improvement of the system of nature use management. 2. Inventory and analysis of land degradation. 3. Development of a normative and legal framework. 4. Development of measures of rational forest utilization. 5. Completion of schemes of development, location and actual creation of a network of specially protected natural territories. 6. Development of economic incentives for combatting desertification.
Medium -term	7. Implementation of desertification monitoring. 8. Development of measures for farming adjustments to climate changes and droughts. 9. Improvement of a wide use of soil protection technology of cultivation. 10. Rational use of natural fodder supply lands, creation of seeded pastures and hayfields on degraded areas. 11. Rehabilitation of the vegetation cover on fallow lands.
Long-term	12. Forest and pasture amelioration on desertified lands. 13. Fixing of moving sands to protect pastures, settlements and economic activities. 14. Amelioration of land affected by secondary salinization. 15. Mountain technique and phytomelioration re-cultivation of lands affected by technogenic damage. 16. Organization of environmental education and increase of public awareness of desertification problems. 17. Development of traditional industries and businesses in agriculture sector.

Source: National Action Programme to Combat Desertification.

farms and agro-enterprises and improve rural incomes and productivity. A GEF project deals with dry lands management for agricultural purposes US$ 5 million) in abandoned areas. Also, a strategy for irrigation and drainage systems is under preparation with proposed loans of US$ 180 million). Another project is concerned with the conservation of agro-biodiversity (GEF project on *in situ* preservation of mountain agrobiodiversity in Kazakhstan, financed by a loan of US$ 241,000).

In the National Environmental Action Plan for Sustainable Development, at least two comprehensive activities have been specifically designed to combat desertification. They are among the priority initiatives identified for conservation of arable lands and pastures:

- Activity 19: Registration of environmentally degraded low productivity lands and their transformation.
- Activity 20: Improvement of the pasture-use system.

Each activity involves specific projects. The following examples relate to the conservation of arable lands and pastures, all in the hands of the Ministry of Agriculture, the MNREP, and relevant *akimats*, and coordinated by the National Environmental Centre for Sustainable Development:

- Preparation of an inventory of environmentally affected non-fertile lands and their transformation. The project was scheduled for 1998-1999, at a cost of US$ 1.37 million.
- Establishment of a Centre for Soil Degradation Problems in Akmola *Oblast*. The project was planned for 1998-2000, at a cost of US$ 2.24 million.
- Improvement of the pasture-use system-creation of sown pastures to prevent desertification processes in Kzylorda, south Kazakhstan and Almaty *oblast*. Implementation scheduled for 1998-2000 at a cost of US$ 7.35 million.

Kazakhstan ratified the United Nations Convention to Combat Desertification on July 7, 1997. As a result of this Convention, the Government worked on the National Action Programme to Combat Desertification (with technical and financial assistance from UNDP and UNEP). The development of the National Strategy and Action Plan to Combat Desertification (NSAPCD) began in 1999. This programme is part of the national

overall strategy "Kazakhstan 2030", and includes detailed information about objectives and the time schedule for their implementation.

The NSAPCD defines action for the short term, the medium term, and the long term. The corresponding 17 specific activities are included in Table 12.11. These activities were translated into well-defined projects in terms of objectives, location, responsibilities, concrete action, equipment required, results expected and budgets. To date, the majority were not carried out for a number of reasons, the most important being lack of finance.

12.5 Conclusions and recommendations

Since 1991, when Kazakhstan gained its independence, several strategic documents have been prepared, and laws passed that were of relevance to environmental concerns in agriculture. A new law on land, the main objective of which is to regulate privatization in agriculture, is now under consideration. The draft of the law provides that agricultural land, including its water resources and forestry, cannot be privately owned. However, plots of land for household farming, horticulture and summer cottage construction may be leased in perpetuity or under temporary tenure. Permanent non-governmental land users have, therefore, all the rights of land use as long as they do not change the purpose of use without authorization.

The new law should clearly specify the rights of farmers and farmer associations with regard to the use of farm facilities and to the use and maintenance of the irrigation systems and not leave the basic entitlements and duties in these regards only to decrees. Furthermore, it is essential, once the law is enacted, that the legal provisions be strictly implemented. . Finally, the law should preclude excessive fragmentation of plots.

Recommendation 12.1:
The rights and duties of farmers and farmer associations in relation to the use of land, farm facilities and water for irrigation in the light of requirements for environmental protection should be clarified in the new law on land. The rules for allotment of land plots should preclude excessive fragmentation. See Recommendation 10.1.

Cooperation between the different institutions (UNDP, UNEP, MNREP and others) has enabled the National Strategy and Action Plan to Combat Desertification to be developed, priorities and objectives to be fixed, and related activities derived. The implementation of the envisaged strategy now requires numerous projects. The application of new technologies for mining, irrigation and agriculture as well as the environmental assessment of the new and existing technologies and the monitoring of the planned activities should all contribute to the solution of the problem. These requirements obviously require ongoing research.

Certain problems of desertification result from the human use of the territory and a number of desertification risks are either caused by land use practices or can be aggravated by them. This implies that local populations have to play a key role in programmes to combat desertification, awareness-raising and training programmes, cooperation with NGOs, and take part in relevant decision-making processes.

The success or failure of almost every activity for combating desertification in the future will depend on the participation of the local population and the promotion of their involvement should therefore be a short-term, rather than a long-term goal.

Combating desertification risks also requires funds. Experiences in Africa, Latin-America, and Asia (Mongolia) have shown that over-reliance on funding by foreign donors is not realistic. Realistic funding mechanisms should also, therefore, be stressed in Kazakhstan. If other mechanisms prove impossible, the creation of a temporary National Desertification Fund may have to be envisaged, with clearly specified revenues and procedures for taking decisions on expenditures.

Recommendation 12.2:
A specific research programme should be implemented in order to develop the technologies to be applied in the fight against desertification. The organization of environmental education and the heightening of public awareness of desertification problems should be considered a short-term and not a long-term goal of the National Strategy and Action Plan to Combat Desertification to ensure that local populations play a key role. Realistic funding mechanisms should be determined for anti-desertification measures.

A number of institutions and programmes exist in relation to agriculture, but while some of the programmes are already being implemented, others are still under preparation. However, programmes such as the National Programme for Irrigation, the

Programme for the Development of Agricultural Production and the National Strategy and Action Plan to Combat Desertification include inconsistent objectives and interests. For example, it is difficult to pursue the increase in the production of cotton and rice envisaged in the Programme for the Development of Agricultural Production in areas like the southern *oblasts* where there are serious problems of desertification. The problem of coordinating the use of water for irrigation constitutes another example, this time in view of the diversity of institutions and users involved (Water Resources Committee, Offices of Water Basins and the Ministry of Agriculture, private farmers and farmer associations).

A third example concerns the large number of national (in the contexts of development of agriculture, NSAPCD, livestock management, irrigation, pasture conservation, etc.) and international programmes involving overlapping responsibilities and objectives related to desertification. Such programmes and related projects should be coordinated during their preliminary planning phase. It might be helpful to involve the Agency for Strategic Planning in such coordination as well as the monitoring of progress achieved in the different programmes, so that any useful experiences can be conveniently shared.

Recommendation 12.3:
The coordination between different institutions, policies, plans and programmes should be improved, in order to increase their mutual consistency with regard to environmental priorities. Criteria for sustainable agricultural development should be included in relevant national strategies and programmes. See Recommendation 10.1.

In large areas of Kazakhstan man-made desertification poses a serious challenge.. The problem has many causes, but its solution should be made a priority of the long-term strategy for sustainable development. Attempts to remedy the situation must primarily overcome the difficulties of monitoring the desertification process and collecting recent data. One solution, in view of the size of the country and the complexity of the problem, would be the use of remote sensing techniques as a standard monitoring method, complemented by ground verification surveys.

No monitoring of the quality of irrigation water is being carried out at present, making the management of risks of secondary salinization difficult. Monitoring of continuous flow, solid particles in water, electrical conductivity, concentration of soluble salts, and of the sodium absorption rate would correspond to well-established international practice in this regard. Measurement methods exist, and monitoring could easily be automatized. As the implementation of such monitoring is urgent, it should initially be funded by the Government, but its cost should gradually be transferred to the irrigation water users.

Recommendation 12.4:
A monitoring system should be implemented for the identification of areas at high risk of desertification. The introduction of monitoring of irrigation water in connection with the management of secondary salinization should be seen as an urgent requirement. See Recommendation 1.3.

Chapter 13

ENVIRONMENTAL CONCERNS IN ENERGY

13.1 The energy economy

Development of main aggregates

Table 13.1: Final energy consumption by type of fuel, 1993-99

Mtoe and %

	1993	1994	1995	1996	1997	1999 *
Total *(Mtoe)*	**40.6**	**33.9**	**27.4**	**23.4**	**20.2**	**18.0**
as % of total						
Petroleum products	*33.7*	*31.6*	*29.9*	*33.3*	*34.7*	*36.1*
Coal	*35.5*	*38.9*	*32.1*	*30.3*	*30.2*	*25.0*
Gas	*15.0*	*15.0*	*21.5*	*19.2*	*17.8*	*19.4*
Electricity	*15.8*	*14.5*	*16.1*	*16.7*	*17.3*	*18.9*
Heat	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	..
Others	..	..	*0.3*	*0.3*	*0.4*	..

Sources: International Energy Agency, and (*) Energy Data Associates.

Table 13.2: Final energy consumption by sector, 1993-97

Mtoe and %

	1993	1994	1995	1996	1997
Total *(Mtoe)*	**40.6**	**33.9**	**27.4**	**23.4**	**20.2**
as % of total					
Industry (exc. raw materials)	*45.1*	*44.8*	*39.8*	*38.0*	*38.1*
Raw materials	*4.2*	*3.8*	*0.4*	*0.4*	*0.0*
Transport	*10.8*	*9.7*	*9.9*	*13.2*	*12.9*
Residential/ commercial	*1.7*	*2.1*	*2.2*	*2.1*	*2.5*
Others	*38.2*	*39.5*	*47.8*	*46.2*	*46.5*

Source: International Energy Agency.

The economy of the Republic of Kazakhstan has traditionally been geared to the production of hydrocarbons and mineral resources for shipment to Russia. Since the declaration of independence in 1991, Kazakhstan has undergone economic restructuring, privatization, institutional reforms and price liberalization. The country has also faced debt problems as the price of fuel imports moves towards world market levels but fortunately possesses sizeable oil and gas reserves (see Chapter 9). An overview of final energy consumption in recent years is provided by Tables 13.1 and 13.2.

Between 1993 and 1997, the share of coal remained in the range of 55-60 per cent of the total primary energy supply and more or less paralleled the overall decrease in energy needs during this period. Indigenous coal production decreased from 51.2 Mtoe in 1993 to 32.0 Mtoe in 1997.

Currently, the giant Tengiz oil field and the Karachaganak gas condensate field in north western Kazakhstan represent two major projects for developing Kazakh hydrocarbon production. Amounting to about 25 per cent of the total primary energy supply, Kazakh oil and condensate output stood at 25.8 Mt in 1992, fell to 20.4 Mt in 1994, rose to 25.6 Mt in 1997 and reached 30.0 Mt in 1999 (an increase of 15.8 per cent compared with 1998, See Table 9.1). This last result met the national production target set by Kazakhoil, the State-owned oil company.

The share of natural gas in energy consumption increased from 15 per cent in 1993/94 to about 20 per cent over the period 1995-1999. Indigenous production of natural gas totalled 9.8 Bcm in 1999, a 18.9 per cent rise on 1998. Gas production zones and gas markets are distant from each other and not well connected. The current Kazakh gas transportation network supplies gas to only two regions of moderate consumption: the southern market, Almaty (covering 52 per cent of the total demand), and the western market supplying 32 per cent of its needs. Only 13 per cent of gas is taken by the northeastern industrial region, which is currently supplied via a Russian gas pipeline.

Total primary supply of energy per unit of GDP is about 3.5 times higher than in western Europe but the supply per capita is about 28 per cent lower.

Table 13.3: Energy intensity measures, 1992-97

	1992	1993	1994	1995	1996	1997	1996 OECD Europe
TPES/GDP* *(Toe / US$ 1000 (1990))*	1.11	0.97	1.02	1.05	0.85	0.72	0.21
TFC/GDP* *(Toe / US$ 1000 (1990))*	..	0.63	0.6	0.52	0.44	0.38	..
TPES/Pop. *(Toe / capita)*	4.82	3.83	3.56	3.42	2.80	2.43	3.39
Elect. Cons./GDP* *(kWh / US$ (1990))*	1.30	1.30	1.30	1.41	1.25	1.07	0.34
Elect. Cons./capita *(kWh / capita)*	5,641	5,230	4,723	4,592	4,126	3,613	5,349

* GDP: PPP.

Source: International Energy Agency.

Intensity of power consumption is 3 times higher in Kazakhstan than in traditional market economies (Table 13.3).

Electricity generation

Kazakhstan's electrical power industry is affected by the country's overall macroeconomic situation, ageing power generation facilities, financial difficulties (non-payment of electricity bills by industrial, residential and government consumers), and general inefficiency. Over the period 1990-1997, power consumption in the industrial sector decreased drastically: 27 per cent in the fuel industry, 37 per cent in non-ferrous metallurgy, 39 per cent in ferrous metallurgy, 57 per cent in machine building and 73 per cent in the chemical and petrochemical industry. Between 1990 and 1999, total electricity consumption declined by 50 per cent.

