Environment and Development Nexus in Kazakhstan

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Foreword by the Minister of Environmental Protection of the Republic of Kazakhstan

Dear Ladies and Gentlemen!

In his speech at the World Summit for Sustainable Development, the President of Kazakhstan reminded the world community of the global scale of the processes that are underway, and called for prevention of irreversible harm to the environment in order to preserve the necessary life resources for our descendants. Environmental safety and sustainable development issues are of vital importance for Kazakhstan.

Water resource deficit and significant land degradation, the Aral Sea disaster, the aftermath of the nuclear tests, accumulation of industrial waste, oil spills – all these problems are no longer fall under the category of environmental ones. Many of these problems are regional and even global.

Coordinated interaction between the mankind and the environment and ensuring a safe environment are one of the priorities of the long-term Kazakhstan-2030 Strategy. It has clear-cut provisions: "...increase efforts in making our citizens healthy during their life time, and enjoying a healthy environment". Moreover, our legislation defines the worsening environment situation as one of the threats to the country's national security.

Kazakhstan has provided a good basis for implementation of its environmental policy. Proper legislative acts have been adopted. The country has joined the major international conventions on the environment protection. The final documents of the UN Conference on Environment and Development (Rio-92) have been signed, and resolutions of the Lucerne (1993) and the Sofia (1995) conferences for Europe have been approved. Kazakhstan was one of the first countries to ratify the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

This publication is one of the Kazakhstan's commitments under the Aarhus Convention, which provides a broad public with an opportunity to learn about the current environmental situation in Kazakhstan as well as the experience in the area of environmental management gained by the country since its independence. I am positive that the report will be interesting and useful for government agencies, academia, students of environmental departments, public and political organizations, and foreign partners.

I would like to take this opportunity to thank UNDP for preparing this Publication. I look forward to our continuing constructive cooperation.

Aitkul B. Samakova

Foreword by the UNDP Resident Representative

The health of our society depends in large part on the health of our environment. Unfortunately, since the dawn of the Industrial Revolution, we have seen a tragic cycle repeated again and again - human activities bring about environmental degradation, and that in turn constrains further human development. This has been the case in many parts of the world and several notable examples are found here in Kazakhstan.

In order to break the cycle, we need to have a clear understanding of the long-term effects that the various human activities have on our environment. We also need the legal mechanisms, institutional structures, and economic incentives to respond to those potential threats.

This publication, "Environment and Development Nexus in Kazakhstan," is UNDP's contribution to that understanding in Kazakhstan. It offers an analysis of the linkages between development and the environment in this country, as well as up-to-date information on environmental conditions in general and an overview of the environmental work of national, international, and non-governmental organizations in Kazakhstan.

In recent years, a considerable amount of attention has been given to environmental issues here, both at the national and international levels. The environmental disasters related to the disappearance of the Aral Sea, the nuclear devastation in the Semipalatinsk polygon over several decades, and the rapid decline of the many plant and animal species from this vast land should remind us all that our actions today can have serious negative consequences for generations to come.

In 2000, Kazakhstan became a signatory to the Aarhus Convention, stating that the public has the right to access information and to participate in decision-making on environmental matters. In fulfilling this commitment, both private individuals and public institutions in Kazakhstan will be more motivated and better able to manage the stewardship given them over our fragile environment. In our joint endeavors with the Government, we strive to live by that Convention and this publication is just one example of that. We trust that the information and analysis provided here will be useful to the government, academia, international organizations, private companies and private citizens.

Although we have taken some initial steps in improving the health of the country's environment, much remains to be done. We, at the United Nations Development Program, are committed to continuing to do our part. Working together, we can create a better world for the benefit of generations to come.

Fikret Akcura

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EXECUTIVE SUMMARY

The world has entered a new millennium. This is not just another chronological step in history but also a new stage in human development—a stage which demands that the world's inhabitants take responsibility for their actions. As the concerns of adults inevitably turn to their legacy, so too the global community has begun to shift its attention to the effects current actions will have on future generations.

The United Nations, as a representative of this community, now realizes that promoting sustainable development must be one of its fundamental goals, and hence it worked with the international community to see that they collectively adopted the *Millennium Declaration,* which defines the main goals of sustainable development:

- *Eradicate extreme poverty and hunger*
- *Achieve universal primary education*
- *Promote gender equality and empower women*
- *Reduce child mortality*
- *Improve maternal health*
- *Combat HIV/AIDS, malaria and other diseases*
- *Ensure environmental sustainability*

Kazakhstan supports this action plan for the new millennium and has signed the *Millennium Declaration* with 190 other countries. Since achieving its independence, Kazakhstan's economic development policies have achieved good results, and beginning in 2002 the Government turned its attention to social policy and complimentary improvements in the social welfare of its people. Kazakhstan's economic and social policies now reflect well the Millennium Development Goals, which are the concrete translation of the Millennium Declaration into agreed targets with fixed deadlines for their achievement.

The country's ability to meet these goals continues to be hampered by a range of environmental constraints brought about, in part, by unsustainable management practices inherited from the Soviet era. Urgent environmental problems include: inefficient water resources and forest management; a continuing environmental and social crisis in the immediate region of the Aral Sea; industrial and municipal air and water pollution; and solid and hazardous wastes management. All these challenges require serious attention by the state and civil society, and they have attracted the attention of the international community in helping Kazakhstan to deal with them.

This publication, "The Environment and Development Nexus in Kazakhstan", has been prepared to assess the status of Kazakhstan's environment and to summarize lessons learned from addressing environmental problems since the country's independence. This report provides an overview of the environmental situation in the country, and it attempts to assess impacts of both the problems and efforts to address them on Kazkhanstan's human development. The six chapters analyze each component of the environment from various angles. The logic behind the review is based of the following principles:

Chapter 1. Country Review

This chapter briefly describes Kazakhstan's geographical conditions, which lay the foundation for current natural conditions and predetermine the development of certain ecological processes in the country. This section also describes the country's social and economic situation, political structure, and natural resource use policies. Significant attention is given to a review of environmental legislation in the Republic and the need for measures to be taken to improve it.

Chapter 2. Changes in Environment due to Economic Activities

Human-induced environmental changes and the way they affect the environment are presented in detail in this chapter. The following economic sectors have been selected for review: mining and processing enterprises, agriculture, testing grounds (nuclear and biological), space rocket launching, and as a result, waste management issues. The above environmental challenges are the country's most urgent contemporary environmental problems to be addressed.

Chapter 3. Current State of Environment

This chapter briefly describes the state of major environmental components: atmospheric air, water resources and biological diversity. The chapter offers extensive data on the volumes and quality of major natural resources, provides characteristics of pollution composition, its volumes/rate, intensity and sources.

Chapter 4. Impact of Environment on Human Development

This chapter focuses on how the environmental situation influences people's health and socio-economic development of the country. An attempt has been made to assess potential risks and reveal connections between the quality of some environmental components and their effects on individuals' lives and society in general. It should be noted that due to the lack of comprehensive environmental studies in this area, this chapter presents only a general review of potential damage to people's health and the country's economy. It demonstrates the real need to develop such scientific research and objective information in order to adjust strategy and develop state policies related to natural resources in the country.

Chapter 5. Environmental Protection in Kazakhstan

This chapter concentrates on national efforts to control the quality of the environment; use of natural resources, funding for environmental programs/ projects as well as the current environmental protection challenges the country faces. It also addresses issues related to environmental expertize, monitoring, an inventory/ cadastres system, and public participation in solving environmental problems.

Chapter 6. International and Regional Cooperation

This chapter reviews Kazakhstan's participation in international and regional environmental programs and projects.

In preparing the review, the following materials were used: the State Program "Republic of Kazakhstan's Development Strategy until 2030"; the President's Address to the People of Kazakhstan; National Concept of Environmental Safety; National Environmental Action Plan for Sustainable Development of the Republic of Kazakhstan; current legislation and bills under consideration by the Government; data and reports from the Ministry of Environment Protection, Committee for Forestry and Fishery, and Committee for Water Resources of the Ministry of Agriculture, National Sanitary Board and State Sanitary Service, Institute of Nutrition at the Ministry of Health Care, National Centre for Health, Agency for Land Resource Management, GosNPCZEM, KazGIDROMET Republican State Enterprise, KazNIIMOSK, the Academy of Science of RK, Central Asia Regional Environmental Center, Kazakhstan's Institute for Strategic Studies, State Forestry Enterprise, National Center for Quarantine and Zoological Infections, Institute of Botany and the Phyto Industry.

List of Abbreviations

API	Air Pollution Index
CB	Convention on Biodiversity
CITEC	Convention on International Trade of Endangered Wild Flora and Fauna Species
EIA	Environment Impact Assessment
FHC	Forestry and Hunting Committee of the Ministry of Agriculture
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEF SGP	GEF Small Grants Programme
GHG	Greenhouse Gases
GIS	Geographic Information System
GRP	Gross Regional Product
ICSD	Interstate Committee on Sustainable Development
IFAS	International Fund for Saving the Aral Sea
JSC	Joint Stock Company
LP	Limited Partnership
MEP	Ministry of Environment Protection
MoA	Ministry of Agriculture
MoES	Ministry of Education and Science
MPC	Maximum Permissible Concentration
MPE	Maximum Permissible Emissions
NAS	National Academy of Science of RK
NEAP	National Environmental Action Plan
NGO	Non-governmental organization
OJSC	Open Joint Stock Company
POPs	Persistent Organic Pollutants
REAP	Regional Environmental Action Plan
REC	Regional Environmental Centre for Central Asia
RK	Republic of Kazakhstan
SPA	Specially Protected Area
Tacis	Technical Assistance Programme for CIS countries
UN	United Nations
UNDP	UN Development Programme
UNEP	UN Environmental Programme
WB	The World Bank
WHO	World Health Organization
WRC	Water Resources Committee under the Ministry of Agriculture of the Republic of Kazakhstan
WWF	World Wildlife Fund

List of Unit Measures

ha	hectare
MW	Megawatt
km/km^2	kilometers per square kilometre
m/sec	meters per second
m^3	cubic metre
m^3/sec	cubic metres per second
mln	million
mln ha	million hectares
mln km^2	million square kilometres
thousand ha	thousand hectares
thousand km^2	thousand square kilometres

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CHAPTER 1. COUNTRY REVIEW

1.1. Physical and Geographical Conditions

Location

Kazakhstan is situated in the middle of the Eurasian continent. The country's geographical boundaries extend approximately 3,000 km from east to west and 1800 km from north to south. Kazakhstan is the ninth largest country in the world (2.72 million km^2). In the west, the country's border runs along the edge of the Caspian Sea and the steppes of Privolzhye, reaching in the north the southern spurs of the Ural Mountains and extending further eastwards along the southern edge of the West-Siberian Plain to the mountain ridges of Altai. Kazakhstan's eastern border runs along the Tarbagatai and Dzungaria ridges; the southern border runs along the Tien Shan Mountains and the Turan Lowlands to the Caspian coast. The highest point in Kazakhstan is Khan Tengri (6,995 meters above sea level) and the lowest point is the Karagie Depression (132 meters below sea level). Kazakhstan borders Russia to the north, China to the east, Kyrgyzstan, Turkmenistan and Uzbekistan to the south, and Azerbaijan and Iran to the west (along the Caspian Sea). The total length of Kazakhstan's border is 15,000 kilometers.

Climate

The vastness of the territory, its openness in the north and southwest, remoteness from oceans and high radiation form a peculiar climate of Kazakhstan, which significantly differs from the climate of adjacent territories and from countries situated approximately on the same latitudes. At the same time, certain specific features of the country's climate can be observed in some remote parts of the world. By the number of sunny days the southern regions of Kazakhstan resemble Egypt and California; by annual evaporation they correspond to the central parts of South and North Americas; arid summers are similar to the inland areas of Iran, Arabia, Egypt and Sudan. Comparison of certain regions of the country to regions on the same latitudes on the Russian Plain shows that the climate of Kazakhstan differs by having lengthy and severe winters, short hot summers, by a greater number of clear days, by higher aridity and changeable temperature.

Winters are long and cold in the north of Kazakhstan, mild in the central part, and warm in the south. The average temperature in January varies from -18ºC in the north to -3ºC in the extreme south of the Kazakhstani plains. On the plains, summers are long and dry. Summers are warm in the north, very warm in the central regions and hot in the south. Average temperature in July varies from 19ºC in the north and to 28-30ºC in the south. In the mountains, summers are short and moderate and winters are relatively warm.

Atmospheric precipitation in the form of rain is insignificant, except for mountainous regions. In the zone of forest steppe precipitation comprises 300-400 mm per annum; in the steppe zone it decreases to 250 mm; in the territory of Kazakh rolling hills annual precipitation reaches 300-400 mm and in semi-deserts and deserts decreases to 200-100 mm. The lowest precipitation (less than 100 mm/year) falls in Pre-Balkhash, on the southeast of the Pre-Aral Kyzylkums and South Ustyurt. In the foothills and mountains precipitation varies from 400 mm to 1600 mm per annum. Maximum precipitation in the central part and in the north falls during summer months, in the south during early spring.