Currently the Kazakh power system is characterized by:

- An uneven distribution of production plants (80 per cent of the electricity is generated in the northern region);
- Connection of the transmission and distribution networks with two Russian grids (north-west and north) and the Central Asian system in the south;
- A high proportion of power losses (15 per cent) during transport due to the country's geographic features.

Most equipment installed in Kazakh power plants was manufactured in the USSR and is obsolete, needing to be refurbished or replaced. Currently, Kazakhstan has 48 fossil-fuelled plants (TPP, including 42 Combined Heat and Power plants - CHP), one nuclear power plant (NPP) in Aktau and six major hydroelectric plants (HPP). Three are located in eastern Kazakhstan on the Irtysh River, two in Almaty *Oblast* on the Ili River and one on the Syrdarya River close to Uzbekistan. The NPP is a BN-350 fast-neutron reactor. It was in operation between 1972 and 1999 as part of the Mangyshlak energy complex. It could, in the future, be replaced by the smallest reactor of the same type (BMH-170, mono-block) if the nuclear waste management issues can be resolved.

Table 13.4: Power plants of Kazakhstan

Installed capacity	Number of plants	Fuel type
4 000 MW	1	coal
2 400 MW	1	coal
> 1 000 MW	2	1 coal, 1 dual fired gas / fuel
> 500 MW	4	2 coal, 2 dual fired gas / fuel
> 200 MW	8	7 coal, 1 dual fired gas / fuel
Others	32	21 coal, 8 dual fired gas / fuel, 2 gas and 1 fuel

Source: Ministry of Energy.

The electric power system has a total installed capacity of 18,700 MW: 16,309 MW in TPP, 2,270 MW in HPP and 121 MW in NPP. In 1999, Kazakhstan produced 47.5 GWh of which 83 per cent came from TPP and 17 per cent from HPP. The current available capacity has probably decreased due to maintenance issues as most gas and steam turbines and one third of the steam boilers have been in use for 20 years or more.

CHP account for about 41 per cent of installed capacity in terms of megawatts and provides both industrial and residential customers. About 80 per cent of the electricity generated in Kazakhstan is produced by coal- fired power plants

Table 13.5: Exchanges of electricity with Russia and Central Asia, 1990-99

Billion kWh

	1990	1993	1994	1995	1996	1997	1998	1999
Total power consumption	100.4	86.2	77.0	73.8	65.7	57.1	53.4	50.7
Total power production	83.0	74.5	64.5	66.5	58.9	52.2	49.6	47.5
Deficit	**17.0**	**11.7**	**12.5**	**7.3**	**6.8**	**4.9**	**3.8**	**3.2**
Import balance	**17.4**	**11.7**	**13.1**	**7.4**	**..**	**..**	**..**	**..**
Total import of electricity	**28.7**	**20.4**	**20.4**	**14.2**	**..**	**..**	**..**	**..**
From Russia	18.4	14.8	14.5	11.0	..	..	..	..
From Central Asia	10.3	5.6	5.9	3.2	3.2	1.7	..	..
Total export of electricity	**11.3**	**8.7**	**7.3**	**6.8**	**..**	**..**	**..**	**..**
To Russia	10.8	8.7	7.3	6.8	..	..	..	..
To Central Asia	0.5	..	..	..	..	..	..	..

Source: International Energy Agency.

located in the north of the country, using mainly coal from the Ekibastuz and Karaganda basins (Table 13.4). The largest one, Ekibastuz TPP (installed capacity: 4,000 MW) was purchased in 1996 by AES, a US company. The industrialized north-eastern region of the country includes the major part of the installed capacity and consumes around 70 per cent of the electricity produced.

Despite the decreasing level of consumption, Kazakhstan cannot meet its electricity needs, because of disparities existing between the country's regions, and because the electrical grid does not allow transfers between zones. For structural and historical reasons, the southern zone and the northern part of the western zone are net importers from central Asia and Russia, respectively. Electricity demand and supply are balanced in the north, which actually even has some surplus to share. In the west, 40 per cent of the needs are produced locally, and 70 per cent in the south. Kazakhstan maintains 460,000 km of distribution lines with voltages of 10, 35, 220 and 500 KV. Table 13.5 shows that since 1995 the overall deficit has declined.

Heat supply

Supplying heat and hot water to commercial and residential customers as well as steam to industry using district heating systems in cities and towns is a very common practice in the CIS countries, where steam and hot water are usually produced in boiler-houses (HOB) or by CHP. Kazakhstan is no exception to the rule and, within the territory, there are 42 central heating systems in operation, which are supplied with heat from 42 CHP and 24 big boiler houses. The total installed capacity is 29,000 Gcal/hour and the overall length of the associated network exceeds 5,000 km.

The biggest central heating system is located in Almaty (connected heat load is about 3,400 Gcal/hour). Around 80 per cent of the heat demand is supplied by the private JSC Almaty Power Consolidated, 16 per cent by JSC Almatyteplocommumenergo and 3 per cent by JSC Kaznii. In addition, a number of organizations or enterprises using small boilers supply small districts. Some independent heat supply enterprises have been transformed in JSC, some others directly purchased by other companies. Globally, heat supply enterprises have a low profitability and privatization progresses slowly.

In 1990, total heat consumption amounted to 172 million Gcal. Central heating represented globally 49 per cent of the total heat production, but this share reached 79 per cent for the 25 most developed cities of the country. The economic crisis also affected heat production which in 1995 totalled only 158.3 Gcal. Of this amount, 40 per cent was produced by CHP, 10 per cent by boiler houses (i.e. 50 per cent by central heating systems) and the remaining 50 per cent by autonomous heating systems.

The share of the different fuels consumed by the heating sector varies significantly according to the region and the accessibility of the resources. It is expected that the share of coal in the future will be smaller and that the gas share will increase.

Table 13.6: Gas reserves

Field	Type of field	Estimated recoverable reserves
Tengiz	Oil	707.5 million tonnes
Karachaganak	Oil/gas condensate	Dissolved gas: 239.3 billion m^3; natural gas: 1 329.6 billion m^3
Zhanazhol	Gas condensate/oil	Dissolved gas: 25.6 billion m^3; gas cap: 25.6 billion m^3
Urihtau	Oil/gas condensate	Nat. gas: 39.8 billion m^3; dissolved gas: 0.5 billion m^3

Source: Kazakhoil.

Oil and gas supply

The Kazakh reserves increased significantly with the development of two major fields, the Tengiz oil field and Karachaganak gas condensate field whose combined proven reserves amount to 40 million tonnes (292 million bbl) (Table 13.6). The Republic's estimates of potentially recoverable oil reserves use techniques that do not correspond to the standards in use in western countries, but nevertheless show the oil sector to be an important factor in national economic development. Currently, crude oil production accounts for 30 per cent of the budget revenues.

Condensate accounts for about 12 per cent of total liquids production. The surge in exports can be explained by the fact that crude oil was an export priority, to the detriment of local refineries. Due to the generally low quality of Kazakh crude and the need to mix it with the Urals blend for shipment to world markets, it trades at a significant discount to Brent.

Kazakhstan has three major oil-processing plants:

- Pavlodar (a foreign investor was given a management concession in 1997; the plant is under government control since summer 1999) processes mainly light crude from Siberia, and supplies the northern region of Kazakhstan;
- Atyrau belongs to Kazakhoil, processing heavy domestic oil, and supplies the western region;
- Shymkent was partially (95 per cent) sold to private investors in 1996, processes dedicated crudes from the region (Kumkol, Aktyubinsk, Turkmen fields) and supplies the south, particularly Almaty.

Russian plants in Samara and Ufa today refine the bulk of Kazakh oil production, while the Pavlovar plant processes Siberian crude. The Pavlodar, Atyrau and Shymkent plants were located and designed taking into account the features of the Russian market and the structure of the Soviet pipeline network. In 1993, the three plants were operating at 80 per cent capacity, but this figure fell to 59 per cent in 1995, because of difficulties associated with the break-up of the USSR, the price of crude, and payments issues. In 1999, about 9.4 million tonnes were processed in the refineries, whose combined design capacity of 20.5 million tonnes per year was utilized only to 46 per cent.

Proven gas reserves were estimated at 1.8 trillion m^3, and potential gas resources are estimated at 3 trillion m^3 (July 1999). Some 75 per cent of the current gas reserves are contained in two fields: Tengiz and Karachaganak. Two other projects, Zanazhol and Urihtau, should boost the gas production potential in the medium term.

For some time, Kazakh gas production has been hampered by the lack of infrastructure, leading oil producers to flare gas instead of using it. Domestic natural gas production has increased regularly since 1994: from 4.5 Bm^3 to 8.1 Bm^3 in 1997, 8.9 Bm^3 in 1998, and 10.7 Bm^3 in 1999 realizing a 20 per cent rise on the previous year. After Karachaganak (40 per cent of the gas reserves), Tengiz, with its associated gas production increasing, is becoming the second most important field in Kazakhstan.

Since 1992, consumption decreased regularly from 7.9 Bm^3 to 5 Bm^3 in 1996, 4 Bm^3 in 1997 and 2.9 Bm^3 in 1998. Several regions depend on imports for their needs, most imported gas going to the southern network, which remains almost completely dependent on imports via Uzbekistan. Following the entry of Tractebel into the market, the importing areas were forced to pay for their gas at a price (US$ 15 to US$ 50, plus VAT) which was 30 per cent to 50 per cent higher than the price charged by national companies, and two or three times higher than domestic prices. The second factor causing a decline in gas consumption is the poor management of the network by regional distributions.

The total length of the gas pipelines is about 10,000 km with gas transport effected by 27 compressor stations. Kazakh consumers receive gas through 85 gas distributing stations, and from two underground gas storage facilities, Bazoysky and Akyr-Tubinsky, with a capacity of 4 Bm^3.

Kazakhstan has three gas processing plants:

- Kazakh GPZ with an annual gas processing capacity of 6 Bm^3;
- Zhanazhol GPZ with 4 Mt of annual crude and condensate preparation capacity and 0.8 Bm^3 of annual gas processing capacity;
- Tengiz GPZ with an annual gas processing capacity of 0.85 Bm^3.

Coal supply

In Kazakhstan, the coal industry is one of the leading sectors of the economy. Estimated coal reserves amount to 39 billion tonnes of steam and coking coals, which currently not only meet domestic requirements but also allow the export of steam coal to the Russian thermal power plants in the Urals and Siberia. The future prospects for the coal industry will therefore strongly depend on domestic coal demand trends and, to some extent, on those of neighbouring countries. The Russian consumers of steam and coking coals, for example, have already significantly reduced imports from Kazakhstan, due to the high transport costs and the payments crisis.

Coal production is concentrated in two major deposits, namely the Karaganda coal basin and the Ekibastuz coal basin, together producing 95 per cent of the total coal output. A few small deposits are scattered throughout the country. In Karaganda, coal is mined primarily by underground methods (19 deep mines and 3 open cast mines were in operation in 1997), while Ekibastuz mines are exclusively open cast (3 high production open cast mines currently in operation: Severnij, Bogatir and Vostochnij, designed to produce 95 Mt in all). All coal from Ekibastuz is consigned to electricity generation, and that of Karaganda is used in both the steel and thermal power sectors. Coal is the primary energy source for electricity generation in Kazakhstan, 80 per cent of the coal output being delivered to the 33 coal- fired power plants.

Since 1990, coal demand and electricity generation have sharply declined: electricity production by 43 per cent and coal output by 58 per cent, from 131,4 Mt in 1990 to 56.4 Mt in 1999 (minus 17 per cent compared with1998). The main reasons are similar to those applying in other economies in transition: economic recession, reduction of investments in the coal sector, phasing-out of State subsidies, slow adaptation of enterprises to market conditions, and low coal prices on the energy market. In addition, some particular phenomena, such as persistent hyperinflation and wage arrears, have since worsened the situation in the coal and thermal power sectors by creating social tension.

Future energy requirements

In 1998, the "Development Strategy of the Republic of Kazakhstan to 2030" was issued (see Chapter 1). In 1999, The MEIT elaborated the "Energy Sector Development Programme to 2030" in which the rehabilitation and energy efficiency improvement of existing power plants appears as one of the main goals for the period 2000-2030.

Strategy for the electricity sector. About 85 per cent of the country's power generation is now privatized. Tractabel obtained management rights for Almatyenergo (now called Almaty Power Consolidated) and AES, a US power generation company, purchased the Ekibastuz coal-fired power plant, two hydroelectric stations and four combined heat and power stations with a total capacity of more than 5,300 MW. In the distribution sector, only two out of 15 existing regional electric companies have been privatized.

Table 13.7: Forecast of electricity supply and demand

TWh

	1990	1995	1999	2000	2004	2005 max/min	2010 max/min	2030 max/min
Consumption	100.3	73.8	50.8	..	..	59/56.3	72/60.5	130/90
Production	83.0	66.5	47.5	51.5	55.1	59/56.3	72/60.5	130/90

Source: Ministry of Energy, Industry and Trade, Energy sector development Programme until 2030.