In winter southwestern winds prevail in the north of Kazakhstan, and northeastern winds prevail on the south. In summer northern winds prevail on the entire territory of the country. Strong winds are characteristic for the entire territory: in a number of regions hurricanes (over 40 m/sec) and exsiccating and freezing winds prevail. In summer dry periods can last 40-60 days. With atmospheric air humidity decreasing to 5-12%, this causes evaporation of water bodies, burning of vegetation (surface drought) and extinction of wildlife. In winter alternation of severe frosts (up to -40-47ºC) and thaws, instability and blowing out of the snow cover result in the freezing of trees, grass roots, formation of multilayer ice crust on the snow cover and complete freezing of water bodies causing constant lack of food, death of plain animals and mass death of fish in lakes.

Terrain

The terrain of Kazakhstan is extremely varied. The northwestern part of the country is occupied by the southern edge of the General Morainic Depression and Pre-Ural Plateau (354 m above sea level). The vast and flat Pre-Caspian Lowlands stretch to the south. In the southwestern part of Kazakhstan lies the Mangyshlak peninsula -a saline lowland with practically no vegetation, deep drain-less cavities and insular argillaceous elevations. The Ustyurt Plateau (up to 340 m above sea level) bordered by bluffs, lies to the south. In the northeast, the Pre-Caspian Lowland is bordered by the southern spurs of the Ural Mugodzhar Mountains (675 m above sea level). The Turgai Plateau (200 to 400 m above sea level) lies to the northeast of the Mugodzhar Mountains. In the south of the country, the Turgai Plateau transforms into the Turan Lowlands, which are occupied by the Kyzylkum Desert. Large and small Barsuks and Pre-Aral Karakum are located to the north of the Aral Sea.

The central part of the country is occupied by the Kazakh rolling hills. To the south of it lies Betpak-Dala, one of the most arid deserts, bordered to the south by the Moinkum Sands and to the east by the Balkhash Cavity and the sand lands of Sary Esik Atyrau. The Ili Cavity lies to the south of the Balkhash Lake, and the Sassykkol-Alakol Depression is to the north.

About 10 percent of the territory of Kazakhstan is mountainous terrain, formed by the Altai Mountains in the north-east (including Belukha Mountain, 4,506m above sea level), Western Tien Shan in the south and southeast, including the Zailiysky Alatau (4,973m above sea level), Dzhungargsky, Talassky Alatau (4,488m above sea level) and Terskey Alatau (Khan Tengri, 6,995m above sea level). Recent tectonic movements and accompanying earthquakes actively manifest in many mountainous regions of Kazakhstan.

Water Resources

Peculiarities of terrain and climate contribute to the uneven distribution of surface-water in Kazakhstan. 39,000 rivers and streams flow on the territory of the Republic. Small plain rivers and streams of less than 10 meters account for over 90% of the river network in Kazakhstan. As a rule, such streams and small rivers appear during spring floods and usually dry up in summer; they may not be filled for several drought years. There are 155 rivers longer than 100 km, and only 7 rivers have a length over 1000 km. Mountainous rivers, fed by snow and glaciers, are predominant in the south and east. Flooding there usually occurs during spring and summer periods.

The majority of the rivers belong to closed basins of the Caspian Sea (the Ural and Emba Rivers) and the Aral Sea (the Syrdarya River), the Balkhash, Tengiz, Shalkar and Karasor lakes. The largest rivers, Irtysh, Isim and Tobol, belong to the Ob River Basin. Ili, Karatal, Aksu, Lepsy, Tentek and Ayaguz Rivers feed the Balkhash-Alakol Lake system; Irtysh, Bukhtarma, Kurchum and Koldzhir flow into the Zaisan Lake and the Bukhtarma reservoir.

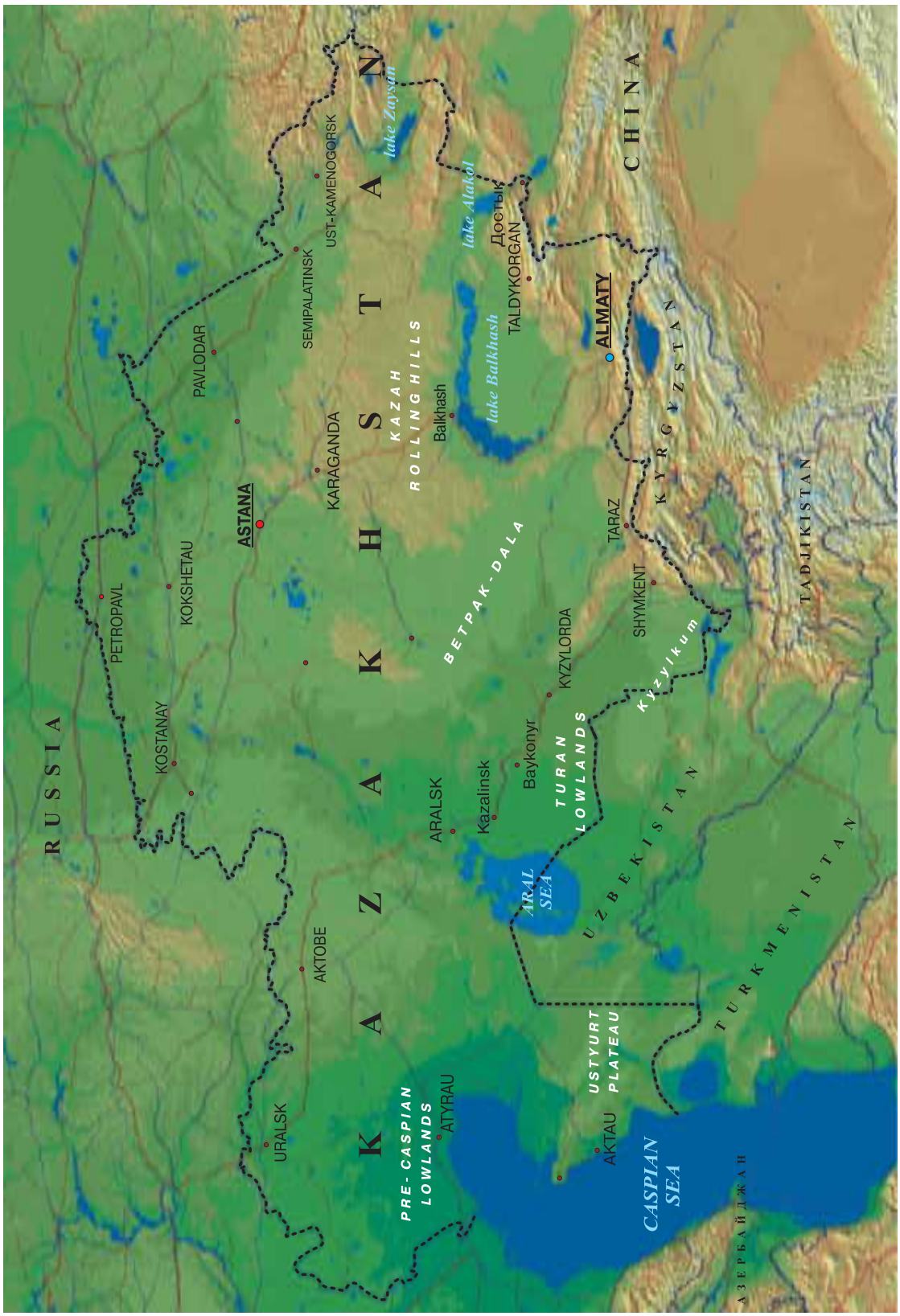
The largest rivers of Ural, Ili, Irtysh and Chu originate outside Kazakhstan. Some 42 to 44% of total water resources come from neighboring territories: 18.9 km^3 from China, 14.6 km^3 from Uzbekistan, 3.0 km^3 from Kyrgyzstan and 7.5 km^3 from Russia. In order to regulate inflow and use of water for industrial and agricultural needs, more than 4000 artificial ponds and water reservoirs have been built. These ponds and reservoirs usually block the natural watercourses, disturb the natural balance and lead to additional loss of water.

There are over 48,000 lakes in Kazakhstan; their total area is 45,000 km^2. Small lakes (less than 1 km^2) comprise 94% of these. The area of 21 lakes is over 100 km^2. Among them are Balkhash, Zaisan, Alakol, Tengiz, Seletyteniz, Sasykkol, Kushmurun, Markakol, Ulken-Karoi and others. Most lakes are of a closed type. Their water level fluctuates sharply on a seasonal and annual basis and their shape and size change periodically. Being located in desert and arid zones and occupying significant area, the network of large and small lakes performs a landscape-forming role, thus forming and sustaining steppe and semi-desert ecosystems. Many of the lake-river systems in Kazakhstan are wetlands of global significance, since they provide resting and breeding places for Afro-Eurasian migratory birds.

Many regions of Kazakhstan possess significant reserves of fresh (40 km^3) and low-salinity ground water (21 km^3), of which approximately 2.6 km^3 is allocated annually for industrial and agricultural needs.

Figure 1.1.1.

Physical map of Kazakhstan



Soils

Soils in Kazakhstan can be clearly classified by zones and altitudes. The chernozem zone is in the north: bleached chernozem of the forest steppe zone, common chernozem and southern chernozem of moderately arid steppe (10% of the total area). Chestnut soils are located to the south: dark-chestnut soils of the arid steppe zone, chestnut soils typical for the arid steppe, and light-chestnut soils of semi-deserts (33%). Further to the south brown and gray-brown desert soils expand, alternating with the massifs of desert sandy and *takyr*-like soils (45%). In the foothills of West and North Tien Shan gray and gray-chestnut soils of mountain plains and foothills prevail. The belt of mountainous brown soils is located higher; the belt of mountainous dark-chestnut, chestnut and chernozem is located in the mountains of the North Tien Shan, Saur, Tarbagatai, West Altai. The belt of mountainous bleached chernozems, forest gray and dark soils is located above the belt of chernozems, and in West Altai above chernozem-like and gray forest soils. The upper belt of all mountainous regions is the belt of mountainous meadow, sub-alpine and alpine soils. The soils of piedmont plains and mountains occupy 12.4% of the territory of the country.

Forests

Its landlocked position and remoteness from oceans and seas, uniform flat topography, vastness of the territory extending in latitudinal and longitudinal directions, various natural and climatic conditions, all determine the diversity of landscape and ecosystems of Kazakhstan.

The flora of Kazakhstan includes 68 species of trees, 266 species of bushes, 433 species of shrubs, semi-shrubs and semi-grasses, 2,598 species of perennial grasses and 849 annual grasses. According to the State Registration, the area of forest reserves and specially protected territories, as of 1 January 2002, comprises 26.08 million hectares, including 11.47 million hectares of forests.

Forests including *saksaul* woods and bushes cover 4.2% of the territory of Kazakhstan (without bushes 1.2%). Within the Republic forests are distributed unevenly. In some regions the area of forests varies from 0.1% to 16%. The largest areas covered with forests (including *saksaul* trees and bushes) are in the south (69.3%), in the southeast (15.5%) and in the north (12.1%) of the country. The main forest-forming species are conifers (pine, spruce, cedar) and non-coniferous (birch, aspen, alder, poplar, willow, saksaul), as well as shrubs such as juniper, dropwort, osier, brier and acacia.

Strip pine tree forests of birch and aspen grow in sandy soils on the right bank of the Irtysh River. Pine tree and partially deciduous forests, which account for over 60% of the forests in Kazakhstan, cover the Kazakhstani part of the Altai mountains. Cedar covers the upper mountainside, with larch, fir and spruce growing on lower slopes. Pine grows on the Kalbinsky range and its spurs, and can also be found in the valley of the Ulba River. The southern slopes are mostly covered with shrub-type vegetation.

Jungar and Zailijsk Alatau ranges border the territory of natural habitat of the northern and central Asian wood species. Forest distribution there is characterized by a vertical zone scheme: shrubs grow in lower zones, followed by wild apple and wild apricot; deciduous trees (aspen, birch) are in the middle zone and coniferous trees are present at higher levels.

Forests in the ravines and valleys of the foothills of the Western Tien Shan are recognized as origins of numerous modern cultivated species of fruit trees and small-fruit (berry) shrubs. The forests are acknowledged to be genetic reserves of global significance and are represented by a variety of wild species of apple-trees, apricot, pistachio, cherry plum (alycha), sea-buckthorn, currant, raspberry, barberry, caprifoil, brier and almond. Above the fruit zone, at an altitude of 2-3,000 meters, the mountains are covered with thickets.

Saksaul forests grow in the deserts between the Zaisan Lake in the east and the Aral Sea in the west, and help to reinforce and hold sands. Bushes of *saksaul* were traditionally used as pastures, and *saksaul* wood has always been considered a high-calorific fuel. Excessive procurement and cutting of *saksaul* has resulted in disappearance of *saksaul* forests in many regions of Kazakhstan.

Tugai forests (a southern type of flood-plain forests) grow along the banks and on islands of rivers in the southern regions of Kazakhstan. Such forests are mostly made up of oleaster, willow, poplar, tamarisk, chingil, calligonum, barberry and atraphaxis. *Turang*-poplar and a relic species of the ash tree (Sogdian ash tree) also grow in this area.

Flood-plain forests are located mostly along the Irtysh, Ishim and Tobol rivers in the north and along the Ural River in the west of the country. Willows, aspens, poplars, Russian elms, birches, bird-cherries and alders prevail; oaks prevail along the Ural River. These forests have exclusive water protection and water regulation significance.

It should be noted that the majority of natural complexes were disturbed during land development for agricultural and industrial and civil construction purposes. The beds of the main rivers were altered; inter-

mountain and steppe areas were ploughed; piedmont and flood-plain forests were cut; unique and relic biological communities have disappeared or are on the verge of extinction.

When analyzing the natural and climatic characteristics of Kazakhstan, it is worth mentioning that the arid climate, with sharp temperature fluctuations (both daily and seasonal), constant winds, land aridity and the uneven distribution of water resources prevail in most areas of the country. The country is extremely poor in forests. Steppes and semi-deserts - which are highly flammable, of low recovery and resistance to human impact - tend to prevail in Kazakhstan. The landlocked location of Kazakhstan and the transboundary nature of water and airflows make the country—from the environmental standpoint—vulnerable to external pollution, and thus responsible to neighboring countries for inefficient environmental management.

1.2. Economic and Social Developments

After gaining independence in December 1991, Kazakhstan embarked on a wholesale transformation of its economic system. The reforms aimed to create a market economy through competition and development of the private sector. The economic reforms in Kazakhstan have passed through four main stages: price liberalization (January 1992); constitutional recognition of the right of individuals to own property (January 1993); adoption by the Government of the National Programme of Privatization and its gradual implementation in industry, agriculture, transport, trade and services (April 1993); departure of Kazakhstan from the "ruble zone" and subsequent introduction of a national currency, the tenge (November 1993). These events resulted in Kazakhstan's independence in financial and monetary management.

Moreover, a reduction in trade distortions, and the privatization of small- and medium-scale enterprises were carried out early on in the transition, and the government established a basic framework to attract foreign direct investment (FDI) into its rich oil and mineral resource base. Banking reforms and state-of-the-art pension reform followed, together with the de-regulation of the electricity sector. More recently, a framework for public resource management was introduced, including foundations for a civil service and the creation of the National Fund to save part of the income from oil and other extractive industries.

The economy declined until 1995 due to severe disruption in input supply and the fact that many industries were unviable at the new relative prices. The economy advanced only modestly during the 1996-97 period and fell again in 1998 with the regional financial crisis and a severe drought that caused agricultural output to drop by 19 percent in real terms. In response, the exchange rate was allowed to depreciate in early 1999 and fiscal policy was strict. Public spending was cut by 3 percent of GDP in 1999 and has remained at around 23 percent of GDP since then.

Led mainly by the oil sector, a vigorous recovery started in 2000 and has continued through 2002 (real GDP grew 13.5 percent in 2001 and 9.5 percent in 2002). Capacity additions in the oil sector increased production from 542 million barrels per day (mbd) during the 1997-99 period to 949 mbd last year. This, and the rising world price, resulted in an unprecedented growth in oil industries, which has spilled over to the non-oil sectors. Non-oil growth has averaged 9% during the past three years and has been broad-based (e.g., agriculture, food industries, textiles, leather, wood processing, publishing and plastics). However, with the exception of grain production, most of these activities are starting from a very small base. Despite significant capital inflows, the currency has been stable and in real terms has appreciated only slightly against the US dollar. Inflation closed at about seven percent last year, mainly reflecting demand pressures for goods, such as fruit and vegetables, whose trade flows are among those tightly controlled by border and regional authorities.

Perhaps the most impressive achievement of the past few years has been a strong increase in gross national savings from 11 to 25 percent of GDP between 1998 and 2002. This has been partially driven by the general government's balance, which improved from a 7.6 percent of GDP **deficit** in 1998 to an estimated 1.4 percent of GDP **surplus** in 2002. Accordingly, the balance in the National Fund has reached US$1.9 billion (8 percent of 2002 GDP). Pension-related savings, managed by developing a private pension fund industry, have also increased with pension assets reaching $ 1.7bn (7 percent of GDP) last year and deposits in commercial banks are about 16 percent of GDP. FDI has averaged 9 percent of GDP for the 1999-2002 period, the highest among all CIS countries, although the bulk of these investments are in the oil industry (Annex 1, Table 1).

Despite these favorable developments, Kazakhstan's performance, as measured by social indicators, reveals a mixed picture. Income per capita in 2002 reached US$1520 (Atlas methodology), but with substantial income inequalities. Preliminary calculations based on the government's subsistence minimum line reveal a 38% overall poverty rate in 2001, but poverty rates in three oblasts (Zhambyl, Kyzylorda, Mangistau) are higher than 57 percent.

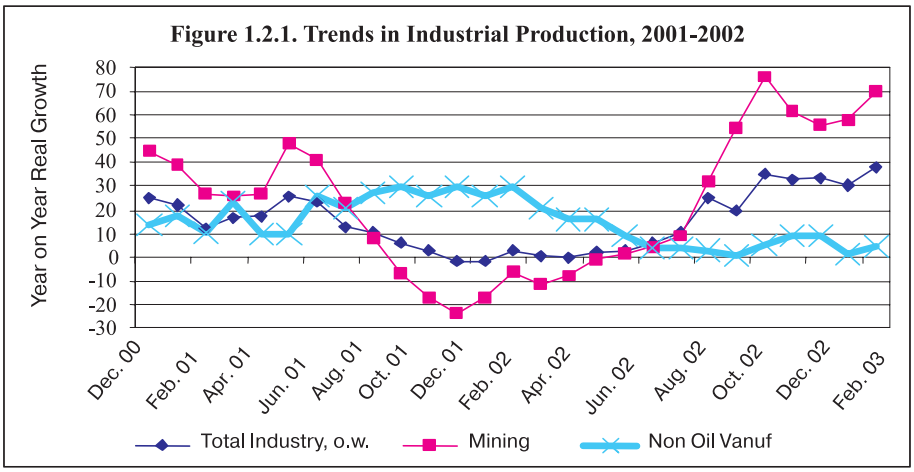
Life expectancy at birth is lower than the average for Europe and Central Asia (ECA), though in 1998 life expectancy rose slightly to 65 years. Kazakhstan's adult mortality rates and the incidence of tuberculosis are significantly higher than in other ECA countries. Access to safe water is well below the Europe and Central Asia average, particularly in rural areas where according to household budget surveys only 6.4 percent of households have access to water supply (44 percent of the population lives in rural areas). The country also faces major environmental challenges related to water availability, water pollution, and a legacy of mismanagement of natural resources, oil and radioactive industries during Soviet times (Annex 1, Table 2).

To ensure that the benefits of recent growth spread over a larger proportion of the population, the authorities are looking for ways to improve public investment (particularly in social sectors) and to promote economic diversification and non-oil sector growth. Diversification into labor-intensive sectors is seen as necessary for widespread growth in employment and income, as well as to avoid the volatility associated with excessive dependence on commodity-led growth.

Kazakhstan's economy is highly dependent on a few commodities. In 2002, oil production, processing and transport accounted for about 16 percent of GDP, while exports of oil and fuel products accounted for 56 percent of the total. Exports of non-extractive commodities (mainly grain, cotton and meat products) have been stagnant since 2000 despite economic recovery in neighboring countries, stability of the real exchange rate after sharp depreciation in 1999, and the recent recovery in world prices for key agricultural commodities. Revenue from extractive industries accounts for about 20 percent of general budget revenue. As shown in Figure 1.1, mining has been the most dynamic component of industry recently, while output growth in non-oil manufacturing has been slowing down since its peak in November 2001.

Recently, non-oil growth has been quite dynamic and broad-based. Non-oil sectors have shown positive performance since 2000 and could grow by about 7% in 2002. Prospects for diversification are reasonable, given the good performance in food processing and other manufacturing sectors (e.g., textiles, leather, wood processing, publishing, and plastics). However these activities are starting from a very small base.

Figure 1.2.1. Trends in Industrial Production, 2001-2002



Success in diversification depends on progress in the following areas: (1) facilitating international and internal trade (2) improving access to knowledge and technology (3) reducing the cost that inspections, licensing, reporting and other procedures impose on SMEs. The extent to which access to finances add constraints to diversification - particularly for SMEs - needs further exploration.

There are two major problems regarding industry. Oil and gas production are concentrated around the Caspian Sea and tend to employ relatively small numbers of highly skilled workers that the local job market finds hard to supply. Activity in mining and mineral-processing industries which have recovered is in specific corners of the country and does not offer much possibility for hiring new workers from around the country. The other major problem is that almost all of the industrial company towns that have historically owed their vibrancy to nearby light and heavy-industry will never be feasible again, as re-optimization within the sovereign Kazakhstan cannot match the previous USSR's economic or defense needs which dictated their creation and maintenance.

The agriculture sector is only slowly recovering. Given that 44% of the population lives in rural areas yet agriculture accounts for only 9% of GDP, it is therefore evident that reform in this sector should open up

productive employment to reduce poverty and urbanization. As in many CIS countries, agriculture has had to adjust to rapid institutional changes, market-based pricing, non-subsidized transport, and the loss of the captive 'Soviet' market. This led to a contraction that lasted until 1998: grain production dropped from 30 million tons in 1992 to 6.5 million in 1998, representing an average annual contraction of 20%. Livestock has also suffered during the last decade. In addition, the cattle stock fell from 9 million in 1992 to 3.9 million in 1998, representing an average annual contraction of 11%.

However, agriculture has shown clear signs of recovery since 1998, particularly in the grain sub-sector. Grain production has increased on average by 46% per year during the 1998-2002 period. By 2002 wheat production had again reached 18 million tons, a level that is probably not far from the country's sustainable potential, although stable external sources of demand and supply need to be found to avoid excessive accumulation of inventories. Recovery in other crops and in the livestock sector has, however, been much slower. Kazakhstan's agricultural sector now faces key challenges, including finding new markets for its wheat since Russia, its current market, is achieving self-sufficiency.

In one of his annual addresses to the nation, the President stressed the need to increase public spending in social sectors and rural development, as well as the need to promote innovation and export-oriented industrial development. The economic policy stance is, however, at a crossroads, with some voices in the government calling for greater state intervention in development, while others are calling for further structural reforms to improve the incentive framework (e.g. trade and taxation regimes) and selective interventions to foster greater competitiveness and productivity across industries. In this regard, the international community is being called upon to share world experience that can assist the authorities in their search for appropriate policies and interventions.

1.3. National Environmental Management

National Policy

The state program «Development Strategy 2030» identifies the following major public policy goals in the area of environmental protection and efficient natural resource use: *stabilizing the quality of the environment, ensuring a favorable environment for human activity and preserving natural resources for future generations.* Between 1994 and 2001 the Republic of Kazakhstan, recognizing the importance of natural resource conservation and its obligations to the international community, ratified 19 environmental conventions embracing preservation of all natural components, including transboundary elements.

Policy in the area of stabilizing environmental quality is aimed at:

- Securing the state's functions to own, dispose of and manage natural resources;
- Reducing the resource dependence of the economy and natural resource input per unit of output;
- Ensuring sustainable economic growth through the efficient use of natural resources;
- Analyzing the state of the environment, identifying causes, effects and objective criteria

The following documents have been prepared with the assistance of the international donor community: a National Environmental Action Plan for Sustainable Development, national strategies and action plans for biodiversity conservation, combating desertification, as well as forest and mountain ecosystem protection. The main sustainable development strategy documents - a **Sustainable Development Framework** and **Agenda 21** - are currently being developed.

National Environmental Management Policy

The Kazakhstan parliament is developing a legal framework for natural resource use and environmental quality management.

Environmental management is conducted by the Kazakhstan Government through its *central executive bodies*, such as the *Ministry of Environmental Protection, the Ministry of Economy and Budgeting, the Ministry of Energy and Mineral Resources, the Ministry of Agriculture and the Agency for Land Resource Management*. National and local governments set out procedures for environmental protection and use, approve resource use fees, regulate activities of natural resource users in accordance with legislation and implement activities for the reproduction of biological resources.

The Ministry of Environmental Protection of Kazakhstan (MEP) is the central executive body in the area of environmental protection. Its responsibilities include pursuing national environmental policy, enforcing laws, administering state supervision and state environmental impact assessment for projects in the area of environmental protection. The MEP oversees the country's compliance with ratified conventions and interstate agreements in

the area of environmental quality and conservation of bio-diversity. The MEP controls emissions and discharges of pollutants, issues permits to enterprises setting the volumes and composition of pollutants, and provides state environmental expertise for projects (Annex 1, Figure 1).

The Forestry and Hunting Committee (*FHC) under the Ministry* of Agriculture administers woodlands and specially protected natural areas: nine national natural reserves and six national natural parks. Fourteen oblast Forestry and Bio-resource Territorial Offices manage at local levels, and 138 governmental Forest Conservation Agencies - accountable to them - are responsible for forest protection and conservation (Annex 1, Figure 2).