Table 13.7 shows the energy sector development programme forecast of power supply and demand to 2030. The 1990 consumption and production level would be reached between 2020 and 2030.

To acquire power independence, the Kazakh authorities want to promote administrative and technical cooperation between regions to establish a single power system with the northern region as a basis, building additional energy sources in the west and south, and north-south transmission lines. The existence of significant oil and gas reserves in the west of the country will allow the construction of power plants using gas turbines, increasing the share of gas as fuel in the power sector (from 14 per cent in 1990) to 20 per cent in 2015.

This development will be accompanied by electricity conversion measures, requiring:

- The introduction of new technologies and greater efficiency of power generation;
- The introduction of new technologies for burning low-grade coal in boilers with fluidized bed combustion;
- The increased use of highly efficient steam-gas plants;
- The reduction of all kinds of energy losses and the use of combined energy installations;
- The refurbishment or reconstruction of inefficient generating capacities.

Hydro-electric plants provide an excellent means of meeting peak demand or to regulate frequency or voltage so as to increase the quality and reliability of the power supplied. As a project for 2010, two hydro-electric stations, Mainaska (300MW) on the Charyn river and Kerbulasky (50MW) on the Ili river could be built and could, in particular, reduce the deficit of electricity in the southern region.

The question of whether to build a new nuclear power plant in Balkhash is now on the agenda. A feasibility study for a 2,000 MW plant (3 reactors of 660MW each) is to be completed by the end of the year 2000, but with regard to nuclear technology the Kazakh population's attitude is reserved.

Strategy for the oil and gas sector. The strategic goal of Kazakhstan is to develop the exploitation of its huge hydrocarbon reserves. For this purpose, the country is obliged to tackle two main issues: the status of the Caspian Sea, which is currently under discussion, and the development of export routes for oil and gas. To a lesser degree, the gas infrastructure has to be developed in order to enable the gas flared by the producers to be consumed.

Following the opening up of Kazakh hydrocarbon resources to foreign investors, projects are being developed through production-sharing agreements (PSAs), block or field concessions, and Joint Venture (JV)s such as Tengizchevroil, to develop the Tengiz oil field. The Kazakh oil and gas sector has been restructured and in March 1997, Munaigaz, the State-owned holding company for Kazakh oil and gas enterprises was dismantled. Most shares in its subsidiaries were transferred to the new State oil company Kazakhoil, which is currently supervising all petroleum industry activities in Kazakhstan. The State shares of privatized companies were transferred to it in December 1998.

Yuzhnefteprovod and the Kazakh and Central Asian Trunk Pipeline Association previously associated with Munaigaz were combined in 1997 to form a new State-owned company, Kaztransoil, in charge of transportation. Munaigaz's central dispatch function was entrusted to Main Oil and Gas Dispatch, another State-owned entity.

In August 1999, the Kazakh parliament adopted a law which amended the existing Presidential decrees "On the Subsurface and its Use" and "On Oil". A new licensing procedure is being proposed whereby the government would approve an annual list of blocks on offer, and a commission would then organize a tender and negotiate with the selected group. This process is intended to clarify, simplify and accelerate the procedure for awarding licenses. Other amendments deal with environmental norms and safety provisions for offshore exploration and development operations in the Caspian Sea. There are also amendments that, with certain limited exceptions, prohibit subsoil users from flaring natural or associated gas.

Several export routes are under consideration. In addition to the existing possibility of exporting oil through Russia by pipelines and by rail, the Caspian Pipeline Consortium (CPC) project would enable oil to be sent to world markets via the Russian Black Sea port of Novorossiysk. Export pipelines from Baku (Azerbaijan) to Ceyhan (Turkey), with a connection on the Caspian Sea bed from Aktau in the north to Baku in the south are under consideration. Oil and gas swaps with Turkmenistan are also envisaged.

Regarding gas, feasibility studies were undertaken for a pipeline from Kazakhstan to China and for twin oil and gas lines from Kazakhstan to Azerbaijan (Baku). Kazakhoil and Phillips, members of the Offshore Kazakhstan International Operating Company (OKIOC), are carrying out a feasibility study for the building of a liquefied natural gas plant at Atyrau.

Strategy for the coal sector. With a view to reversing the coal sector's deterioration process, in 1994 the Kazakh Government adopted a remedial programme which was subsequently approved as a sectoral part of the "Government Action Plan on the Further Restructuring of State-owned Enterprises, 1996-1998" and the "Programme for Privatization and Restructuring of State-owned Enterprises, 1996-1998". These programmes were reinforced by the recently-adopted Law on Foreign Investments (March 1997), the Presidential Decree on the Utilization of Underground Resources (1996), the Presidential Decree on Electricity (December 1995), and the Law on Environmental Protection (July 1997). The coal sector strategy includes mainly liquidation, privatization and investment measures.

Technical closure is under the responsibility of Karagandaliquidshaht, a newly created company specializing in the liquidation of mines. Liquidation costs amount to US$ 15 million per year, and US$ 45 million have been provided for the period 1996-1998. Between 1993 and 1997 the number of employees declined by 45 per cent, from 86,600 to 48,100. In 1997, the number of deep mines in the Karaganda coal basin was reduced from 26 mines (in 1990) to 14, while the number of open cast mines increased to 17 production units.

In accordance with the "Programme for Privatization and Restructuring of State-owned Enterprises, 1996-1998" the privatization of major coal enterprises was rapidly completed. The new owners are mainly foreign companies. In the Karaganda basin there are three open cast mines in operation and these will remain State-owned companies.

In the longer term, the total capital investment requirements in the coal sector are estimated to be US$ 2.0-2.5 billion. The major projects for modernization will involve Karaganda and Ekibastuz, but there are also proposals for developing other coal deposits such as Choubarkol, Borli, and Karajira. The Karajira coal deposit is attractive to foreign investors because its production can be increased from 2.5 to 10 Mt/ year, with a local market, if a new electric power plant is built on the spot.

According to the restructuring programme (Government Decree, May 1996) the process of adaptation of the electric power sector has been completed in three phases. Since 1996, 16 power plants in Kazakhstan (11 thermal power and 5 hydro power plants) have been privatized to several foreign companies. The continuing decline of coal demand in Kazakhstan could be reversed if new emerging markets for electricity were identified in the region, and in this regard the Government is considering all alternatives including possibilities for joint-ventures and trade arrangements with the neighbouring Chinese provinces. The thermal power plants of the Pavlodarsky region, for example, could supply electricity to China at a price of less than US$ 0.05/kwh (the average price of electricity on the Chinese market), if the electricity transmission systems could be connected and the regional electricity infrastructure improved.

Strategy for the heat and hot water sector. Table 13.8 shows forecasts of future demand for heat. According to KazNIIEnergoprom, in 2000-2005 the share of co-generation in heat supply will represent 45 per cent, and that of boiler houses 17 per cent. Currently, the autonomous sources of heat are increasing, to the detriment of central heating plants which, as fuel prices

Table 13.8: Forecast of heat demand

Gcal/year

	1990	2000	2005 max/min	2010 max/min	2020 max/min
Total	**172**	**158**	**157/156**	**166/162**	**179/168**
Heat demand of cities	110	98	104/103	120/116	134/123
Rural heat demand	62	60	53	46	45

Source: KazNIIEnergoprom.

approach world market levels, are no longer economically viable.

Driven by market mechanisms, and following an energy conservation policy, the heat supply sector will be reorganized and developed within the framework of periodically updated programmes, favouring district-heating networks using co-generation instead of decentralized systems. In this regard the Government launched a project entitled "Removing Barriers to Energy Efficiency in Municipal Heat and Hot Water Supply". This project associated UNDP, the Ministry of Natural Resources and Environmental Protection (MNREP), the Ministry of Energy, Industry and Trade, the Scientific Research Institute of Power Engineering (KazNIIEnergetic), Almatyteplocomenergo and Almaty Power Consolidated and aims to reduce the overall costs to the population of the heating and hot water supply. The initial stage of the project will focus on the heat and hot water supply in the city of Almaty. The programme outlines the institutional, legislative and financial issues to be overcome to improve energy efficiency and conservation and specifies the following practical measures:

- Optimization of the size and coverage of district heating (co-generation), taking into account technical, economic and environmental aspects;
- Improvement of the efficiency of the existing systems (upgrading of equipment and insulation);
- Improvement of insulation and maintenance of the heat network;
- Reduction of water losses and pipeline corrosion;
- Introduction of a metering and billing system;
- Improvement of temperature and flow control systems;
- Adaptation to modern building codes and integration of energy efficiency considerations into the renovation of existing buildings.

13.2 Main environmental concerns in energy sectors

Coal and power sectors

Table 13.9: Emissions of carbon dioxide from fuel combustion in 1997

Million t CO_2

	Total	of which:		
		Coal	Oil	Gas
Total	**126.65**	**84.92**	**27.2**	**14.5**
Public electricity and heat production	67.39	59.78	3.87	3.74
Other energy industries	3.47	-	1.13	2.33
Manufacturing industries	25.25	25.13	0.12	-
Transport	6.80	-	6.80	-
of which: Road	5.83	-	5.83	-
Other sectors	22.31	-	13.98	8.33
Losses and/or transformation	1.44	-	1.35	0.09

Source: International Energy Agency.

Electricity generation is a significant contributor to air pollution (see Table 13.9) regarding emissions of carbon dioxide from fuel combustion), owing to the use of low-quality fuels and poor pollution prevention and monitoring equipment. Most of the thermal power plants are old and use obsolete technology and low quality fuel. The facilities of the sector include 448 water heating and power boilers, of which 247 are heated by coal dust. From the seventies to the mid-eighties, practically all power stations were equipped with ash traps whose efficiency reached 96-97 per cent. By the end of the eighties, however, a programme was launched to build the devices necessary to minimize harmful

Table 13.10: Emissions of air pollutants from the Atyrau thermal power plant

Tonnes/year

	1996		1997		1998	
	Actual	Limit	Actual	Limit	Actual	Limit
Total	**5,945.8**	**6,613.1**	**4,450.9**	**6,390.9**	**4,652.3**	**6,283.0**
SO_2	2,063.3	2,155.5	1,229.1	2,154.6	1,659.4	2,138.5
NO_x	2,052.1	2,106.0	1,549.2	2,012.6	1,206.1	1,998.5
Ash	1,600.6	2,103.1	1,448.9	1,976.5	1,621.0	1,898.8
CO	224.5	240.0	218.3	240.0	158.8	240.0

Source: International Energy Agency.

emissions and inexpensive technologies to reduce NOx emissions were introduced in all power plants, but their low efficiency (15-30 per cent) did not enable the pollution problems to be overcome.

The bulk of the installed thermal power capacity has been in operation for more than 25 years and requires considerable investment in clean combustion and gas-emission control technologies. For instance, the cost of reducing emissions of SO_2 and NO_x at Ekibastuz (4,000 MW) to German limits was estimated at US$ 1.5 billion. Other plants, such as the Atyrau installation, have achieved positive results in controlling their emissions (see Table 13.10).

Heat supply

Between 1994 and 1998, within the framework of USAID technical assistance to Kazakhstan, a US-based company investigated the heating systems of Almaty, Ust-Kamenogorsk and Karaganda. In 1998, a Finnish company carried out a study on the Almaty system for Almaty Power Consolidated. The weaknesses of the Almaty district-heating system were identified as follows:

- Open domestic hot water connection;
- Internal and external corrosion of the pipelines;
- Poor quality of the underground sections of pipelines;
- No control devices at the consumer installations;
- High pumping costs (constant flow pumps).

The annual heat losses were estimated at about 25 per cent of the annual heat production. The reasons for this high rate of loss are the inadequate insulation (pipes too thin, old pipes of poor quality materials, or inferior and leaky underground pipes). The situation encountered in Almaty may be considered to be representative and in some cities the heat losses can even reach 40-50 per cent.

Oil and gas

The environmental programme of the Karachaganak Oil and Gas Condensate Field provides an example of the issues that the oil and gas sector is facing. This document was elaborated by the Karachaganak Petroleum Operating BV (KPO bv) to honour the commitments with regard to the health protection, industrial safety, and environmental protection (HSE) requirements of the final Production Sharing Agreement (PSA) concluded in November 18, 1997 between Kazakhstan and the Contractor, represented by Agip Karachaganak, BG, Texaco and Lukoil. The PSA accords the contractor sole rights to the use of mineral resources for 40 years, within the limits of the contractual territory.

The Karachaganak Oil and Gas Condensate Field has been in operation since 1984. Currently a pipeline network links the existing wells to a unit separating gas and condensates, transmitting the latter to the Orenburg (Russia) gas refinery. The development plan of the Karachaganak field includes refurbishment and improvement of the existing capacity and the construction of new plant. According to the plan, the output volume of hydrocarbons could be increased by up to 12 million tonnes per year by 2005. Additional volumes of products will be processed at Karachaganak field, while the Orenburg plant will continue to run at the current level of production. The main objective of the first development stage is the construction of new production facilities in order to provide exports of hydrocarbons (6 million tonnes/year) through the CPC pipeline in addition to the 2 million tonnes per year sent to the Orenburg refinery.

Table 13.11: Air emissions from the Karachanagak field

1 000 t

	1996	1997	1998	1999	2000 *
Total emissions	2.2	4.3	6.4	13.5	26.9

Source: Kazakhoil (*) forecast.

The Karachaganak field is characterized by a high share of acidic components in the formation of gas (SO_2: 3.7 per cent and CO_2: 6.3 per cent), an unusually high pressure (520-600 bars), and the presence of six condensate storage caverns of which two are defective. These caverns, created by nuclear explosions, represent a dangerous source of radiological contamination of underground waters, soils and the Ural River. At the beginning of 1999, 134 wells on the site were operational, with 40 of them equipped with a heightened tubing pressure of up to 200 bars. Unless measures are introduced to limit air emissions, development of the field will be accompanied by an increase of pollutants in the atmosphere, as shown in Table 13.11.

Assisted production of crude oil requires large quantities of water and solvents which results in some places, such as the Konchubai ravine, being

exposed to the risk of contamination. For the main part of the year 1999, the water was characterized by the following parameters: pH 7.1-8.3; H_2S 0.001-0.002 mg/l, and oil products 0.052-0.204 mg/l. Existing wells should be monitored for technological defects and appropriate repairs carried out. Drilling new wells may cause the same damage, with the quantity and the quality of the potential pollutants (such as hydrocarbons, specific mud or brine and CO_2 or SO_2 emanations) aggravating the consequences of an accident. Poor cementation could also provoke cross-water circulation between aquifers, leading to a contamination of drinking-water resources on a regional scale.

Waste management is becoming an important issue. The volume of waste accumulated within the field polygon amounted to 993 tonnes in 1998 and 17,382 tonnes in 1999, the increase mainly being due to the treatment of degraded land areas. During the field development, KPO is to set up new recycling and disposal facilities.

The Burlinsky, Chingirlau and Terikty regions (together representing 1,660,000 hectares) are potentially subject to impact from the Karachaganak field. In the Burli region, excessive emissions of NO_2 occurred in 1998 but it was not possible to localize their sources, as there was no appropriate control system in place at that time. The Utva and Berezovka rivers (tributaries of the Ural river) which could be polluted only by flows from surface or underground formations display high salinity (223-684 mg/l), while pollutants in the Berezovka include nitrogen, ammonium (1.1-1.5 MPC), and petroleum compounds (3-6 MPC). Excess heavy metals have also been recorded: Ni > 18 MPC, Cd > 17 MPC, and Co > 2 MPC.

The population of Aksai uses drinking water with a high scale of hardness (up to 14.6-32.4) compared with the standard 7.0. In a series of settlements, the water contains an excess of sulphate (2.7-3.4 MPC) or chloride (2.3-4 MPC). According to research carried out at the West Kazakhstan State University, the major part of the soil in the area is polluted, and 112 hectares have been declared a "dead area". The soils are polluted by heavy metal, sometimes dangerously (78-1520 mg/kg of soil), and in certain places elevated concentrations of trapped gas were found: CO_2 (up to 342 cm3/kg), CH_4 (32.3 cm3/kg), ethane, ethylene, propane and propylene.

Taking into account the effects of the Karachaganak field development on the environment and the local population, the priorities of the programme are:

- to decrease emissions of pollutants
- to control the reinjection of fluids into geological formations
- to build an integrated system for treatment of sewage
- to create a disposal system for water-methanol mixtures
- to ensure the quality of drinking water
- to monitor the main environmental parameters
- to build a waste disposal system for toxic material
- to undertake reforestation of the field area.

13.3 Policy and management issues

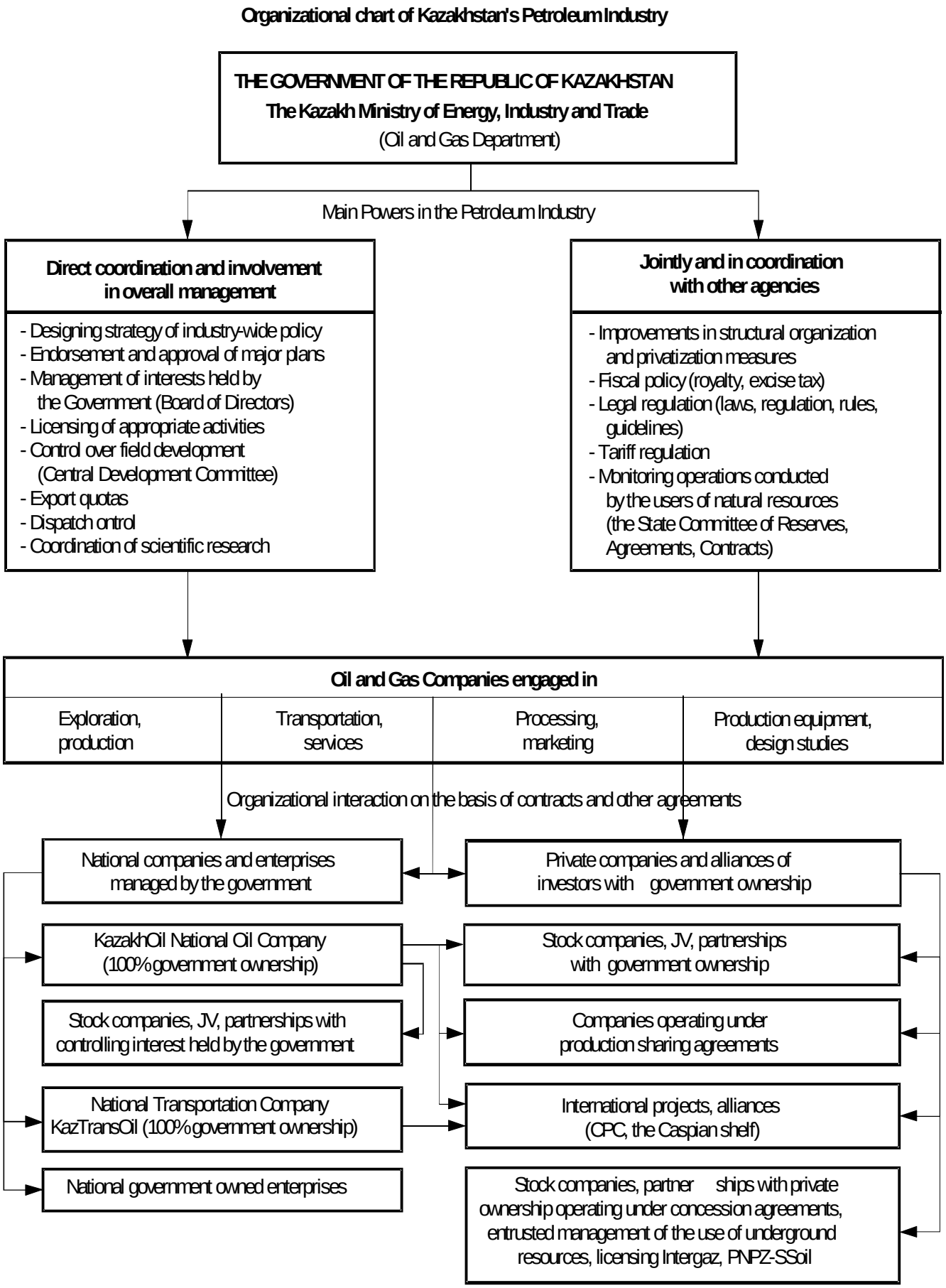
Legal and political frameworks

The Kazakh legal and regulatory framework is in constant evolution. New, appropriate regulating acts are being elaborated while existing statutes are being improved. Among the main legal instruments, the following are related to energy sector development:

- The Law on Energy Saving was adopted in December 1997. It covers all aspects of energy conservation in both the energy production and energy consumption fields, including the question of increasing energy efficiency and the development of the use of renewables. The regulations necessary for enforcement of the law have not yet been implemented;
- The Law on Environmental Protection (July 1997);
- The Law on Foreign Investments (March 1997);
- The Presidential Decree on the Utilization of Underground Resources (1996);
- The Presidential Decrees on Electricity (1995), on Land (1995), and on Oil (1995).

The National Environment Action Plan of Kazakhstan was initiated in 1995 (see Chapter 1) and defines the Kazakh strategy for environmental protection and sustainable development. It also facilitates coordination of the environmental actions realized in Kazakhstan. During the NEAP the issue of environmental pollution in

Figure 13.1: Organizational structure of the Kazakh oil industry



Source: Ministry of Energy, Industry and Trade

oil-producing areas was identified as being among the environmental protection priorities.

Kazakhstan ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 17 May 1995, and in March 1999 signed the Kyoto protocol (see Chapter 3).

Institutional arrangements

In March 1997, the Kazakh oil and gas sector was reorganized. The Ministry of Oil and Gas, Ministry of Coal and Power were replaced by a Ministry of Energy, which was absorbed into the Ministry of Energy, Industry and Trade (MEIT). Long-term economic policy guidance is ensured by the Agency for Strategic Planning and Reforms, and the Ministry of Natural Resources and Environmental Protection. The latter includes the Geology, Subsoil Protection and Use Committee.

The State Committee on Investments is the national licensing authority. It has taken over the State's share in most Kazakh companies (excluding those transferred to Kazakhoil) and is the Kazakh regulatory authority, whilst Kazakhoil administrates the State-owned interest in up- and downstream companies. Both entities report directly to the President.

The organizational structure of the Kazakh oil industry is presented in Figure 13.1.

13.4 Conclusions and recommendations

While energy and the energy industry are of paramount importance for environmental development in any country, Kazakhstan plans, by the year 2010, to become the world's sixth biggest oil producer. To reach this goal, the Kazakh authorities have fixed as the main task for the sector the development of oil gas and condensate fields. However, almost all of the fields are characterized by the presence of acid components which complicate gas and condensate production. In these conditions, special equipment and considerable investment are needed to bring the production on stream and to reach its objectives Kazakhstan has decided to attract foreign partners. If serious consequences for the environment are to be avoided, however, the key role assigned to energy production, particularly in the electricity and the oil and gas sectors, necessitates anticipation of the impact on the environment.

To ensure the success of the partnership with foreign investors, the Kazakh authorities should create a political and fiscal environment that permits the development of all types of energy-related infrastructures in the country but, from the start, respects environmental priorities. The stable financing of fixed investment hinges first of all on the existence of a legal, regulatory and institutional framework that favours long-term finance. An effective mechanism for corporate governance is also necessary so that investors can be sure that they will have a voice in corporate affairs.

Improving contract terms, speeding up processes, simplifying the tax regime, and reducing the number of government agencies involved in the realization of projects could contribute to the establishment of a coherent framework, which should subsequently be implemented with complete transparency - a key issue for any country wishing to attract foreign investments. This framework should from the beginning include those provisions for investors that are today widely accepted as standard.

Recommendation 13.1:
The transition of the energy sector should concentrate on energy-saving programmes, starting with the development and enforcement of the regulations required for the implementation of the Law on Energy Saving. A stable legal, regulatory and institutional framework for investments in the energy sector should be created. It should contain environmental impact assessment procedures, as well as the usual provisions for environmental protection in this sector, while meeting the need to attract large-scale investment. See Recommendation 1.1.

Thermal power plants should continue to become more efficient. The introduction of cleaner technologies that allow low-quality coal to be burnt in boiler units should be facilitated, especially those that allow combustion of coal with specific features, such as high-ash coal, abrasive ash etc. Consequently, coal desulphurization units and control systems that minimize atmospheric emissions of dust, sulphur, nitrogen and carbon compounds should be installed, when existing thermal power stations are refurbished or new generating units built. The refurbishing enables the productivity and efficiency of boilers to be increased and lowers the specific consumption of

fuel thus reducing harmful emissions. To improve the efficiency of the dust collection equipment, newer technology and fabric filters need to be installed. Investment priority should be given to the reconditioning of existing thermal power plants, focusing on the introduction of a flexible capacity to meet peak loads.

Kazakhstan should develop a fully integrated national electric power system. The electricity generated in the northern region could provide electricity to other parts of the country, if power transmission lines could be installed linking the northern and the southern regions. The development of the existing system should be optimized on the basis of an economic assessment based on forecasts of expected market conditions.

Recommendation 13.2:
The transition of the electricity supply system should concentrate firstly on reducing air emissions from existing thermal power stations and, in the longer term, on completing an integrated and interconnected grid system inside the country linked to neighbouring States. See Recommendation 4.3.

Regarding the environmental concerns related to the oil and gas sector, the NEAP has identified priorities for action. These priorities should be addressed in the form envisaged and in view of the expected dynamic development of production they are urgent. The environmental programmes developed and implemented by companies should be encouraged, possibly with the help of economic instruments.

Recommendation 13.3:
The action foreseen for environmental protection in relation to the activities of the oil and gas producing sectors should be implemented as a matter of urgency. Companies involved in these activities should introduce environmental management systems and undertake protective measures.