The Water Resource Committee under the Ministry of Agriculture administers the state reporting system in relation to the protection and efficient use of water resources. Its registry includes: (i) water intake from natural water objects and ground sources (ii) fresh water consumption (iii) water use for production (iv) water use for agriculture (v) conservation of fresh water and the recycling of water supply and (vi) sewage discharges into natural water bodies and underground (Annex 1, Figure 3).

The following state agencies also have specific authority in the field of environmental protection:

- The Atomic Energy Committee of the Ministry of Energy and Mineral Resources (radioactive waste management and other sources of radiation)
- Emergency Management Agency (disaster management and prevention, including fires).
- Agency for Statistics (statistics relating to environmental management and protection).

Local oblast and rayon authorities (*akimats* being the executive and *Maslikhats* being representative authorities) are entitled to perform state supervision and can approve some provisions on and tariffs for natural resource use. They can also allocate natural resources, including mountain and woodland pastures and grasslands, and can also establish and administer local Special Protected Areas (SPAs).

Financial Mechanisms in the Area of Environmental Management and Protection

Currently, major environmental payments are centralized to feed into the national budget. The Code for Taxes and Other Mandatory Budgetary Payments distinguishes the following environmental payments:

- Charge for environmental pollution;
- Charge for land use;
- Charge for use of water resources from surface water sources;
- Charge for fauna use;
- Charge for forest use;
- Charge for protected natural area use.

In this connection, charges for the use of fauna and protected natural areas of the republican importance go to the republican budget. Others are channelled to local budgets. Thus, the bulk of environmental payments, apart from taxes paid by subsoil resource users, are paid to local budgets.

The republican budget finances state environmental activities to be managed by the Ministry of Environmental Protection and natural resources committees under the Ministry of Agriculture, with environmental protection activities being funded out of local budgets. The amount of money allocated for environmental needs is determined on an annual basis as a part of the republican and local budget approval process.

The current centralized system of environmental payment collection by tax agencies is considered more effective versus previously existed targeted environmental funds in terms of payment collection processes and related administrative costs of collection. At the same time, the lack of targeted environmental payments is a significant barrier from the point of view of management system sustainability, feasibility of measures for economic stimulation and long-term planning of rational use of natural resources and environmental management. In addition, the problem of a considerable proportion of environmental payments being spent on activities not related to environmental protection is also becoming acute. The need to set up targeted state environmental funds is being increasingly discussed by some governmental agencies. However, establishment or rehabilitation of such funds has not yet been planned officially. According to the Ministry of Environmental Protection only 8.8% of funds that local budgets receive as environmental payments is spent on environmental conservation.[1]

Cross-sectoral Cooperation in the Area of Environmental Management and Protection

Currently Kazakhstan does not have an approved national environmental protection program. The National Environmental Action Plan (NEAP) for sustainable development was developed in 1998 with UNDP support and its major components were incorporated into the extended «RK Development Strategy 2030». The action plan is designed to address the five priority issues:

[1] 'Khabar' News Agency at www.khabar.kz dated January 2004, "Gazeta.kz", Internet-based newspaper at www.gazeta.kz

- Water resource conservation;
- Conservation of forests and SPAs;
- Reduction of industrial waste and oil and gas pollution;
- Air quality improvement in cities;
- Preservation of arable land and pastures

It is apparent that even the general framework of environmental management goes beyond the competence and powers of the MEP. The process involves a number of different ministries and agencies. The system of natural resource and environmental quality management is far from perfect and requires consistent cooperative efforts. This phenomenon is typical for economies in transition, where economic and political realities tend to dictate priorities. As a result of such actions, state plans and strategies aimed at meeting social, economic, food and energy needs do not always properly consider the limited environmental capacity and assessment of actual natural resource reserves. This appears at governmental level through:

- insufficient funding for state environmental protection and restoration programs and activities;
- weak integration of environmental measures into the economic and social domains;
- exacerbation of inconsistencies in economic and environmental objectives to be addressed by the state (for instance, oil production sector development contributes to economic development but is causes land and water pollution; mineral resource production and processing results in the loss of land resources as well as air and water pollution);
- non-regulated natural resource exploitation.

It is evident that effective conservation of natural resources requires coordinated actions of the key ministries in implementation of the state's strategic environmental policy, aiming to ensure a favorable environment for the population without damaging natural resources. The quality of the environment ultimately determines the quality of the community's environment and gives us a clear idea of whether or not it is favorable for human beings. Insufficient water and air quality, as well as polluted soil and food have a great impact on human health, as well as on the social and economic development of the country's oblasts and regions.

Government action should include adoption of the National Environmental Action Plan, the National Strategy on Conservation of Bio-diversity and Combating Desertification and other long-term programs, with fixed funding from the budget and designated implementing ministries. Approval, adoption and financing of environmental programs at the national level will ensure rehabilitation of the human environment and will mitigate man-made impacts on human health. Moreover, the country's own effective public policy coupled with accession to international conventions should facilitate additional funding from the international environmental community.

1.4. Environmental Legislation

The Constitution of the Republic of Kazakhstan, which was adopted in 1995, forms the basis of national environmental legislation. Article 31 of the Constitution states that "*the state shall set an objective to protect the environment favorable for the life and health of the citizen"***.** Consequently, though the right to an environment favorable for life and health is not stipulated as a constitutional right, the fundamental law affirms the responsibility of the state to provide favorable environmental conditions for its citizens. The Constitution also states that officials shall be held accountable for the concealment of facts and circumstances endangering the life and health of the people.[2] The access of the citizens of Kazakhstan to information on the environmental situation is viewed as a guarantee of the implementation of state policy on environmental protection.

Another important document, essential for domestic and foreign policy in the area of environmental protection and nature use, is the *Concept of environmental safety*, approved by Decree No. 2967 of the President of the Republic of Kazakhstan of April the 30th, 1996. This document defines the fundamental principles and priorities of domestic and foreign policy, the legal and economic instruments, and the priority directions of activity essential for ensuring and preserving sustainable environmental, economic and human development, and the prevention of disasters and industrial hazards in Kazakhstan.

Kazakhstan's basic law in the area of environmental protection is the *Law on Environmental Protection* of July 15, 1997. This law defines the basic terms in the area of environmental protection, determines the rights of civil society (citizens and public associations) and the competence of state agencies and local government

[2] Article 31 Paragraph 2 of the Constitution of the Republic of Kazakhstan

in this area. The law determines general provisions relating to the licensing and use of natural resources and environmental protection, monitoring of the environment, environmental payments and insurance. It also establishes norms, standardization and certification in the area of environment and provides for environmental expertise, establishment of state nature reserves and specially protected natural territories (SPNT). It stipulates the need for ecological audit and control in the area of environmental protection and sets out responsibility for violation of environmental legislation as well as looking into other issues related to environmental protection.

The law on Environmental Protection[3] guarantees the right to environmental conditions conducive to life and health. Enjoyment of this right is granted not only to citizens of Kazakhstan, but also to refuges and foreigners living on the territory of the Republic. The right to a favorable environment entitles people to obtain information about environmental conditions, address state bodies with proposals on environmental protection issues, initiate and take part in public environmental expertise (EE), file for the reversal of economic or administrative decisions, as well as for the restriction of any activity which may have a negative impact on the environment or human health, and to demand just punishment. Citizens are entitled to request a public environmental impact assessment by the state. They also have the legal right to participate in the development and implementation of ecological programs, to discuss relevant draft laws and to exercise public control of environmental protection.

In addition to the above-mentioned law, Kazakhstan has adopted a number of specific laws in the area of environmental protection:

- The Law on Environmental Expertise of March 18, 1997;
- The Law on Specially Protected Natural Territories of July 15, 1997;
- The Law on Protection of Atmospheric Air of March 11, 2002;
- The Law on Protection, Reproduction and Use of Wildlife of October 21, 1993

Provisions of the Land Code (2003), the Water Code (2003), the Forest Code (2003), and a Decree from the President of the Republic of Kazakhstan of legal force on Sub-soil and Sub-soil Management (1996) also regulate issues of environmental management. The following draft laws are being developed and submitted for approval to government: the Law on Mandatory Ecological Insurance and Environmental Audit; the Law on Industrial and Domestic Waste; the Law on Wild Life Protection.

Subsidiary laws regulate specific issues on environmental protection, such as permits and payments for environmental pollution, environmental monitoring, state registers and inventories of natural resources. A normative base for environmental standards is now being developed. The relevant issues are regulated by government resolutions, normative acts of the Ministry for Environmental Protection of Kazakhstan and its predecessors, by various committees and agencies in the area of environmental protection, and by the normative acts of local representative and executive authorities.

Legislation on Environmental Expertise and Environmental Impact Assessment (EIA)

The Law on Environmental Expertise, adopted on March 18, 1997, is the first law in Kazakhstan that regulates public relations in the area of environmental expertise. This normative legal act defines the basic terms and competence of state agencies and identifies the possible and obligatory objects of environmental expertise. This law also regulates the principal issues related to the order of environmental expertise, including funding, expert commissions' conclusions, resolution of disagreements with the environmental expertise agency, and establishes general provisions pertaining to responsibility for violation of environmental expertise legislation.

Article 16 of the Law on Environmental Expertise regulates the issues of environmental impact assessment (EIA). EIA details are specified in a *Temporary instruction on procedures of environmental impact assessment* of December 30, 1993. Paragraph 4.1 of this document requires that this procedure should be applied to all types of planned economic activity, without exception. The procedure of environmental impact assessment is applied in corpora to types of environmental activity which are defined as environmentally hazardous[4], or can be applied by the decision of the central executive body in the area of environmental protection i.e. the Ministry of Environmental Protection of the Republic of Kazakhstan. Current instructions on EIA procedure do not clearly specify the requirements and do not provide for effective public involvement in this procedure.

The Law on Specially Protected Natural Territories was adopted on 15 July 1997. This normative legal act regulates issues related to specially protected natural territories (SPNT) - in particular the area of defining types and categories of specially protected natural territories, their legal status, competence of state authorities, and the procedure of arrangement, protection and use of SPNTs. The Law also reaffirms the rights of citizens

[3] Paragraph 1 of Article 5

[4] Appendix 6 to the Instruction on EIA

and public associations in the area of SPNTs and defines general requirements for the inventory and cadastres of such territories.

The various aspects of public relations related to SPNTs are regulated by subsidiary laws, among them «*Rules for use of financial resources of SPNT being legal entities»*, approved by Government Resolution No.933 of August 21, 2002; *Rules of land reservation for specially protected natural territories* and *Rules of state register and state cadastre of specially protected natural territories*, approved by Government Resolution No.983, adopted on July 18, 2001; *Rules of fees collection for use of specially protected natural territories and their services*, approved by Government Resolution No. 693 of May 10, 2000; *Rules of organization of state control of specially protected natural territories*, approved by Resolution No.80-P of the Ministry of Natural Resources and Environmental Protection of April 4, 2001. Government Resolution No.195 *On approval of fee rates for control of specially protected territories of national importance* was adopted on February 24, 2003. The *Concept of development and arrangement of specially protected territories until 2030* has been adopted and special programs for SPNT development are being created.

The Law on Protection of Atmospheric Air was adopted on June 12, 1981, with a new version in effect as of March 11, 2002. The present Law defines basic terms and principles of state control of atmospheric air conditions, determines the competence of relevant state bodies, identifies rights and duties of individuals and legal entities and establishes basic requirements for the procedure of state control of sources of hazardous atmospheric air pollution and control in the area of atmospheric air protection.

The Law determines requirements for the following specific measures: regulation of atmospheric air quality and sources of hazardous physical impact; licensing of activities associated with the emission of air pollutants; establishment of specific requirements and standards of individual types of air pollution related activities, including transport; arrangement, construction, reconstruction and the use of various economic units; settlement development; storage, disposal, neutralization and the burning of industrial and domestic waste, toxic substances and pesticides.

The Law on Protection, Reproduction and Use of Wildlife was adopted on October 21, 1993. It defines the competence of state bodies and the rights of citizens and public associations in this area of nature use. It determines the procedure for state register and cadastre of wildlife, state control and liability for violation of legislation on the protection of the reproduction and use of wildlife. Some issues regarding wildlife use are regulated by subsidiary laws. Government Resolution No.408, adopted on 10 April 2002, provides an index of rare and endangered animal species, including 40 mammals, 57 birds, 10 reptiles, 3 amphibians and 19 fish species. Government resolutions No.1140 of 4 September 2001 and No.429 of 15 April 2002 stipulate compensation of damage caused by violation of the law on protection, reproduction and use of wildlife, and associated fee rates for wildlife use. A new version of this law is to be adopted in 2003.

The Forest law of 2003 (The Forest Code) regulates the main provisions of forest use, protection and conservation of forests, as well as forest restoration. Specific issues related to the protection and conservation of forests are regulated by subsidiary laws. In particular, Government Resolution No.942 of August 23, 2002 *On Measures of saksaul conservation*, Government Resolution No.785 of July 16, 2002, *Rules for compensation of damage to forestry, and damage caused by illegal collection, logging, damage or destruction of plants from the Red Book* adopted by Government Resolution No.1186 of 12 September 2001, *Rules of forest fire safety in Kazakhstan*, adopted by decision of the Chairman of the Forestry Committee on 13 July 1996. Recently, Kazakhstan's parliament has adopted a new version of the Forest Code.

Legislative regulation of environmental pollution and environmental norms

A range of subsidiary laws regulate these issues. The procedure of issue and legalization of environmental pollution permits and general requirements of organizations exercising the right to special nature use are regulated by the rules of environmental pollution permits, approved by the Government Resolution No.1154, adopted on 6 September 2001. This document states that, depending on the volume and composition of polluting substances, a permit can be issued by the Ministry of Environmental Protection, or its local departments.[5]

Environmental pollution permits are issued on the basis of a written request from the nature user and are based on other documents that are obligatory for submission. Paragraph 10 of these rules sets out the general access to the information about these requests and permits, relevant to the volume of permitted discharge of pollutants and storage of wastes.

[5] Paragraphs 6 and 7 of the Rules of Issue of Environmental Pollution Permits of 6 of September 2001

The legislative regulation of state control and cadastres

The general provisions of the state register and cadastres of natural resources are regulated by the Law on Environmental Protection (Articles 19 and 72). The state register and cadastre of natural resources aggregates information about environmental conditions and specific natural resources, their use, reproduction and protection. State statistics in the area of environment and rational use of natural resources is also regulated by general provisions of the Law on State Statistics, adopted on May 7, 1997. The types of state statistical reports on environmental conditions and the frequency of printing are defined by resolutions of the Statistics Agency of the Republic of Kazakhstan.

The procedure of keeping registers and cadastres of specific types of natural resources was established by Resolution of the Cabinet of Ministers No.1198 of November 30,1993 *On approval of regulations for the state forest cadastre of the Republic of Kazakhstan;* Resolution of Cabinet of Ministers No.160 of February 15, 1995 On *approval of the Regulations on state water-survey and use;* **Resolution of the Cabinet of Ministers No.1153 of August 21, 1995** *On approval of procedure of state wildlife inventory and keeping the state cadastre of wildlife of the Republic of Kazakhstan;* Resolution of the Cabinet of Ministers No. 710 of June 6, 1996 *On approval of procedures of state land survey in the Republic of Kazakhstan***.**

Government Resolution No. 1285 of October 18, 1996 provides for the establishment of an inventory of nuclear waste landfills. This cadas tre should become the most important inventory of accumulated nuclear waste and should represent a source of reference for state agencies and the community. It should include detailed information about the properties of nuclear waste storages, information on organizations whose activities cause accumulation of nuclear waste, as well as a description of the wastes. However, due to lack of funds, this cadastre has not yet been developed. Recently, there has been discussion on the possibility of setting up a GIS-based unified system of natural resources cadastre, as endorsed by the special Government Resolution No. 1449 of September 25, 2000.

Laws on protection of environment and health of citizens in the areas of environmental emergencies and catastrophes

These laws include: the Law of June 30, 1992 *On social protection of citizens affected by environmental disaster in the Pre-Aral Sea Area* and the Law of December 18, 1992 *On social protection of citizens affected by nuclear tests at the Semipalatinsk nuclear testing-site.* These laws form a legislative framework for the rehabilitation of the environment and the health of residents of these two regions of Kazakhstan, which have suffered the worst environmental damage.

The Law *On social protection of citizens affected by environmental disasters in the Pre-Aral Sea Area* defines criteria for the status of a "victim of environmental catastrophe in the Pre-Aral Sea Area and the procedure for registration with the purpose of obtaining status, payment of compensation and various benefits." Due to shortage of funds, implementation of this law has been suspended until 2005.

The Law *On the social protection of citizens affected by the nuclear tests at the Semipalatinsk nuclear testing-site* defines the status of victims, their right to compensation for the damage to their health and property and determines the state's obligation of ensuring this right. It also classifies the territories affected by nuclear explosions, lists types of compensation, benefits and measures aimed at social and economic development of this territory and spells out the economic base for welfare of residents and defines the responsibilities of public officials.

The issue of liability for violation of the environmental protection regime is regulated *by criminal and administrative legislation.* Liability as a result of violation of environmental protection legislation is regulated by the Law on Environmental Protection and civil legislation. The Criminal Code in force from July 16, 1997 includes a special Article (#11) on environmental crime. This Article covers the following types of environmental offences:

- Violation of environmental statutory regulations of economic and other types of activity;
- Violation of environmental requirements during the process of production and use of potentially hazardous chemical, radioactive and biological substances;
- Violation of safety regulations during the process of handling microbiological and other biological agents or toxins;
- Violation of veterinary rules and regulations of pest and plant disease control;
- Water pollution, clogging and depletion of water resources;
- Air pollution;
- Pollution of the marine environment;
- Violation of legislation on the continental shelf of Kazakhstan and special economic zone of the country;
- Damage of land;
- Violation of regulations on protection and use of subsoil;

- Illegal capture of aquatic species and plants;
- Illegal hunting;
- Violation of regulations of wildlife protection;
- Illegal use and exploitation of rare and endangered species and plants;
- Illegal cutting down of trees and bushes;
- Destruction or damage of forests;
- Violation of the regime of specially protected natural territories;
- Failure to take measures to ameliorate the consequences of environmental pollution.

The general provisions on compensation for damage caused by the violation of environmental legislation are established in Article 86 of the Law on Environmental Protection. According to Paragraph 1 of this article, individuals causing damage to the environment, the health of citizens, the property of organizations, individuals and state, are obliged to compensate for the damage. According to Paragraph 2 of the same Article, legal entities and individuals performing environmentally dangerous activities are obliged to compensate for damage resulting from their activities.

Improvement of environmental legislation and environmental regulations

The Law No. 302 on Atmospheric Air Protection, adopted on March 11, 2002 provides for activities aimed at the reduction of atmospheric pollutant emission. Measures of Implementation of the Law on Atmospheric Air Protection were submitted to the government.

In order to implement Presidential Decree No. 491 On the State Program of Development of Insurance in the Republic of Kazakhstan for 2000 – 2002 of November 27, 2000, the government has developed a draft law on obligatory environmental insurance in order to regulate issues of civil and legal responsibility of hazardous sources by owners and environmental insurance.

The Government of the Republic of Kazakhstan has approved a *Concept of Development of the Water Sector and Water Management Policy until 2010* and a sectoral program on *Potable Water***.** In order to enhance the economic instruments for paid water supply, the *Principles of Calculation of Payment Rates for Use of Surface Waters* and a draft resolution *On Payment Rates for Use of Surface Waters* have been developed.

The Strategic Plan for Development of the Republic of Kazakhstan until 2010 and the Governmental Program for 2002 – 2004 include sections on natural resources and environmental protection. The Plan of Activities for the implementation of the Governmental Plan of Actions includes 18 environmental protection initiatives, such as measures for domestic and industrial waste reduction and a Program for liquidation of abandoned hazardous waste storages.

Procedures for mandatory ecological audits of organizations conducting environmentally hazardous activity were laid down in 1997 and additional environmental regulations on activity in the preserved areas of the Caspian Sea were developed.

Implementation of activities pertaining to *Establishment of Standards in the Republic of Kazakhstan* was continued by the MEP, while state agencies are preparing to use international environmental standards *ISO 14000***.** On February 2, 2002, the Technical Committee for standardization **"***Environmental Quality Management"* No. 39 was set up on the basis of a laboratory of the Republican Center for the Protection of Atmospheric Air (by resolution of the Committee on environmental protection of February 2, 2002). Three projects on ISO 14000, on environmental audit and qualification criteria for environmental auditors were developed and sent for registration to the State Standards Agency.

Instruction **No. 1843** *on Concordance and Approval of Planned Norms of Maximum Permitted Levels Emissions {MPE} and Maximum Permitted Discharge (MPD) of Pollutants into the Environment* of 3 May 2002 was developed and registered with the Ministry of Justice. This instruction was sent to regional agencies for environmental protection in order to guide their work.

Instructions for Concordance and Approval of Planned Norms of MPE and MPD and of Principles of Standards' Calculation approved by the order of Ministry of Natural Resources and Environmental Protection on December 19, 2001 were discussed. It was decided that a revision is needed to bring these norms into compliance with environmental legislation.

For the purposes of improvement in the normative and legal framework of SPNT, drafts of governmental resolutions have been developed and submitted for consideration by state agencies. These documents include resolutions: *On the Register of Specially Protected Natural Areas of National and International Importance***;** *On Payment Rates for SPNT Use***;** *On Regulations of Order of Establishment and Use of SPNTs; On Modification of Land Area of the State National Park Altyn-Yemel and On Allocation of Land Plots for Permanent Use to the Naurzum National reserve.*

A common problem in this area of environmental protection is the shortage of qualified experts in the field of environmental legislation, which affects the quality of normative drafts and has an adverse impact on their implementation and enforcement. The practice of drafting normative environmental legal acts with no input

from legal experts is widespread in Kazakhstan. As a result, many of these documents have legal defects. The situation is increasingly unstable when it comes to enforcement of legislation.

There is no doubt that training of professionals in the area of environmental legislation is crucial for Kazakhstan. Regardless of the great number of higher education institutions offering law courses, the majority lack qualified instructors that able to provide training in environmental law. Accordingly, the present education system does not provide follow up training or retraining of environmentalists and staff employed by environmental protection agencies.

Conclusions to Chapter 1

1. *Kazakhstan is the ninth largest country by land mass in the world and is characterized by complicated natural and climatic conditions. Its territory, which is extremely remote from and does not have access to oceans, is made up mainly of semi-desert and desert landscapes. The climate of the Republic is extremely continental and arid. The hydrographic system is very sparse and water flows are unstable.*
2. *Economic indicators have shown very favorable trends. Gross National Product has been increasing impressively and provides a good basis for resolving this young nation's socio-economic development challenges. A positive tendency in the development of production and financial sectors of the economy offers potential for the implementation of a complex of measures to support social programs.*
3. *Kazakhstan faces the problem of how to effectively implement the provisions of existing legislation. Kazakhstan needs to strengthen its environmental legislation, but more important is ensuring compliance with such legislation. Moreover, capacity has to be developed to implement Kazakhstan's international environment treaty obligations.*
4. *Kazakhstan's environmental monitoring system and system for managing natural resources are being developed and require continuous institutional support. Coordination between state executive agencies has not been established and there is no uniform policy to stabilize and improve environmental quality.*

CHAPTER 2.
CHANGES IN THE ENVIRONMENT DUE TO ECONOMIC ACTIVITIES

2.1. Industry

2.1.1. The Power Sector

A brief overview of Kazakhstan's power sector

Kazakhstan's economy developed as an integral part of a single united economic complex within the former USSR. Its rich mineral resources and raw materials served as the basis for the development of a powerful industry and the specialization of the Republican branches of the national economy with a well developed fuel and energy complex. The huge investments made during the Soviet era in the coal and power sectors make it possible to successfully develop these sectors now and in the future.

Kazakhstan's largest power generating stations are located near the coal fields in the northern and central parts of the country, providing these regions with a surplus of electric power. At the same time, southern Kazakhstan lacks energy resources and has to import coal, gas, petroleum and electricity from other regions of the country and abroad. Western Kazakhstan has some of the world's richest oil and gas reserves. However, at present the country has only just begun to develop these natural resources, and continues to import some energy, as an end product, from Russia.

After independence, Kazakhstan's energy sector underwent market transformation, with the major energy producers being restructured and privatized. A number of national companies, including the national electricity grid and production and transportation of oil and gas, have been set up. Thus, the state has preserved its regulatory functions in the energy management sector. In April 1999, the "Energy Sector Development Program to 2030" was adopted in order to ensure a reliable supply of electric power in Kazakhstan. This was done in order to create an export-oriented and technologically linked fuel and energy complex, which would take into consideration domestic and foreign energy markets. The Program's main priority is to achieve energy independence. Kazakhstan has enough energy resources not only to meet domestic demand, but also to export energy resources to other countries as raw material or final energy product. The country's mineral fuel reserve amounts to about 45.4 billion tons of fuel equivalent, of which coal makes up 80%, oil 13% and gas 7%.

The **coal industry** plays a special role in Kazakhstan. The country's coal production is the eighth largest in the world and third among CIS countries. More than 40 coal deposits have been explored in Kazakhstan with commercial reserves of around 34.1 billion tons. The largest coal fields are Ekibastuz - 12.5 billion tons, Karaganda - 9.3 billion tons and Turgaisky - 5.8 billion tons. The Ekibastuz and Turgaisky fields are open caste mines: open caste coal production is 3-5 times cheaper than underground mining.

In terms of explored **oil resources**, Kazakhstan is now in the top ten countries of the world. About 208 deposits have been discovered in the Republic, with forecasted reserves of over 13 billion tons of petroleum and condensate. In 1990 about 26.6 million tons of petroleum and condensate gas were developed in Kazakhstan; by 2001 this had risen to 39.9 million tons, and in the longer term the level of annual oil production is expected to increase to 100 million tons by the year 2010.