Chapter 14

HEALTH AND THE ENVIRONMENT

14.1 Health status of the population

General health status

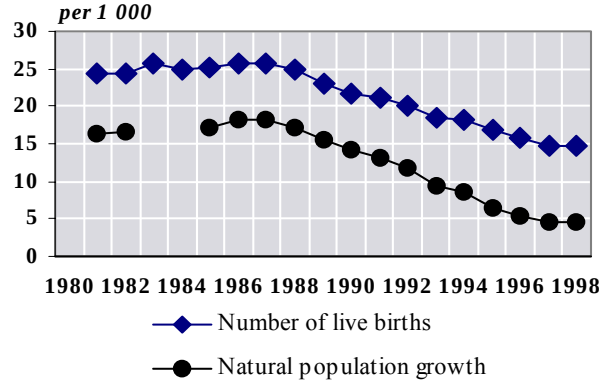
The population density in Kazakhstan is the lowest in the WHO European Region (except for that of Iceland). About 55 per cent of the population lives in cities. The population has been declining since 1987, due to migration and a decreasing birth rate. In 1992 the number of live births has declined from 19,9 per 1000 persons to 14,2 per 1000 in 1999. The fertility rate is slowly decreasing from 2.2 children per woman in 1992 to 2.0 in 1998. Table 14.1 and Figure 14.1 present some demographic characteristics.

Table 14.1: Demographic characteristics

	1992	1995	1998
Population *(Millions)*	16.9	16.5	15.1
0-14 years *(%)*	32	31	29
15-65 years *(%)*	61.7	62.1	64.2
>65 years *(%)*	6.3	6.9	6.8
Population density *(person/km²)*	6.3	6.1	5.5
Urban population *(%)*	58	60	61

Source: Agency on Statistics, 1999.

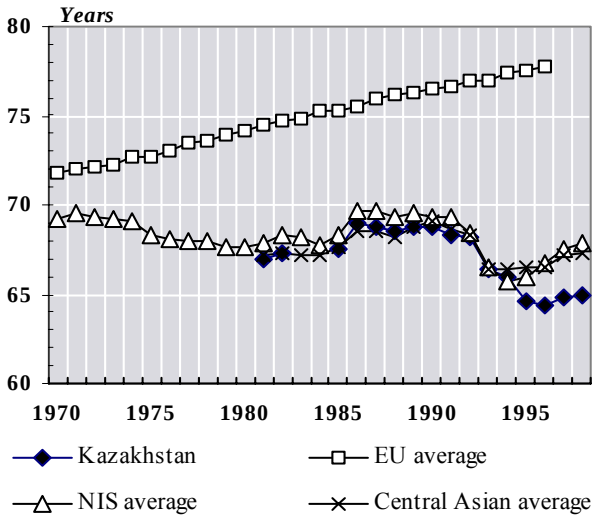
Figure 14.1: Number of live births and population growth, 1981-98



Source: WHO Health for All Database, 1999.

In 1998, life expectancy at birth was 65 years, which is lower than in other Central Asian republics and Europe. Since 1990 there has been a strong decline (Figure 14.2). Life expectancy among men (59 years) is on average 11 years lower than for women (70,2 years).

Figure 14.2: Life expectancy at birth, 1970-1998



Source: WHO Health for All Database, 1999.

The infant mortality rate in 1998 was 21.8 per 1000 live births. The rate has slowly declined since 1993 (28.7/1000 live birth). It is higher than in Europe and the newly independent States (NIS), but lower than the Central Asian average (24.7 in 1998). The four main causes of death of children up to one year of age are due to mortality in the perinatal period (32.3 per cent), diseases of the respiratory system (29.8 per cent), infectious and parasitic diseases (15.7 per cent) and congenital disorders (14.8 per cent). Post-neonatal mortality, which is related to hygienic conditions, was 10.2 per 1000 live births in 1998. Although the post-neonatal mortality has declined from 14.5 per 1000 live births in 1992, the rate is still more than three times the European average (3.0 per 1000 live births).

Table 14.2: Mortality by main cause, age 0-64 years, 1998

%

	Kazakhstan	Central Asian Republics	NIS	Europe*
Cardiovascular diseases	34.4	36.9	34.2	30.8
Cancer	14.8	11.7	16.5	22.8
Accidents, injuries and poisoning	20.2	14.0	24.0	19.6
Disease of the respiratory syster	7.5	11.7	6.3	5.7
Infectious and parasitic diseases	7.5	6.8	3.8	3
Diseases of the digestive system	4.8	6.8	5.0	5.7
Ill-defined conditions	2.2	2.1	2.0	2.7
Other diseases	8.6	9.9	8.3	9.2

Source: WHO Health for All Database, 1999.

* 1997

Causes of death

Table 14.2 shows mortality by main cause of death for the 0-64 year age group, and the corresponding Central Asian, NIS and European averages. Like in most other countries, mortality from cardiovascular diseases is the most common cause of death. Death from cancer, external causes and infectious/parasitic diseases is more common in Kazakhstan than in Central Asia as a whole. The mortality rate for cancer has fallen in recent years, but is still one of the highest compared to other Central Asian republics, NIS and Europe. The highest mortality rates for cancer are in the north and the east.

The mortality from infectious and parasitic diseases shows a twofold increase since 1990, partly due to an increasing mortality from tuberculosis. Mortality from respiratory diseases is declining, but still substantially higher than in Europe. Mortality is mostly due to chronic obstructive pulmonary disease. The highest mortality rate for respiratory diseases is found in north Kazakhstan and in the Kyzylorda *oblast*.

Causes of disease (morbidity)

Table 14.3 reproduces the structure of morbidity by main cause as a percentage of all hospitalized patients in 1998. Comparable data are available only for Europe.

Table 14.3: Morbidity by main cause, 1998

%

	Kazakhstan	Europe*
Diseases of the respiratory syster	13.9	10.0
Infectious and parasitic diseases	11.0	3.5
Accidents, injuries and poisoning	9.2	8.3
Diseases of the digestive system	9.2	9.7
Cardiovascular diseases	7.9	11.7
Cancer	3.2	6.5
Other diseases	45.6	50.3

Source: WHO Health for All Database, 1999.

* 1997

Most patients were hospitalized for diseases of the respiratory system or infectious/parasitic diseases. This is different from the pattern in Europe, where cardiovascular diseases take the first place in hospitalization. There is a separate registry for respiratory diseases, which could not be obtained at the time of the EPR mission. Instead, the incidence of chronic obstructive pulmonary disease is used to estimate regional differences in respiratory diseases. The incidence of all respiratory diseases will be much higher.

The highest incidence of infectious diseases is found in the Kyzylorda *oblast*, the Mangistau *oblast*, Astana city and Almaty city. The incidence of infectious and parasitic diseases among children

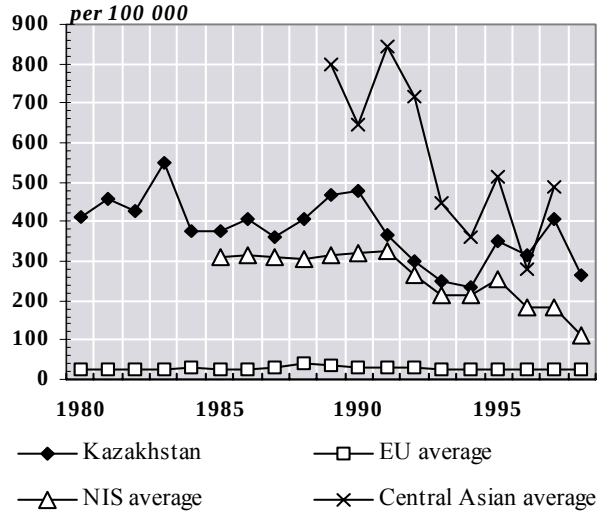
(0–10 years) is even higher. The highest incidence is found in the Kyzylorda *oblast* (7,960 per 100,000). The incidence of diseases of the digestive system is above average in the Kyzylorda *oblast*, the Karaganda *oblast* and the South Kazakhstan *oblast*. Like for infectious diseases, the incidence of diseases of the digestive system among children aged 0 – 10 are the highest in the Kyzylorda *oblast*, with figures up to 9,770 per 100,000.

Cancer is particularly prevalent in the East Kazakhstan *oblast*, the Kostanai *oblast* and Almaty city. High incidences of chronic obstructive pulmonary disease are mainly found in the Kyzylorda *oblast* and the South Kazakhstan *oblast*. It is expected that the incidence of chronic obstructive pulmonary disease also reflects the variation in incidence of respiratory disease in general. It should be emphasized that the causes of the regional variation in disease incidence are socio-economic differences, different lifestyles, environmental differences, age, gender and ethnic composition of the population.

Viral hepatitis, a disease linked to poor drinking water quality and unhygienic conditions, is close to the Central Asian average (Figure 14.3). The highest incidence is found in the south-west, where the supply of safe drinking water is the most problematic.

Cystic echinococcosis is an emerging parasitic disease and related to the regions where sheep breeding is most developed. The incidence of the disease has risen in the Zhambyl *oblast* from 3.8 cases per 100000 in 1990 to 10.3 cases per 100000 in 1997 and in the South Kazakhstan *oblast* from 2.7 cases per 100000 in 1990 to 3.6 cases per 100000 in 1997. The incidence is probably severely underestimated. The resurgence of echinococcosis in Kazakhstan is in contrast to the development in many other regions of the world, where control programmes have made significant progress. The route of exposure is contamination of soil, vegetables and water by dog faeces. The sheep serves as an in-between host. Consumption of infected mutton is not the source of infection of man. Changing sheep-breeding techniques (small stocks, no transport), more dogs to guard the livestock, lack of veterinary services and slaughtering of sheep on farms with little hygiene are the causes of the higher number of infected sheep (more than 60 per cent of adult sheep).

Figure 14.3: Viral hepatitis incidence



Source: WHO Health for All Database, 1999.

14.2 Health aspects of environmental conditions

Drinking-water supply and quality

The main public health factors affecting the supply and quality of drinking water are the lack of treatment (chlorination and filtering) of raw water, irregular chlorination due to a shortage of chlorine, corrosion and leakage of the water pipes, the lack of distance between drinking-water pipes and sewerage pipes, and electricity shortages making the drinking water stay in the pipes for too long. Consequently, there is a high risk of microbiological contamination of the drinking water.

In the Caspian and Aral Sea region the drinking water conditions are the worst. In addition to a high rate of microbiological contamination, the salt content of the drinking water is also high (up to 1.5 to 2.0 g/l), due to the high mineral content of the groundwater and improper desalination. Groundwater is also highly mineralized in the northern and central parts of the country, with a salt content of up to 3.0 g/l. A link between the high mineral content of drinking water and kidney and bladder disease is suspected. The incidence of these diseases is above average (45.3/100000) in the Karaganda *oblast* (65.8/100000), Astana city (82.4/100000) and the Mangistau *oblast* (99.9/100000).

Table 14.4: Reservoir-water and drinking-water samples exceeding chemical and microbiological standards, 1998 and 1999

	Chemical standards				Microbiological standards			
	Reservoir water		*Drinking water*		*Reservoir water*		*Drinking water*	
	1998	1999	1998	1999	1998	1999	1998	1999
Kazakhstan	**8.5**	**10.2**	**13.0**	**10.1**	**7.7**	**9.3**	**4.9**	**5.6**
Astana city	-	6.7	9.7	5.8	-	17.2	1.4	5.9
Almaty city	4.5	-	10.1	3.6	40.3	41.9	3.5	3.2
Akmola oblast	11.1	15.0	23.9	22.5	2.6	6.4	6.4	1.3
Aktobe oblast	26.7	12.0	9.6	8.6	3.5	-	4.1	5.8
Almaty oblast	2.1	3.2	4.6	2.8	2.8	2.4	4.0	3.6
Atyrau oblast	8.1	9.6	9.0	6.3	10.7	4.1	2.2	3.3
East Kaz. oblast	9.1	15.5	4.8	8.5	6.1	17.9	4.1	47.0
Zhambyl oblast	0.6	0.7	0.1	4.0	1.6	-	3.6	1.5
West Kaz. oblast	13.1	15.0	18.0		5.1	5.6	8.4	5.5
Karaghanda oblast	11.5	15.5	15.8	9.4	7.6	6.8	2.5	6.8
Kostanai oblast	8.1	8.6	24.5	17.5	5.5	5.4	6.5	3.9
Kyzylorda oblast	56.8	55.8	22.2	22.3	16.1	49.1	11.1	6.8
Manghystau oblast	-	-	26.6	26.6	1.3	2.2	1.6	1.3
Pavlodar oblast	6.1	5.0	6.6	5.9	5.6	5.4	4.4	8.7
North Kaz. oblast	11.2	3.9	28.8	10.9	8.2	25.0	8.3	5.7
South Kaz. oblast	3.1	3.6	3.6	2.9	4.9	7.9	3.0	3.4

Source: SES Inspectorate, Agency for Health Affairs.

The Sanitary Epidemiological Services (SES) control drinking-water quality. The results of measurements of the quality of reservoir water (for use as drinking water) and the quality of tap water in 1998 and 1999 are shown in Table 14.4. In 1998 7,148 samples were taken from reservoirs nationwide for chemical analysis and in 1999 6,864. In 1998 17,734 samples were taken from reservoirs for microbiological analysis and in 1999 14,271. Between individual *oblasts* the sampling rate differs greatly, for example: in 1999 in the Kyzylorda *oblast* 242 samples were taken for chemical analysis and in the Almaty *oblast* 3,342. Sampling rates seem to be independent of the percentage of samples exceeding standards. There are no data on the number of tap-water samples.