The potential resources of **natural gas** have been estimated at more than 8 trillion cubic meters, with the main volume produced in the Caspian region. In 1990, 7.7 billion m^3 of gas were produced, of which only 2.9 billion m^3 were processed in the Republic: more than 0.65 billion m^3 of associated gas is burned as petroleum gas flares from oil production. By 2010, production of around 44.6 billion m^3 is planned.[6]

In addition to these natural resources there are bitumen reserves of 1.9 billion tons of fuel equivalent

[6]Materials of the Institute for Strategic Studies, 2001 [79]

(t.e.f) and 21 billion t.e.f of uranium. At the existing production rate, Kazakhstan has enough coal reserves to last for 200 years, oil for 120 years, and gas for 400 years.

The energy sector is the major consumer of primary energy resources in Kazakhstan, producing electricity and heat using about 50% of the fuel consumed in Kazakhstan. Energy generating sources in Kazakhstan have a total capacity of around 18 GW (gigawatt), of which heat power stations account for about 87% , hydropower stations - for about 12%, and other sources for 1%. Combined cycle power plants producing both heat and electric power generate around 38% of the total capacity (6.7 GW). In 2002, 58.2 billion kWh were generated in Kazakhstan, of which coal stations accounted for 80% of the power produced, coal & mazut stations for 5% and power stations for 15%. Power generation and consumption in Kazakhstan are presented in Table 2.1.1.

Table 2.1.1.1.

Power Generation and Consumption in Kazakhstan

Indicators	1990	1995	2000	2002	2010 max/min	2030 max/min
Consumption, billion kWh	104.72	74.38	54.4	58.0	72/60.5	130/90
Generation, billion kWh	87.38	66.98	51.4	58.2	72/60.5	130/90
Import	17.34	7.4	3	-	-	-

Source: Programme of Power Sector Development until 2030

Kazakhstan's climatic conditions result in significant consumption of energy for heating. Annual consumption of heat amounts to about 150 mln. Gcal, the majority of which is consumed by cities. Central district heating and electric and heat power plants cover over 50% of heat demand in the cities. This provides people in the cities with comfortable living conditions and—with the use of cogeneration power plants—reduces fuel consumption. Heat consumption in Kazakhstan for the period 1990-2020 are presented in Table 2.1.1.2.

Table 2.1.1.2.

Heat Consumption in Kazakhstan, 1990-2020

Heat consumption, Gcal/year	1990	1995	2005* max/min	2010* max/min	2020* max/min
Heat consumption in urban areas	109.7	98.3	104.4/102.6	119.9/115.8	133.9/123.0
Heat consumption in rural areas	62.0	60.0	53.0	46.0	45.0
Total	171.7	158.3	157.4/155.6	165.9/161.8	178.9/168.3

Source: Programme of Power Sector Development until 2030

Social and economic risks of the power sector

The fuel and energy complex is essential to ensure life and economic development of the country. Currently, the needs of the national economy in energy resources are met through domestic production, which covers 86% of the need in oil refinery products, 45-50% of the need in natural gas and 100% of the need in electric power. Therefore, the economy depends on imported oil refinery products and gas. The lack of domestically produced oil products and gas fuel has a negative effect on secure supply of transport with fuel and of power engineering facilities and the country's population with gas fuel.

The main challenge that the power sector (electric power and heat supply) is facing an increasing deterioration of its key assets, which is now estimated to be 50%. Key assets deterioration causes excess fuel flow, affects the effectiveness and reliability of power supply and may cause a shortage of power supply, which will hamper the socio-economic development of Kazakhstan.

Heat water supply is now strained in cities. Centralised heat supply networks have undergone just minor upgrades or renovations, which may cause heat water supply failures in wintertime and initiate emergencies. The main factor hindering investment in upgrading and restoring the power sector is limited rates of heat and power charges due to low capacity of the majority of the population to pay for heat and power supply services.

Rural electric power supply is another concern, especially in remote areas, which is also largely due to low paying capacity of rural population. Rural people experience lack of electric power and fuel supply to make food and heat their homes. Deficient electric power supply of rural settlements negatively affects the living

standards of rural population, who are deprived of such services as lighting, water supply, storage of perishable foods, television and radio broadcasting, etc. The needs of rural population in fuel are often met through using local vegetation, causing large-scale cutting of trees and bushes, which significantly damages the nature, especially in areas with poor vegetation, and leads to degradation and desertification.

All of the above mentioned factors hamper the social and economic development of rural areas, cause migration and land retirement and, ultimately, damages the country's economy.

Energy-saving

Increasing effectiveness of power is vital to Kazakhstan's economy. Rates of the Kazakh GDP's energy output remain very high (1.8 USD/kg of fuel equivalent) versus rates of developed countries (5.5USD/kg of fuel equivalent). GDP's power consumption has increased by 15-20% over the period of economic reforms started in 1991. This has had a negative effect on both the overall economy and end users.

The transition of the economy to energy-saving technologies is justified in terms of both environmental security and rational use of fuel and power resources. According to some expert data excess fuel flow is 10-15% for electric energy production and 15-20% for heat supply. Costs of introduction of energy saving technologies are 5 times less than costs of new energy production. Kazakhstan has developed and adopted National Energy-Saving Programme. However, in practice little is done to promote energy saving. In order to support energy saving, as a part of technical assistance to Kazakhstan, UN Development Programme and the Government of the Republic of Kazakhstan are implementing a project "Removing barriers to energy efficiency in municipal heat and hot water supply" that aims to increase energy efficiency of the heat supply sector in Kazakhstan.

Ecological risks related to energy sector activity

Air pollution

The power sector in Kazakhstan is one of the main sources of atmospheric pollution through its emissions of sulfur oxide, nitrogen, carbon monoxide and ash (Table 2.1.1.3). In 1990 the energy sector emitted around 2.3 million tons of such pollution, accounting for 35% of total atmospheric emissions and 53% of emissions from stationary sources. In 1996, there were about 1 million tons emitted, or 28% of the total volume of emissions and 41% of emissions from stationary sources. Much of this pollution is caused by the use of low quality coal as the main fuel, and also by poorly equipped thermal power stations with systems of purification of volatile gases of boiler-houses.

Due to decreases in thermal and electric power production the amounts of pollutants emitted by the energy sector have decreased by almost 50%. Nevertheless, the atmospheric pollution problem caused by the energy sector remains severe.

Table 2.1.1.3.

Weight of pollutants from heating and power generation enterprises, ferrous and nonferrous metallurgy and oil and gas sector

Gaseous emissions	1990	1991	1992	1994	1995	1996	1998	1999	2000
Emissions of CO_2, thousand tons	275.1			182.3					113.5
Emissions of CH_4, thousand tons	2.2			1.8					1.4
Emissions of greenhouse gases, CO_2 equivalent	319.0		324.5					152.9	152.5
Emissions of SO_x NO_x CO, thousand tons.	1,480 738 2,158	1,471 319 760	1422 310 687	1135 241 468	1133 233 446		983 159 361	946 151 380	1080 162 391
Total weight Emissions of pollutants from stationary sources, million tons	4.7	4.3	4.1	3.3	3.1	2.4	2.3	2.3	2.4
Power sector contribution of Total, million tons	2.5					1.0			

Source: Environment Pollution Monitoring Centre, Kazgidromet

Greenhouse gas emissions and the costs of their reduction

Surveys have shown that global climate change, caused by increased concentration of greenhouse gases in the atmosphere, can have a significant negative impact on the economy and natural resources of Kazakhstan. The country's climate is characterized by its increasing cyclical pattern and intensity of extreme weather conditions: the average annual temperature has increased by a factor of 1.3 over the past one hundred years, which is more than double the global average increase. Climate change can intensify desertification and land degradation, decrease agricultural productivity and increase the water resource deficit.

According to the International Energy Agency, Kazakhstan leads the world in greenhouse gas emissions per GDP unit (3.38 kg/USD), and holds the 13th place - per capita (13.3 tons of CO_2 per person).

An inventory of emission sources and greenhouse gas discharges and compilation of national cadastres was carried out for various years in Kazakhstan (1990, 1992, 1994 and 1999-2001). The results indicate that the major causes of greenhouse gas emissions are activities in the country's energy sector. These include production, transportation, processing, and flaring of various kinds of organic fuel, mainly coal. CO_2 accounts for 78%; methane – for 16% and nitrous oxide – for 6% of total GHG emissions.

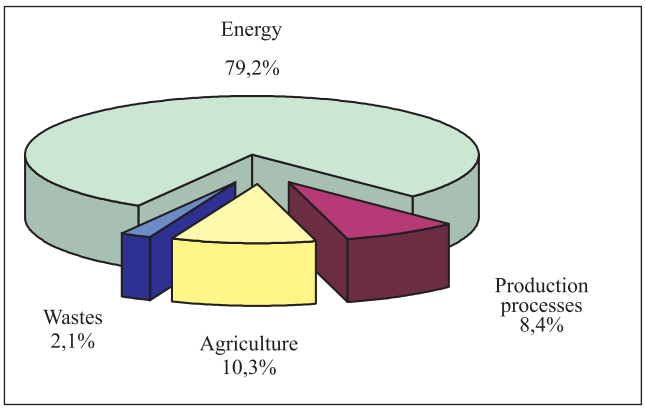
According to the Kazakh inventory of total gas emissions, greenhouse gases with direct greenhouse effects amounted to 154.7 million tons of CO_2 equivalent in 2001, including 122.5 million tons of emissions from the energy sector, 13 million tons from industrial processes, 16 million tons from the agricultural sector and 3.3 million tons from waste. Forest sequestration of CO_2 totaled 8.3 million tons.

Therefore, Kazakhstan's net emissions are estimated at 147.5 million tons of CO2 equivalent. Total CO2 emissions are 120.8 million tons without forest seizure and 112.5 million tons with forest sequestration. Total emissions of greenhouse gasses were 10 tons per capita in 2001, of which 8.1 tonnes were pure CO2 emissions.

Figures 2.1.1.1 and 2.1.1.2 show the input of greenhouse gas sources in total emissions and percentages of the main greenhouse gases in Kazakhstan's total emissions in 2001.

Figure 2.1.1.1.

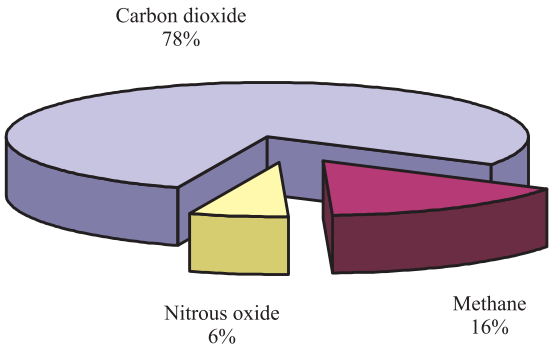
% of National Emissions by Sources in 2001



Source: KazNIIMOSK, 2002

Figure 2.1.1.2.

% of GHG in Total National Emissions in 2001

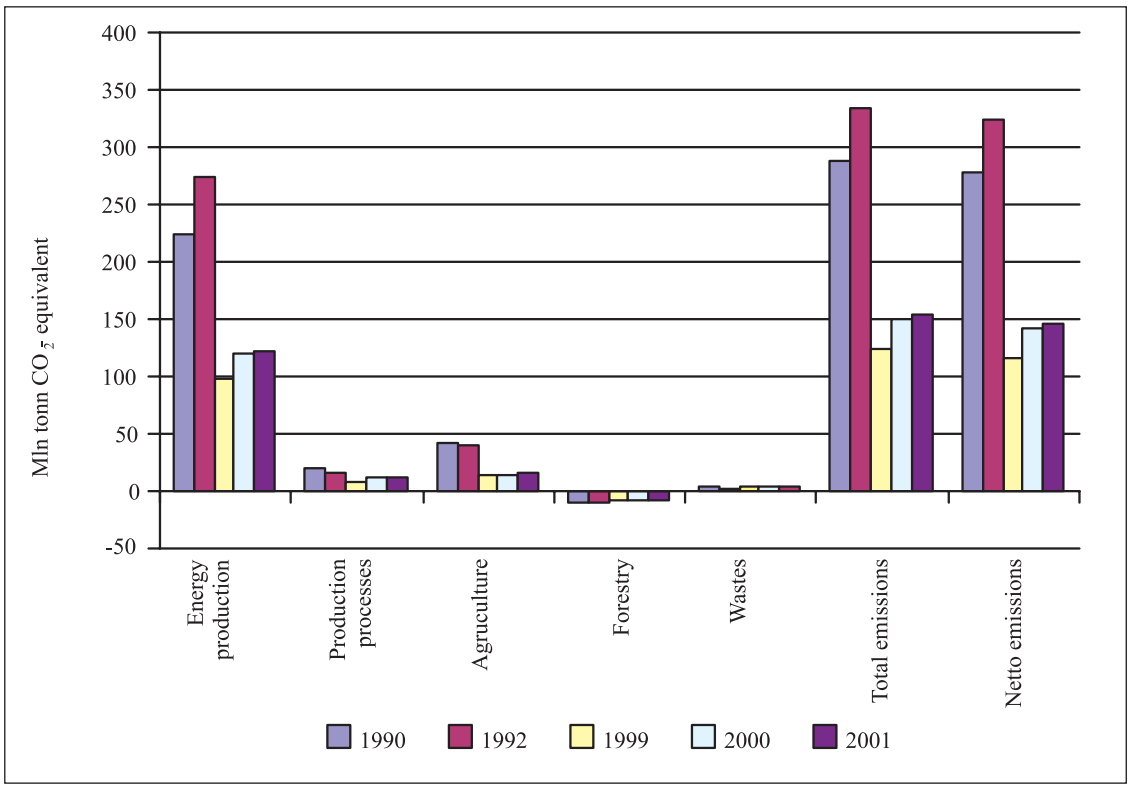


Source: KazNIIMOSK, 2002

The level of greenhouse gas emissions in 2001 was 48% of the level of the base year of 1992, when the emitted volume was at its peak (Figure 2.1.1.3). This reduction was due to the economic decline that started in 1992 and was accompanied by radical restructuring of the industrial sector, an increase of the relative share of raw material resources and the energy sector, and a decrease of input in the processing industry.

Figure 2.1.1.3.

GHG Emissions by Main Sources in Kazakhstan



Source: KazNIIMOSK, 2002

Thus, in spite of having significant energy resources, a developed energy sector, and an economy that is energy intensive, the population does not have sufficient energy supply. In this light, steps to decrease the intensity of the energy sector, increase the effectiveness of industrial production and energy transportation, energy resource use - including renewable energy sources - in conjunction with population support of the energy supply goal are necessary to provide Kazakhstan with sustainable development and an increase in living standards.

The potential for use of alternative energy sources

Alternative or renewable energy sources include hydro-electric power, wind power, marine wave action, solar radiation, geothermal energy, energy of biomass and biogas.

Kazakhstan has significant potential in renewable energy sources, but only a small part of this is being used. This is due to the fact that Kazakhstan's energy sector was developed as part of the centralized energy supply system of the huge and 'traditional' electricity production stations of the former Soviet Union. The development of local energy sources was not emphasized.

The issue of renewable energy development has been highlighted for different reasons. The vast territory of Kazakhstan, its low population density and concentration of generating capacity mainly in the northern part of the country, mean that energy must be transported over significant distances, resulting in losses of up to 30%. Therefore the centralization of the energy supply of remote areas is economically inefficient and the development of small and alternative energy supplies has the potential to solve some of the existing problems, in particular:

- Guaranteed energy independence,
- Organization of energy production at the location of its consumption,
- Improvement of ecological conditions,
- Provision of electricity to remote nomadic settlements and the work settlements of geologists and oil workers.

According to the survey "Kazakhstan and Kyrgyzstan - opportunities for the development of renewable energy sources" executed within the framework of the Program of Technical Assistance ESMAP in 1997, about 5100 remote settlements in Kazakhstan are not connected to electricity transmission lines. Under these conditions the development of renewable energy sources to provide local energy is economically justified.

Hydroelectric power

Kazakhstan possesses significant potential for hydroelectric power, estimated at 170 billion kWh annually. The economic potential is 23.5 billion kWh and at present about 8 billion kWh are used annually. The development of small river potential in Kazakhstan is also quite promising. According to data of the Kazakhstan Institute "Hydroproject", more than 503 projects are available for construction of hydroelectric power stations on small rivers, with an overall capacity of 1380 Megawatts. Possible electric power production by these small river power plants has the potential to produce around 6.3 billion kWh annually. The State Program of "Electro-energy development until 2030" foresees construction of a number of hydroelectric power stations. The most promising projects are: Mainakskaya hydroelectric power station on the Charyn River, with a capacity of 300 Megawatts; and Kerbulakskaya hydroelectric power station on the Ili River, with a capacity of 50 Megawatts. Annual production of electric power by these river facilities may reach about 900 million kWh.

Wind power

Due to its location, much of Kazakhstan is in the 'wind belt' of the northern hemisphere and is extremely rich in wind resources. According to estimates, the density of the wind potential in Kazakhstan equals approximately 10 megawatts per square kilometer.

A number of areas in the northern, central, and southeast regions of Kazakhstan, and also in western Kazakhstan, have considerable wind potential. According to data from meteorological observation posts, the average wind speed in these regions exceeds 5 km/second and in some places reaches 6-7 km/second, making the use of wind potential a viable prospect. The Kazakhstan Institute, Kazselenergoproekt has surveyed at least 15 sites for the construction of large Wind Energy Stations ('wind farms') that have the capacity to produce several hundred megawatts. According to the 2030 Energy Development Program, a 500-megawatt wind power station (WPS) is expected to be built in Kazakhstan. These wind farms have the potential to produce 1-1.5 billion kWh of energy annually.

The wind potential of the Dzungarian and Sheleksky corridor in Almatinsky Oblast, southeast Kazakhstan, has been extensively investigated. Within the framework of technical assistance to Kazakhstan under the UN Development Program on wind energy development, detailed wind measurements have been carried out in these two regions, revealing significant wind potential. The average annual wind speed in the Dzungarian Gates is 7.5 km/s, and in the Sheleksky corridor – 5.8 km/s at a height of 10 meters. With support from the UNDP/GEF, the first pilot wind-driven power plant is expected to be constructed, producing 5 megawatts, in the Dzungarian Gates. The company Almatyavtomatika is currently installing the first Kazakh wind power plant at Druzhba in the Dzungarian Gates, with a production capacity of 500 kW. Other low-capacity wind farms have also been installed in several settlements. There are a number of small wind energy installation projects in Akmolinsky Oblast benefiting from Dutch technical assistance.

There are also prospects for wind energy use to raise water from wells using wind pumps. In Soviet period such wind pumps were widely used in the territory of Kazakhstan.

Solar energy

In spite of the fact that Kazakhstan is located northward between latitudes 42 and 55, the potential solar radiation is significant and may produce 1300-1800 kWh per square meter. Due to the continental climate the number of solar hours is about 2200-3000 per year, making solar energy use possible.

The main area of solar energy use is the generation of hot water using solar collectors, or 'suntraps'. According to estimates of local experts it is possible to generate about 13 million Gcal of heat for heating water supplies, allowing savings of more than 1 million tons of petroleum equivalent. The use of solar panels for heating water can be carried out both on boiler systems for a central heat supply and a heat supply for individual buildings. Now, with the support of UNDP and the Canadian Agency for International Development a pilot project is being carried out on the use of solar collectors in one boiler-house in Almaty.

In Kazakhstan there is great demand for solar collectors to heat water. However, they have not yet found wide application due to their high cost, at around 200-300 USD per 1 sq. meter. However it is possible to significantly decrease the cost and expand the scale of their application if the solar collectors can be produced locally.

The other area of potential solar power use is the generation of electricity with the help of photo-

electric converters. Photo-electric panels can be used to generate electricity in small quantities for such needs as illumination, tele-radio broadcasting on small agricultural farms and shepherd camps. According to estimates from research conducted under the framework of ESMAP, application of small solar photo-electric panels with batteries can work out even more economical than the use of kerosene lamps for lighting. The possible market for 20-watt solar photo-electric panels in Kazakhstan should be about 20,000 units.

There are also opportunities for photo-electric panels' application to operate small electric pumps to raise water from underground wells. A combination of photo-electric panels and wind-driven power plants for water pumps is also possible and will increase the reliability of water-supply. With the UNDP framework it is planned to implement a pilot project on water supply in remote areas in the Aral region, using photo-electric panels and wind-driven power plants which will produce electricity for pumps and a desalinization plant for preparation of potable water. The Ministry of Energy and Mineral Resources, MEP, and the Ministry of Education and Science are jointly developing a Programme on "Energy Saving and Development of Alternative Sources of Energy".

Geothermal energy

Kazakhstan has a number of places with underground sources of hot water. However, their practical use is restricted since the temperature of water is generally below 55 degrees.

According to the ESMAP research "Kazakhstan and Kyrgyzstan - opportunities for development of renewable energy sources" only one underground source of hot water above 96° has been found, close to Zharkent. This source can be used for heating needs.

Biomass

Biomass energy is the generation of gas from waste vegetation, waste products of animal husbandry, household waste products, deposits of sewage, etc. Calculations show that processing annual waste from agriculture for biogas generation can produce an energy volume equal to 14-15 million tons of fuel equivalent, or 10.32 million tons of petroleum.

TACIS and UNDP Programs support the use of biogas by farmers and inhabitants of remote settlements as a means of preserving forest tracts, harnessing animal waste and preventing stream flow pollution. In a number of settlements installations for the generation of biogas from manure have been assembled. The experience shows that use of biogas installations producing 15 cubic meters of biogas per day (1 ton of manure for 4 months) ensures heating a building of 60 square meters and cooking meals for a family of 4-5 persons.

Tidal Energy

The frontline of the Caspian Sea can serve as a source of wave energy. According to meteorological data it may be highly profitability to use wave power stations. There are projects of a modular wave power station with a capacity up to 3 megawatts. At a wave height of 3-5 meters, annual electricity production can reach about 3 million kWh with a cost price per 1 kWh of around 3-4 USD cents.

Realization of similar projects has the potential to supply oil-field settlements in the Caspian Sea area with independent energy sources and reduce current consumption of electricity from the national network by 50-85%.

2.1.2. The Oil and Gas Sector

The prospective oil and gas bearing region of Kazakhstan is some 1.7 million square kilometres in area, which is more than 62% of the total territory. To date, more than 208 oil and gas deposits have been discovered with minable oil reserves of 2.2 billion tons, 690 million tons of condensate and about 2 trillion cubic meters of gas (not including Caspian Sea shelf reserves). Forecasted resources total about 13 billion tons of oil.

Oil industry development in Kazakhstan started with the exploration well Karachungul and two deposits Dossor (1911) and Makat (1915). Maximum oil production in Emba in 1914 was 272,000 tons. Oil production has held the promise of providing the basis for stable and sustainable development of the economy for a long time. By 1991, the level of oil and gas condensate production in Kazakhstan had reached 26.4 million tons. Production of the Tengiz oil field, discovered in 1979, now accounts for almost 80% of the total volume of hydrocarbon production in Atyrau Oblast.

Long-term prospective oil production development hopes are high for the Caspian Sea shelf and the sub-salt complex of the Pre-Caspian depression. In 1999 OKIOC drilled a well to a depth of 5.2 kilometres, and the first petroleum was found in the area of Vostochnyi Kashagan in 2000. The oil-bearing capacity of the Western Kashagan geological structure has been confirmed. Commercial development of the Caspian Sea shelf will begin after 2005.

The country's oil-and-gas complex includes both its *oil refining* and *gas-processing* industries. Kazakhstan

presently has three functioning oil refineries: in Atyrau, Pavlodar and Shimkent. Their total annual capacity is 18.5 million tons of petroleum, with an average utilization rate of 65.3%. Of the total amount of petroleum processed in Kazakhstan, 40% comes from the Atyrau oil refinery, with a further 25% and 35% from Pavlodar and Shimkent, respectively.

While playing a vital role in the national economy, oil and gas production also is one of the main causes of adverse ecological conditions in production and processing regions. The pollution caused by oil refineries has generated strong public interest in connection with increased production and processing of sulphurous oil and associated sulphur emissions. In addition to oil containing traditional sulphur compounds (sulphury, free sulphur and others), the production of oils and condensates containing compounds of "active" sulphur (mercaptan, carbon sulphide) has been increasing, making their production and processing ecologically hazardous.

Of total oil industry pollutants, approximately 75%,occur as atmospheric emissions, with about 20% of pollution to water and 5% into the soil. According to estimates, about 3.5% of oil extracted is lost in the field. Some petroleum is lost in oil collection and separation systems and during transportation through oil pipelines. Losses of petroleum from tanks are also considerable in Kazakhstan due to their generally poor design. [126,134,168]

Despite some recent efforts to improve practices, considerable pollution still occurs during oil field exploitation. During exploration and development of hydrocarbon sites, 70-80% of vegetation is destroyed within a radius of 500-800 m. Atmospheric emissions and oil spills present the largest threat of pollution during oil field exploitation. The main causes of oil spills are: corrosion, defects of construction and erection works, and mechanical damage. Further, there are no reliable emergency spill prevention systems on the main domestic pipelines. The record-keeping system to account for losses at the various stages of production, collection, storage, transportation and processing does not meet contemporary requirements for resource efficiency. It is estimated that, each year, 0.02 tons of oil are spilled per square kilometre in oilfield and pipeline zones.

The most acute environmental problems are as follows:

- Development of deep "subsalt" strata (Karachaganak, Kenkyak, Zhanazhol, Tengiz, and other deposits) with a high content of sulphurous gas, sulphur dioxide, carbon sulphide, sulphide, disulphides, mercaptans, seriously impacting the environment and also hazardous to human health;
- Increased volume of technical and technological waste products with associated waters, gases, tailings, and wastes associated from dehydration, oil demineralization at preparation and millions of tonnes of sulphur lumps; and
- Crude oil production in the reserve area of the Caspian sea, where offshore drilling increases the probability of accidents (emissions of carbon sulphide, petroleum) and threatens catastrophic pollution of the sea, seabed and foreshore brushwood as well as poisoning of living organisms in significant areas.

Disposal of associated gas in oil production remains a major environmental and sanitary problem. Disposal is only performed in Manghistau oblast. Overall in Kazakhstan, over 800 million m3 of associated gas is burnt in flares annually. Over 1965-1988, 38 billion m3 of gas were burnt in flares with millions of tons of pollutants emitted into the atmosphere [75].