In 1999, 5.6 per cent of the tap-water samples and 9.3 per cent of the reservoir-water samples exceeded microbiological standards. The situation is the worst in the East Kazakhstan *oblast* (47 per cent), the Karaganda *oblast* (6.8 per cent), the Kyzylorda *oblast* (6.8 per cent) and the Pavlodar *oblast* (8.7 per cent). The drinking water is analysed for the bacterial pathogen E. coli, rotaviruses and viruses like the hepatitis virus (sub-specification in A-, B- and C-type is not available). Bacteriological contamination of drinking water is probably one of the causes of the increasing incidence of acute gastrointestinal infections. Also, the contamination of drinking water with the hepatitis virus is increasing and is a major concern.

In 1999, 10.1 per cent of the tap-water samples did not meet the chemical standards. For reservoir water this was 10.2 per cent. The situation is the worst in the Akmola *oblast* (22.5 per cent), the Kostanai *oblast* (17.5 per cent), the Kyzylorda *oblast* (22.3 per cent) and the Mangistau *oblast* (26.6 per cent). Physical analysis includes odour, taste, colour and depositions. Chemical parameters in analysis are organochlorine pesticides (OCP), organophosphorus pesticides (OPP) and heavy metals. The problems encountered are mostly the high content of suspended matter and the high iron content of the tap water, due to corrosion in the iron pipes. There are almost no problems with more toxic heavy metals like lead and cadmium. The OCP/OPP content meets the standards most of the time.

In the cities approximately 70 per cent of the buildings are connected to the central sewage system. In small cities and rural areas the density of the sewage system is much lower. In these areas

there is no purification of sewage, which is stored in reservoirs. The reservoirs are sometimes very close to drinking-water wells, without a proper protection zone. Drinking-water-supply pipes and sewers are located very closely together. Due to bad maintenance, leakage of both is common, with the ensuing risk of microbiological contamination of drinking water.

In basements of buildings, leakage of the sewerage pipes is common and attracts vermin like rats.

Solid waste

Human health is at risk when pollutants leach from waste landfills into groundwater that is used for drinking-water supply. The risk cannot be assessed, because leachate from disposal sites is not monitored. Due to the untimely collection and removal of waste in the places where it is collected, the inadequacy of the waste containers, and fly-tipping, the sanitary and hygiene conditions in the cities are unfavourable and may lead to plagues of vermin.

Ambient air quality

Lead (Pb) can be measured in air but also in humans. Assuming that exposure to other sources of lead is minimal, the lead content of blood can serve as a biological marker for air pollution from leaded petrol exhaust. The Kazakh State University has measured the level of lead in blood of Almaty's inhabitants since 1978. In the 1978-1982 period this level was high due to industrial lead emissions. The level dropped in 1986-1988 and has been increasing again since 1988. In 1998 it was again high at four times the admissible norm. Researchers see an obvious link with the growing use of high-octane leaded petrol.

Food contamination

Microbiological food poisoning has been decreasing (392 cases in 1993, 196 cases in 1996, 47 cases in 1998 and 61 cases in 1999). It is not clear if the decrease is caused by a better control of the quality of food. For economic reasons, many people have to buy food of low quality. Also people do not seek medical aid for lack of proper health care. Underreporting of the number of cases may therefore be possible. Table 14.5 presents the results of microbiological and chemical analysis.

The number of food samples taken for microbiological analysis varies little over the years: 247,775 in 1996, 259,705 in 1997, 266,857 in 1998 and 256,048 in 1999. Most samples are taken from meat, meat products and eggs (on average 69,000 samples/year) and from milk and dairy products (on average 51,000 samples/year). The number of food samples taken for chemical analysis is declining: from 190,269 in 1996, 188,650 in 1997, 184,050 in 1998 to 121,079 in 1999. Again, most samples are taken from meat, meat products and eggs (on average 23,000 samples/year) and from milk and dairy products (on average 34,000 samples/year).

Table 14.5: Food samples exceeding chemical and microbiological standards, 1998 and 1999

	Chemical standards		Microbiological standards	
	1998	1999	1998	1999
Meat, meat products, eggs	5.0	7.3	4.2	4.9
Milk, dairy products	6.5	6.0	7.6	8.6
Fish	9.2	10.5	6.6	7.5
Grain, flour, cereals	..	..	6.6	6.3
Confectionery	..	..	4.7	5.8
Vegetables, fruit	..	..	9.6	8.8
Vegetable oil products	5.1	6.2	2.4	4.5
Drinks	18.5	21.1	4.1	3.3
Infant milk	7.4	6.0	4.9	4.2
Preserved (canned) food	3.6	6.4	2.2	2.7

Source: SES Inspectorate, Agency for Health Affairs.

Only very occasionally are heavy metals like lead or cadmium detected in food. More often, iron and tin are found in canned sour food and drinks. The total radioactivity of food samples due to the radionuclides ^{137}Cs and ^{90}Sr is on average 0.02 Bq/kg.

In the south of Kazakhstan, persistent pesticides, herbicides and defoliants have been extensively used. Residues of organochlorine pesticides (OCP), dioxins and furans (PCDD/PCDF) are detected in animal food products. Areas of concern are the Mangystau oblast, the Akmola oblast, the South Kazakhstan oblast, the Kostanai oblast, the Aktobe oblast and the Almaty oblast. These very persistent chlorinated contaminants accumulate in human fat and are mobilized during pregnancy and breastfeeding and newborn infants are therefore at risk.

An analysis of PCDD/PCDF, PCB, OCP, toxic metals and ^{137}Cs in breast milk has been carried out at 7 different places in Kazakhstan: Almaty, Aralsk, Atyrau, Shimkent, Djetisay, Kirov and Kyzylorda. Djetisay and Kirov are districts in the cotton-growing region. In these regions, high levels of TCDD are found in breast milk. A generalized contamination with β-HCH and DDT has been found. The concentrations of the other components are similar to or lower than those in Europe.

A risk analysis of the data shows that the DDT intake of a breastfed baby is less than half the acceptable daily intake (ADI). The concentration of β-HCH in breast milk exceeds the current median European levels, but is comparable with levels in the Russian Federation and historical levels in some European countries in the 70s and 80s. No adverse effects have been recorded for these levels. The daily intake of I-TEQ of 50 pg/kg of body weight exceeds the maximum exposure for a breastfed baby (which US-EPA and WHO set at 1 pg/kg of body weight), but are similar to that in some European countries. Based on this research, a WHO/EURO expert group recommended the Agency for Health Affairs in 1998 to continue to promote breastfeeding. However, possible adverse developmental effects associated with both prenatal and perinatal (through breast milk) TCDD exposure have not been adequately assessed. Further epidemiological research is therefore needed to examine these effects in this high-risk population.

Besides food contamination, food deficiencies are also a cause for concern. Environmental contaminants may cause more harm to human health when food deficiencies occur. In many parts of the country dietary deficiency of iodine is common, leading to thyroid dysfunctions like goitre. Actions like adding iodine to bread and giving iodine supplements to children under 14 have started.

In the west of Kazakhstan, iron deficiency is common and a major concern. The Demographic and Health Survey conducted by the Institute of Nutrition in 1995 showed that the prevalence of anaemia among women was 49 per cent and among children 69 per cent. The anaemia is largely due to iron deficiency caused by an unbalanced diet. The problem is the worst among ethnic rural Kazakhs living in the west of the country. Iron deficiency in pregnant women is a risk factor for perinatal mortality and congenital malformations in newborn infants. With the help of UNICEF and WHO in 1998, action was taken to deal with the iron deficiency by adding iron to flour and giving iron supplements to pregnant women and women of child-bearing age. The administration of iron has led to a reduction in anaemia, but does not seem effective in 30 per cent of all cases. More research is needed to find out the causes of anaemia. The project is not continued because of funding problems.

Occupational health and safety

As elsewhere in Central Asia, the incidence of new cases of occupational disease is low (6 per 100,000 in 1998) compared to that in the European region (some 30 per 100,000). The rate of persons injured in work-related accidents is 49 per 100000 and far lower than in the European region (724 per 100,000). The rate of work-related deaths is 2 per 100,000 in Kazakhstan and 2.3 per 100,000 in Europe. This may indicate an incomplete registration of morbidity.

There is no systematic monitoring of the air quality at the workplace. Air-quality measurements at selected workplaces have shown that the health standards for air pollution are exceeded in 40 per cent of the enterprises investigated.

Indoor air pollution

Although indoor air pollution is a major source of exposure to a large variety of air pollutants, there are no practically data available on this subject. Limited information exists about indoor radon. Some important items are exposure to environmental tobacco smoke (with volatile

organic compounds and polycyclic aromatic hydrocarbons), exposure to combustion products of gas cookers and heating devices, exposure to bio-allergens in damp houses, and exposure to chemicals emitted by building materials (volatile organic compounds). It should be emphasized that respiratory diseases in children are more associated with indoor air pollution than with outdoor air pollution.

Health and environment in the Aral Sea region (Kyzylorda oblast)

The population in the area has been exposed to organochlorine pesticides like DDT, aldrin, dieldrin and lindane, to PCDD/PCDF as a result of the use of defoliants, and to PCB and heavy metals as a result of industrial contamination. Toxic contaminants have accumulated in the water, the soil and the food chain. The main source of organochlorine compounds is probably the consumption of contaminated animal fat from beef, goat, chicken and milk products (butter). For infants, the main source after birth is breast milk. There is no information available on other exposure routes like the inhalation of contaminated dust.

Hospitalized schoolchildren have remarkably higher levels of PCB, DDT, DDE and β-HCH in their blood than Swedish children (no dioxins analysed). Despite the high levels, the thyroid function of the schoolchildren was not affected.

An analysis of breast milk in agricultural villages in southern Kazakhstan revealed high levels of TCDD (35 pg/g fat; range 6-208 pg/g fat). TCDD is, with 70 per cent, the major contributor to I-TEQ. The highest levels are found in women working on State cotton farms, and living near a reservoir that receives run-off water from cotton fields. In urban regions, the congener pattern is similar to that in other countries; TCDD levels are 5.3 pg/g (17 per cent of I-TEQ). The food chain in the Aral Sea region is contaminated, especially cow milk, lamb fat and butter. There is less contamination of vegetable oils (like cottonseed oil).

In parallel with the worsening ecological situation, certain diseases seem to be on the increase, in particular anaemia, diseases of the digestive system, including kidney and liver diseases, and diseases of the respiratory system. In addition, increasing rates of birth defects, reproductive pathology (like miscarriages), complications during pregnancy and decreasing lactation performances have been reported.

Due to the lack of information about current exposure levels of children to heavy metals and organochlorine compounds, no link can be established between increasing morbidity and exposure to environmental pollutants. However, it seems obvious that the cause of poor health is not only exposure to toxic chemicals. Poverty with crowding, poor hygiene and sanitation, poor drinking-water quality and inadequate nutrition are far more important risk factors for bad health, especially in children. Indicators of poor sanitation are diarrhoeal diseases, tuberculosis and parasitic infections. The rate of infectious and parasitic diseases among children in the Aral Sea region is the highest in Kazakhstan. Anaemia and infections are a more likely cause of premature birth and perinatal mortality than toxic chemicals.

The high rate of respiratory diseases is still unexplained, but researchers at the Kazakh State Medical University suspect a link with the high content of salty dust in the air.

Radiation and health

The former Semipalatinsk nuclear test site. It is obvious that the health of many has been affected by the radiation from the large number of nuclear explosions on the site. It is estimated that the highest exposure to fallout is from the surface nuclear explosions conducted on 29 August 1949 and 12 August 1953. Effective dose estimates due to external and internal exposure attributable to the 1949 and 1953 tests in villages near the polygon range from 70 mSv to 4470 mSv.

Epidemiological and clinical studies have been carried out to assess the health effects. A study on cancer incidence since 1956 revealed an excess cancer rate until 1970 for cancer of the oesophagus among the population with an average effective dose equivalent (H-eff) of 2000 mSv compared with a control population (H-eff 70 mSv). After 1970, the oesophagus cancer incidence decreased and a second peak in cancer incidence was observed around 1990 due to cancer of the lung, breast and thyroid.

In another study, the risk of childhood leukaemia between 1981 and 1990 was studied as a function of distance to the test site. The risk of acute leukaemia rose significantly the closer the children lived to the testing areas, with a relative risk of 1.76 for those living less than 200 kilometres from the site of air explosions compared with those living more than 400 kilometres away.

Other studies show a higher overall morbidity or mortality rate due to the exposure till 1963. It is also suspected from cytogenetic studies that genetic damage has occurred. This will affect the offspring of the second and third generation.

The epidemiological studies give some indication of the effects of past radiation on health. But the findings in many studies may be affected by potential confounders (like urban/rural status, ethnic factors and lifestyle factors) and exposure misclassification. A registry of the rural population in the Altai region is therefore being established in order to study in detail the effects of long-term low-level exposure to radioactivity.

At present *on the experimental sites* there is still contamination of the soil with ^{239}PU, ^{240}PU, ^{137}Cs, ^{60}Co, ^{152}Eu and ^{154}Eu. Measurements in air at ground level show an exposure to a H-eff of 30µSv/hour (= 260 mSv/year). This dose exceeds the annual permissible dose of 1 mSv/year and imposes a radiation risk to people who stay at the experimental sites for a long time. Due to the radioactive pollution of the ground, radionuclides can enter the food chain if this area is used by grazing cattle.

In *the off-site area* of Kurchatov, the level of radioactive contamination due to fallout from the Semipalatinsk nuclear test site was around background levels (mean external doses from soil contamination in the off-site area are 0.60-0.63 mSv/year). The population dose at this time is low. Environmental samples (soil, plants, food) show normal levels of radionuclides. At present there is no significant increase in the natural background due to fallout from the Semipalatinsk nuclear test site (mean values of the internal doses are below 2 µSv/year for ^{90}Sr).

Other nuclear testing sites. In the Atyrau *oblast*, there are three military testing sites: the Azgyr nuclear testing site and two missile testing sites. In Azgyr, 17 underground and 2 surface nuclear explosions have taken place. There is no information available about the radiation dose of the people involved. There is no information about the missile testing sites and exposure risks of the population.

Uranium mines. Nuclear waste from uranium mines (tailings) is not always properly stored. At some dumping sites the radioactive sludge from dissolved ores is not covered with water and dries in the wind. Radioactive dust can be spread by the wind and directly inhaled or contaminate the food chain after deposition on the ground. The old abandoned and unguarded uranium mines are also a health risk. The population uses much material from the mines (rocks and iron material) for building purposes. This material can be highly contaminated with radioactivity.

Natural radioactivity: radon, thoron and disintegration products. It is estimated that radon exposure contributes 44 per cent of the total radiation exposure in Kazakhstan. The contribution of the other sources are: atmospheric radiation 27 per cent, medical treatment 23 per cent, nuclear tests/global fallout 5 per cent and power plants 1 per cent. Radon is mainly an indoor air pollutant. Radon can enter the building through soil with a rocky underground, or by building materials with a high radon content. Measurements in buildings have been carried out, but only on a small scale. The radon content in air in buildings is on average 50 Bq/m^3. The recommended maximum level is 200 Bq/m^3, which is sometimes exceeded. When the guidelines are exceeded, measures are taken to improve the basement ventilation of the building.

14.3 Environmental health management

Institutional responsibilities and legislation

The Ministry of Natural Resources and Environmental Protection and the Agency for Health Affairs are the main ministries in charge of environmental health issues. The Agency for Health Affairs is responsible for disease registration, disease prevention and the health-care system. Its Statistical Department is primarily responsible for collecting health data. The information is generated under the responsibility of staff at local health-care facilities and then sent to the Statistical Department through the district and *oblast* health departments. The Statistical Department compiles and analyses these data, and issues annual reports. Its disease classification follows the International Classification of Diseases (ICD9).

In environmental health, the main tasks are performed by the Sanitary Epidemiological Services (SES) under the responsibility of the SES Inspectorate of the Agency for Health Affairs. The work of the SES is set out in the Decree on the adaptation of State Sanitary and Epidemiological Service (1995). The Sanitary Epidemiological System is still capable of performing most tasks, but insufficient financing has precluded the

completion of regular control, preventive and anti-epidemic measures, especially in rural areas. Outdated laboratory equipment and the lack of modern computer systems make it difficult to do proper work.

The SES consists of 240 district stations and 20 larger *oblast* stations. It pursues two aims:

- monitoring the quality of food and drinking water, air quality, radiation hygiene, noise and vibration, indoor air and hygiene at the workplace
- monitoring diseases, including the detection and managing of outbreaks

Its food-monitoring programme is divided into:

- public nutrition monitoring (restaurants and catering in schools and kindergartens)
- monitoring of manufacturing, transport and import of food products
- monitoring at selling points (marketplaces, shops).

The monitoring is performed according to the procedures described in order 318 of the Law on the Sanitary and Epidemiological Welfare of the Population (1994). Monitoring frequency differs for each category. Drinking water is monitored each month for micro-bacteriological contamination, and every three months for chemical contamination. In addition to the SES, the water company ('vodokanal') self-monitors drinking-water quality.

Other institutions are also involved in monitoring food, air and drinking water. For example, food quality is also controlled out by the Institute of Nutrition and some agencies of the Ministry of Agriculture that are responsible for veterinary control.

At present, most standards for air, food and drinking-water quality are based on the former Soviet Union standards (GOST). For new substances, new standards are set by the Principal Doctor of the Agency for Health Affairs, upon the advice of the SES in Almaty city, which is seen as a national centre of expertise.

The National Institute of Nutrition is a research centre to study the state of the population's nutrition. The Institute developed the National Nutrition Policy in 1996 with technical assistance from UNDP, UNICEF and WHO. The Policy aims to improve the national food control and nutrition surveillance systems, and promote breastfeeding and iron and iodine fortification programmes. A large demographic and health survey was carried out among the population in 1995. Recommendations were issued on the basis of this survey, but the lack of funding makes it difficult to carry out the desired follow-up programmes.

The Kazakh State Medical University carries out scientific research into environmental health. It has investigated the health impact of environmental pollution in the Aral Sea region, in cooperation with European research institutes. For research and treatment of children from the Aral Sea region, the University has established the Children's Rehabilitation Centre (URPAK). Modern scientific research is difficult due to the lack of finance.

The Kazakh Scientific Institute for Radiation Medicine and Ecology carries out research on radiation medicine.

The Environmental Health Unit of the Kazakhstan School of Public Health runs a training programme for environmental health specialists from SES and hospitals.

As part of the Caspian Environment Programme, the Caspian Regional Thematic Centre for Sustainable Human Development and Health was established in Turkmenistan in March 2000. It will facilitate the compilation of a region-wide inventory of environmental health hazards in the Caspian coastal areas, including solid and liquid waste hazards, food contamination, malnutrition, access to safe drinking water, occupational health practice, etc. The Centre plans to strengthen the national environmental health capacity through regional training courses and information exchange. The Centre will coordinate the development of a regional environmental health action plan that will be part of the Caspian Environment Programme's Strategic Action Programme.

Action programmes

The NEAP/SD deals mainly with ecological priorities like oil spill prevention and the prevention of soil and groundwater pollution. Some of its actions deal more directly with human health:

- Preventing pollution of water sources with waste water from mining dumps and industrial waste (East Kazakhstan *oblast*)

- Measures to reduce air pollution (lead dust in Ust-Kamenogorsk and radioactive dust from tailings in Aktau)
- Collection and safe storage of municipal waste (in Pavlodar, Shymkent and Almaty city)
- Reduction of lead in petrol (Almaty city and Shymkent city)
- Prospecting for water for urban and populated areas (in Kyzylorda, Aktobe and South Kazakhstan *oblasts*; specific locations in Semipalatinsk, Zhambyl, West Kazakhstan and Pavlodar *oblasts*).

The Agency for Health Affairs has drawn up a National Environmental Health Action Plan (NEHAP) in cooperation with the MNREP. The recent draft (March 2000) has been approved by the ministries involved, the Ministry of Finance and other institutions (*akimats*, Kazhydromet, Soil Institute, etc.). The NEHAP has been approved by the Kazakh Government (Decree 878, 9 June 2000).

The NEHAP sets the environmental health priorities. These are divided into 10 groups of measures that agree with the 'Health of Nation' programme approved by the Kazakh President. The priorities are:

- Evaluating the environmental hygiene conditions.
- Ensuring safe drinking water and an adequate water supply.
- Ensuring the sanitary-hygienic supervision of the sources of air pollution, electromagnetic fields and other physical factors.
- Ensuring the sanitary-hygienic safety of soils. Cleaning up industrial and municipal waste disposal sites.
- Ensuring the safety of food products and improving the population's nutritional status.
- Ensuring the radiation safety of the population.
- Preventing epidemics in regions where natural disasters or industrial calamities occur.
- Improving hygiene in the workplace.
- Protecting the health of children and teenagers
- Providing health education

For all priorities, activities have been formulated to achieve the formulated goals within the time limit. The goals of the NEHAP are supposed to be reached in three stages: 2000-2001, 2002-2003, 2004-2005. The planned activities should be taken up in regional and local environmental health action plans, in which activities can be worked out in detail.

A proposal for a regional environmental health action plan in the eastern part of the Caspian Sea was developed by a joint mission of UNDP, WHO and national experts in November 1999. It resulted in proposals for 17 local and regional projects in Turkmenistan (5 projects), Kazakhstan (11 projects), and the proposal to establish the Caspian Regional Thematic Centre for Sustainable Human Development and Health (see above). The projects are related to the NEHAP priorities of drinking-water supply and quality, radiation safety, health/hygiene education and nutritional status of the population. Financial problems may arise.

14.4 Conclusions and recommendations

Since independence, some health indicators have deteriorated in Kazakhstan. There is much concern about the declining life expectancy, perinatal and postnatal mortality and the high morbidity from infectious and respiratory diseases. There are large regional differences in mortality and morbidity patterns, which can be explained by socio-economic differences, different lifestyles, environmental conditions, age, gender and ethnic composition of the population. Furthermore, the health-care system, which is changing from budgetary to insurance-based funding, may not be as easily accessible to the population as it should be.

In general, although there are health risks from past and present man-made environmental causes (like the radiation problems, the Aral Sea disaster and traffic-related air pollution), it seems that environmental mortality and morbidity are more related to basic hygiene issues, like drinking-water quality, food quality, nutritional status and personal hygiene. While the NEAP deals with environmental issues related to past and present industrialization and pollution prevention, the NEHAP deals more specifically with sanitary-hygiene issues related to present human health problems. Therefore the NEHAP is a necessary supplement to the NEAP.

Taking both plans together, the most important topics in environmental health are:

- Drinking-water quality, sewage disposal and personal hygiene
- Food quality and nutritional status

- Radiation safety
- Ambient air quality in large cities

The poor drinking-water quality in many regions causes infectious diseases like viral hepatitis and acute gastrointestinal infections. Contamination of the sources of drinking water (by bacteria and viruses in sewage) can be avoided by creating larger safety zones around the sources and by better protecting the sources. Contamination of the sources with sewage should be avoided at all cost.

Replacing highly corroded drinking-water pipes, and shortening the time that drinking water stays in the pipes will diminish the growth of micro-organisms in the water distribution network. The contamination of drinking water with sewage water through leakage in both pipe systems should also be avoided. The first step in improving drinking-water supply is to use reliable chlorination, which is a cheap and effective measure. In large areas of Kazakhstan the groundwater which is used as drinking water has a very high mineral content. Desalination is recommended to prevent kidney disease.

Recommendation 14.1:
Drinking-water quality and supply should be improved. Restructuring of the drinking-water supply (safe drinking-water sources, source protection and improvement of the water distribution networks) is a priority. The measures that should be taken immediately are reliable chlorination of drinking water, and proper desalination of highly mineralized raw water. The required measures call for the establishment of a respective State programme and of legislation on drinking water supply and quality, in accordance with WHO Water Quality Guidelines. See Recommendations 7.1 and 7.3.

Many of Kazakhstan's environmental problems are related to regions or districts and have their specific features, for example the Semipalatinsk nuclear test site, the Aral and Caspian Sea regions and the larger cities. The activities mentioned in the NEHAP should therefore be implemented in regional and local plans in order to specify the needed actions in detail. A good example of such a regional plan is the action plan for the eastern part of the Caspian Sea, which was proposed after a joint mission of UNDP, WHO and national experts. The plan shows that the various problems need a specific approach and the commitment of regional and local authorities and health institutions.

Recommendation 14.2:
Local environmental health action plans should be developed as part of the implementation of the National Environmental Health Action Plan. All these plans need to be coordinated between the ministries involved, the local authorities, health institutions and NGOs and should be widely disseminated. See Recommendation 1.2.

Most gastrointestinal infectious diseases are related to food and poor food hygiene. Especially among children, morbidity and mortality from food-related "dirty hands" diseases is high. In combination with an unbalanced diet, characterized by a shortage of vegetables and fruits, children become more vulnerable to diseases. Nutritional deficits in pregnancy (for example iron deficiency) are a risk factor for perinatal mortality and congenital malformations.

The National Nutrition Policy (Institute of Nutrition, 1996), which aims to improve the national food control and nutrition surveillance systems, and promote breastfeeding and iron and iodine fortification programmes, should be implemented.

Recommendation 14.3:
Food quality and nutritional status should be made stricter. Food chain safety control should be intensified in order to reduce the risk of food-borne disease outbreaks. Special educational programmes promoting food hygiene and a balanced diet should be set up for the manufacturers and suppliers of food products, and for the general population. The National Nutrition Policy, proposed by the Institute of Nutrition, should be implemented.

The NEHAP radiation safety activities deal with radioactive waste disposal, the safe storage of tailings, a survey of the polygons and a monitoring system for radon at the workplace. This attention should be extended to other concerns. For example, on the former nuclear testing sites, people can still be exposed to high radiation levels due to residual radiation in soil. Closing the area to people and cattle is a first step in reducing exposure, and in trying to stop radionuclides from entering into the food chain.

There is a lack of information about the use of radioactive building materials (rocks, metal parts) from old abandoned mines. It is possible that these materials impose a direct radiation risk, and their

use should be prohibited. For an assessment of their radiation risk, a survey should be carried out to estimate the radiation dose of those who are exposed. The public should be made aware of the dangers of the use of these materials. The existing regulations on the radiation safety of building materials should be strictly enforced. Coordination of the activities of different ministries in the field of radiation safety should be improved.

Recommendation 14.4:
Nuclear test sites should be closed to people and livestock. The old uranium mines should be sealed off. A survey of the use of building materials from old uranium mines should be carried out. The level of indoor radon should be assessed to identify the high-risk areas, to enable preventive measures to be taken and to evaluate them. A public awareness campaign should be launched to inform the population about the risks associated with using building materials from old uranium mines, and about radon and its associated risks. Regulations on the radioactive content of building materials should ensure a safe radiation level in buildings and be enforced. See Recommendation 6.2.

Lead is a known risk factor for the neuro-psychological development of children. The use of unleaded petrol may be a powerful measure to reduce lead levels in blood. A survey of the lead level in the blood of children in Almaty city has highlighted the need for such measures in large cities. The use of unleaded petrol also helps to reduce other harmful substances like nitrogen dioxide and volatile organic compounds.

Recommendation 14.5:
The use of unleaded petrol should be promoted at least in large settlements. See Recommendation 4.4

Indoor air pollution is an important risk factor in respiratory diseases. Combustion gases and tobacco smoke are well known air pollutants linked to respiratory disease, especially in children. Also dampness in homes is a risk factor in allergic diseases, like asthma and chronic obstructive pulmonary disease. Information about indoor air quality is needed to tackle the major problems. At the workplace, there should be an adequate monitoring system for indoor air pollution, starting with high-risk occupations. After such monitoring, risk assessment measures can be taken to diminish air pollution at the workplace and to minimize occupational disease due to these exposures.

Recommendation 14.6:
More attention should be paid to indoor air pollution, starting with the collection of data on its most important sources. Likewise, a monitoring system for indoor air quality at the work places should be developed and implemented. See Recommendation 4.2.

Environmental health management in Kazakhstan can be achieved only with a network of capable public health institutions that are prepared for their community tasks. The system of Sanitary Epidemiological Services is by law committed to performing public health tasks in the field of environmental health (monitoring of exposure and of diseases). But the possibilities are limited for lack of financial means. The laboratories are poorly equipped for analysing drinking water and controlling food safety, and they do not have modern computer systems. Therefore, the monitoring tasks cannot be carried out properly and the lack of computer support makes it almost impossible to conduct health surveys or research into disease clusters in relation to environmental pollution.

General health statistics are not suitable to perform sophisticated disease cluster analyses using small area statistics. It is not possible for many sources of environmental pollution to link human exposure to health effects. For a scientific approach, specially designed studies are needed of the health impact of environmental pollution, although, for the decision-making process, it is sufficient to recognize the main possible risk factors in environmental health and to anticipate them with a clear policy.

Recommendation 14.7:
The restructuring and strengthening of the system of Sanitary Epidemiological Services to improve the performance in environmental health should be seen as a priority, including the upgrading of its computing and laboratory equipment to improve the usability of the data collected. A study to find the optimal scale of the Sanitary Epidemiological Services in terms of geography and demography is recommended.

ANNEXES

Annex I

SELECTED ECONOMIC AND ENVIRONMENTAL DATA

Selected economic data	
	Kazakhstan
TOTAL AREA (1 000 km^2)	2,724.90
POPULATION	
Total population, 1998 *(100 000 inh.)*	150.73
- % change (1993-1998)	-7.98
Population density, 1998 *(inh./km^2)*	5.53
GROSS DOMESTIC PRODUCT	
GDP, 1999 *(US$ billion)*	15.70
- % change (1993-1999)	2.61
per capita, 1999 *(US$ per capita)*	1,041.60
INDUSTRY	
Value added in industry, 1998 *(% of GDP)*	22.00
ENERGY SUPPLY	
Total supply, 1999 *(Mtoe)*	36.40
Energy intensity 1999 *(toe/ US$ 1 000)*	2.32
Structure of energy supply, 1999 *(%)*	
- Coal	42.58
- Oil and oil products	23.35
- Gas	24.18
- Others	9.89
ROAD TRANSPORT	
- 10 000 vehicles	128.50
- % change (1993-1998)	-13.87
- private cars per capita *(veh./1 000 inh.)* 1996	64.93

Sources: Kazakhstan and UNECE.

Selected environmental data	
	Kazakhstan
LAND	
Total area *(1 000 km²)*	2,724.9
Protected areas* *(% of total area)*	3
Nitrogenous fertilizer use, 1998 *(tonne/km² arable land)*	0.1
FOREST	
Forest area *(% of land area)*	4.2
THREATENED SPECIES	
Mammals *(% of known species)*	16.8
Birds *(% of known species)*	9.4
Freshwater Fish *(% of known species)*	14.9
WATER	
Water withdrawal *(% of gross annual availability)* 1998	5.1
Fish catches** *(t)*	23,089.0
AIR ***	
Emissions of sulphur oxides, 1998 *(kg/inh.)*	65.2
Emissions of sulphur oxides, 1998 *(kg/US$ 1 000 GDP)*	62.6
Emissions of nitrogen oxides, 1998 *(kg/inh.)*	10.6
Emissions of nitrogen oxides, 1998 *(kg/US$ 1 000 GDP)*	10.2
Emissions of carbon monoxide, 1998 *(kg/inh.)*	23.9
Emissions of carbon monoxide, 1998 *(tg/US$ 1 000 GDP)*	23.0
WASTE GENERATED	
Industrial waste *(kg/US$ 1 000 GDP) 1998*	5.3
Municipal waste **** *(kg/inh./day)*	0.8

Sources: Kazakhstan and UNECE.

Notes:

* including zakazniks and natural monuments

** fish and other sea products

*** data refer to emissions by stationary sources only

**** In Almaty City

Annex II

SELECTED MULTILATERAL AND REGIONAL AND SUBREGIONAL AGREEMENTS

Selected multilateral agreements			
	Worldwide agreements		**Kazakhstan**
	As of 1 July 2000		
1949	(GENEVA) Convention on Road Traffic	**y**	
1957	(BRUSSELS) Int. Conv. Relating to Limitation of Liability of Owners of Sea-going Ships	**y**	
1958	(GENEVA) Conv. Fishing and Conserv. Living Resources of High Seas	**y**	
1969	(BRUSSELS) Intern. Convention on Civil Liability for Oil Pollution Damage	**y**	**R**
	1976 (LONDON) Protocol	**y**	
1969	(BRUSSELS) Conv. Intervention on the High Seas in Case of Oil Pollution Casualties	**y**	
1971	(RAMSAR) Conv. Wetlands of International Importance, especially as waterfowl habitat	**y**	
	1982 (PARIS) Amendment	**y**	
	1987 (REGINA) Amendments	**y**	
1971	(GENEVA) Conv. on Protection against Hazards from Benzene (ILO 136)	**y**	
1971	(BRUSSELS) Conv. Establishment of an International Fund for Compensation of Oil Pollution Damage	**y**	
1972	(PARIS) Conv. Protection of the World Cultural and Natural Heritage	**y**	**R**
1972	(LONDON) Conv. On the Prevention of Marine Poll. By Dumping of Wastes and Other Matter	**y**	
	1978 Amendments to Annexes (incineration at sea)	**y**	
	1980 Amendments to Annexes (list of sustances)	**y**	
1972	(GENEVA) Conv. Safe Container (CSC)	**y**	
1973	(WASHINGTON) Conv. International Trade Endangered Species of Wild Fauna and Flora (CITES)	**y**	**R**
	1983 (GABORONE) Amendment	**y**	
1973	(LONDON) Internat. Conv. for the Prevention of Pollution from Ships (MARPOL)	**y**	**R**
	1978 (LONDON) Protocol (segregated balast)	**y**	
	1978 (LONDON) Annex III on Hazardous Substances	**y**	
	1978 (LONDON) Annex IV on Sewage		
	1978 (LONDON) Annex V on Garbage	**y**	
1974	(GENEVA) Conv. on Prot. against Hazards from Carcinogenic Subst. (ILO 139)	**y**	
1977	(GENEVA) Conv. on Prot. against Hazards from Air Poll., Noise and Vibration (ILO 148)	**y**	
1979	(BONN) Conv. Conservation Migratory Species of Wild Animals	**y**	
	1991(LONDON) Agr. Conservation of Bats in Europe	**y**	
	Agreement on the Consevation of African-Euroasian Migratory Waterbirds (AEWA)	**y**	
	1992 (NEW YORK) Agreement ASCOBANS	**y**	

Source: UNECE and Ministry of Natural Resources and Environmental Protection

y = in force; **S** = signed; **R** = ratified, acceded, approved

Selected multilateral agreements (continued)

1982	(MONTEGO BAY) United Nations Conv. on the Law of the Sea	**y**	
	1994 New York Agreement. Related the Implementation of Part XI of the Convention	**y**	
	1994 New York Agreem. Implementation of the Provisions the Convention and management of stradding fish stocks and highly migratory fish stocks		
1985	(VIENNA) Vienna Conv. for the Protection of the Ozone Layer	**y**	**R**
	1987 (MONTREAL) Montreal Prot. Subst. that Deplete the Ozone Layer	**y**	**R**
	1990 (LONDON) Amendment to Protocol	**y**	
	1992 (COPENHAGEN) Amendment to Protocol	**y**	
1960	(GENEVA) Conv. Concerning the Protection of Workers Against Ionizing Radiation	**y**	
1963	(VIENNA) Conv. Civil Liability for Nuclear Damage	**y**	
	Protocol on Amendments to the Convention	**y**	
1963	(MOSCOW) Treaty banning nuclear Weapons Tests in the Atmosphere, in Outer Space and under Water	**y**	
1986	(VIENNA) Conv. on Early Notification of Nuclear Accidents	**y**	
1986	(VIENNA) Conv. on Assistance in the Case of Nuclear Accident or Radiological Emergency	**y**	
1971	(LONDON, MOSCOW, WASHINGTON) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in Subsoil Thereof	**y**	
1989	(BASEL) Conv. Control of Transbound. Movts of Hazard. Wastes	**y**	
1990	(LONDON) Conv. Oil Pollution Preparedness, Response and Cooperation	**y**	
1992	(RIO) Conv. Biological Diversity	**y**	**R**
1992	(NEW YORK) United Nations Framework Conv. Climate Change	**y**	**R**
	1998 KYOTO Protocol to FCCC		**S**
1993	Convention on the World Meteorology Organization		**R**
1993	Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques		**R**
1994	(VIENNA) International Nuclear Safety Convention	**y**	
1997	(VIENNA) Conv. Management of Radioactive Wastes and spent nuclear fuel		
1997	(VIENNA) Conv. Supplementary Compensation for Nuclear Damage		
1994	(PARIS) Convention to Combat Desertification		**R**

Source: UNECE and Ministry of Natural Resources and Environmental Protection

y = in force; **S** = signed; **R** = ratified, acceded, approved

	Regional and subregional agreements		Kazakhstan
	As of 1 July 2000		
1950	(PARIS) Intern. Conv. for the Protection of Birds	y	
1957	(GENEVA) European Agreement-Intern. Carriage Dangerous Goods by Road (ADR)	y	
1958	(GENEVA) Agreem. Adoption Uniform Cond. of Approval and Recognition for Motor Vehicles Equipment and Parts	y	
1968	(PARIS) European Conv. Protection of Animals during Intern. Transport	y	
	1979 (STRASBOURG) Additional Protocol	y	
1969	(LONDON) European Conv. Protection of Archeological Heritage	y	
1978	(OTTAWA) Convention on Multilateral Cooperation in North-West Atlantic Fisheries	y	
1979	(BERN) Conv. Conservation European Wildlife & Natural Habitats	y	
1979	(GENEVA) Conv. Long-range Transboundary Air Pollution	y	
	1984 (GENEVA) Prot. Financing of Coop Programme (EMEP)	y	
	1985 (HELSINKI) Prot. Reduction of Sulphur Emissions by 30%	y	
	1988 (SOFIA) Prot. Control of Emissions of Nitrogen Oxides	y	
	1991 (GENEVA) Prot. Volatile Organic Compounds	y	
	1994 (OSLO) Prot. Further Reduction of Sulphur Emissions	y	
	1998 (AARHUS) Protocol on Persistent Organic Pollutants		
	1998 (AARHUS) Protocol on Heavy Metals		
1992	(BUCHAREST) Conv. Protection Black Sea Against Pollution	y	
	1992 (BUCHAREST) Protocol (combatting pollution by oil and other harmful substances in emergency stuation	Y	
	1992 (BUCHAREST) Protocol (protection of the Black Sea marine Environment against pollution from dumping)	Y	
	1992 (BUCHAREST) Protocol (protection of the Black Sea marine Environment against pollution from land-based sources)	Y	
1991	(ESPOO) Conv. on Env. Impact Ass. in a Transboundary Context	y	
1992	(HELSINKI) Conv. on the Protection and Use of Transboundary Watercourses and Intern. Lakes	y	
1992	(HELSINKI) Conv. Transboundary Effects of Industrial Accidents	y	
1998	(AARHUS) Conv. Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters		S
1992	(PARIS) Conv. Protection Marine Env. North-East Atlantic		
1993	(LUGANO) Conv. Civil Liability for Damage from Activities Dangerous for the Environment		
1994	(LISBON) Energy Charter Treaty		R
	1994 (LISBON) Prot. on Energy Efficiency and Related Aspects		R

Source: UNECE and Ministry of Natural Resources and Environmental Protection

y = in force; S = signed; R = ratified, acceded, approved

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