According to the Oblast Environmental Branch office, 25 oil refineries and gas production enterprises are located in the oblast.

In the report, Atyrau Oblast—being the most representative—has been chosen for a detailed study of the impacts of oil and gas enterprises.

The ***condition of atmospheric air*** in Atyrau Oblast is characterized as having a "moderate-low level of contamination". The sanitary-ecological condition of the city's air and surrounding areas has been characterized as generally satisfactory over the past decade, as the basic air pollutants (CO, SO_2, NOx, H_2S, phenol and suspended particles) were below the maximum permissible concentration (MPC). This is assisted greatly by favourable local weather conditions, especially by nearly constant wind. Gross annual air pollution emissions in Atyrau Oblast are some 164,650 tons. Analysis of emissions shows that hydrocarbons make up about 50-60% (sulphur dioxide about 20-30% and carbon oxides 30-40%) of the total volume of gross emissions. During 1997-2001, stabilization and increased capacity of production resulted in a noticeable increase of emissions in comparison to the economically depressed period from 1990 to 1996.

On average, 110,500 tons (72.5%) of the total emissions (165,650 tons) in the Oblast are *emissions from stationary sources*. The most significant stationary sources are oil companies, with 89% of the total. Of total atmospheric emissions, 3.85% are made by solid matters, while 94.15 % are derived from gaseous sources.

The composition of the gaseous fraction emissions from stationary sources comprises sulphur dioxide (from 7.3 to 32.5%), carbon monoxide (from 18.2 to 47%), hydrocarbons (from 13 to 44%) and nitrogen oxide (from 5.6 to 18.8%). Emission of other compounds varies from 5.6 to 18.3%.

The air pollution emissions by the biggest enterprises are shown in the table below. Their contribution to total atmospheric pollution ranges from 79.7 to 85.6% and is distributed across the enterprises, with the major polluters being: LLP «TCO»; and the Joint Stock Company "Kazakhoil-Emba".

Table 2.1.2.1.

Emissions of air pollutants from large enterprises of the Atyrau Oblast, thousand tons

Enterprises	1998		1999		2000		2001	
	Limit	Actual	Limit	Actual	Limit	Actual	Limit	Actual
LLP «TCO»	55.0	82.3	36.4	75.0	22.1	62.96	57.37	78.44
JSC «Kazakhoil-Emba»	38.9	32.85	38.8	21.9	40.9	21.35	46.67	13.1
JSC «Atyrau Oil Refinery»	17.5	12.4	15.85	11.74	15.88	12.0	15.87	11.58
JSC «ATETS»	5.4	1.6	7.89	1.66	7.9	1.43	4.34	2.17
CJSC «ITsA»	20.7	0.021	244.6	58.0	160.4	19.14	-	18.66
Total:	137.5	129.17	343.5	168.3	247.2	116.9	124.25	**123.9**

Use of Water Resources

On average, about 32.7 million cubic meters of water are used for injection into wells and are discharged into the rivers. Some 84% of discharged waters from industrial enterprises and municipal services are transported to evaporation fields. The water pumped from wells and associated strata waters are used by oil enterprises for injection into seams. This underflooding and flooding of the oil sites is causing pollution of marine and shoaling waters and reed beds, as well as decreased fish stocks and reduced seal and water bird populations. [69-71]

The oil-and-gas companies of the Oblast contaminate the soil with various chemical compounds leading to the process of ***disturbing the surface layers and structure of soil***. Manmade land pollution in the form of high percentages of mazut in soil can be seen in over 1.3 million hectares of Atyrau oblast, with the mazut level reaching 10 meters thick in some oilfields. Some 267 radioactively polluted sites with radiation powers ranging from 100 to 17,000 mcr/hr have been identified at the sites of 22 major active oilfields. The total area of radioactively polluted sites with radiation powers over 100 mcr/hr is 650 hectares, while the volume of radioactive waste reaches 1.3 million cubic metres [69-71]. The sources and reasons of land contamination are as follows:

- Use of powerful, highly destructive equipment for transport, drilling and construction;
- Major extensions of transport systems for raw material transport;
- Insufficient reliability of oil field equipment and transport;
- Accumulation of oil and drilling sludges, their processing and disposal;
- High content of hydrogen sulphide in raw materials;
- Oil spills;
- Waste and diesel fuel contaminated waters.

In 2001, the area of affected land in the Oblast was 2300 hectares, of which 134.25 hectares only have been subject to remedial action. LLP Tengizchevroil (TCO), "Kulsaryneft" and "Prorvaneft" account for the majority of disturbed land.

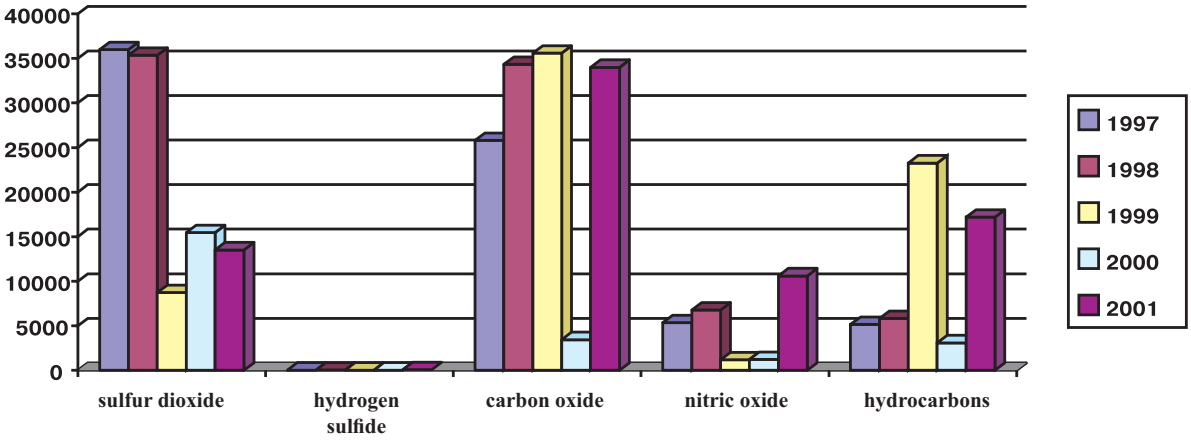
Data on activities of the largest oil companies and their impacts on the region's environment are presented below.

Tengiz Chevron Oil (TengizChevroil, LLP "TCO")

As indicated, LLP "TCO" is one of the country's biggest oil production companies and, likewise, one of its largest polluters. Gas flares, stacks, boiler houses and hydro-thermal power stations account for the largest quantity of emitted pollutants from LLP "TCO" operations. The major pollutants are: nitrogen oxide, carbon oxide and sulphur dioxide hydrocarbons.

Figure 2.1.2.1.

Distribution of emissions by components for LLP "TCO"



LLP "TCO" systematically exceeds the permissible limits of pollutant emissions into the atmosphere. The latest figures show that permissible levels were exceeded by 21,516.60 tons for 20 components (NO_2, NO, H_2S and CH, etc.). Total loss as a result of gas flaring in 2001 was 35,838.457 tons, or 46% of total emissions.

Analysis of the company's sewage structure shows significant growth during 2001 and 2002 in nitrites, iron, petroleum and sulphide etc. in the total volume of pollutants. The overall annual volume of waste discharge at evaporation fields has increased. Sewage increased by 267,000 m^3 in comparison with 2000, which is an indicator of the increasing of activities and population in the settlements run by LLP "TCO".

Warehousing and neutralization of solid waste from production and consumption is carried out in waste collectors, which are located at two acting polygons - for industrial and solid human waste.

Each year waste volumes continue to increase due to TCO operations. The 5,832 ton increase in waste formation in 2001 was due to the expansion of the borehole drilling program and the formation of additional waste from thermal desorption equipment of the borehole cuttings.

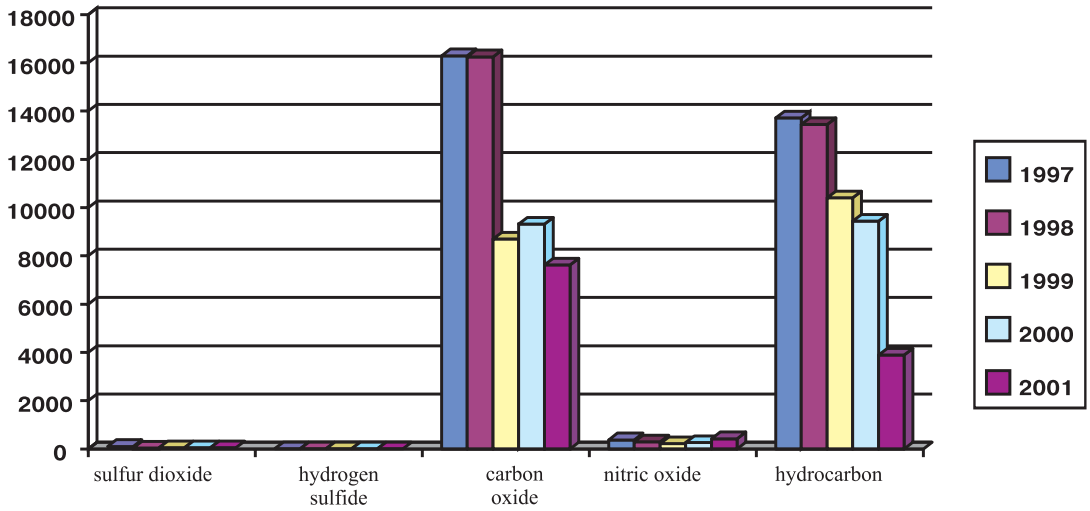
In the past 10 years the problem of salvaging or liquidating 5.6 million tons of ball sulphur has not been resolved on the TCO platforms. TCO managed to ship small amounts of crushed sulphur by railroad; however this type of shipment terminated in 1999.

JSC "Kazakhoil-Emba"

JSC "Kazakhoil-Emba" incorporates 6 oil production enterprises: "Zhaikneft", "Makatneft", "Kulsaryneft", "Dossorneft", "Prorvaneft" and "Kainarmunaigas", with a total of 3146 emission sources. Stationary sources total 2417 units, including an organized 212. The main sources of pollutant emissions at the named enterprises are boiler houses, furnaces for petroleum heating, processing equipment in the fields, popping of associated gas, welding posts, warehouses for fuel lubricant storage and auto-tractor parks. Thus, hydrocarbons (41%), carbon monoxide (35%), solid particles (ash, 4%), nitrogen oxide and sulphur dioxide are emitted into the atmosphere.

Figure 2.1.2.2.

Distribution of emissions by components for JSC "Kazakhoil - Emba"



Total emissions of the enterprise have decreased in spite of bringing new fields, such as Western Prorva and Eastern Moldabek, into operation. The reduced emissions are due to lower volumes of crude oil production and reduced fuel consumption for industrial needs.

As development of oil deposits extends over long periods, and petroleum is being extracted along with strata water, many oil fields are flooded. The extracted strata water is characterized by high mineralization, which varies within 100-225 gr/l. Not useful for any other purposes, this water is then entirely used for re-injection into strata in order to maintain strata pressure.

Operations produce various waste products resulting in soil pollution by petroleum during drilling, cleaning of tanks, etc. The area of land affected by JSC "Kazakhoil-Emba" amounts to some 2 million ha, of which only 28.4 hectares have undergone remedial action! In total, 14,591 tons of waste have been produced, of which solid wastes account for 0.5 thousand tons. In 2001, the area of disturbed lands decreased by 345.8 hectares compared to 2000. Liquidation of petroleum sumps and remediation of polluted soil, however, is being conducted at a slow pace.

"AGIP KKO" Company

In contrast with domestic and other foreign oil producers, the company "AGIP KKO" (OKIOG) implements its oil production plans directly in the reserve area of the Caspian Sea, namely in the shallow area of the sea. Wildcat drilling started in 1999 in the Eastern Kashagan deposit. Pollution of the atmosphere is caused by the drill platforms "Sunkar" and №2. Wildcat drilling causes a wide spectrum of environmental impacts. The working draft operational plan of "AGIP KKO" foresees further development of the foreshore water area, with construction of artificial islands.

The problem of drilling on the shelf of the Caspian Sea is aggravated by the fact that there has been no equivalent work conducted in very shallow waters of a landlocked body of water elsewhere in the world. This lack of experience requires the realization that additional environmental protection provisions are needed as well as the fulfilment of strict regulations to control the quality of sewage.

Negative impacts on atmospheric air are connected to pollution from incineration of petroleum during the testing of wells, and subsequently during the permanent operation of flares. Incineration of petroleum is necessary due to the impossibility of collecting and safely storing petroleum with sulphur content up to 0.22%. It has been observed that atmospheric emissions contain up to 60 volatile organic components during the treatment process. Construction of artificial islands is accompanied by the transport of stone and equipment from Bautino and transporting oily sewage, drill cuttings, municipal and economic waste to Bautino. The work of barges and ships will increase pollution in the sea, which is twice as hazardous on shore.

Emissions from wells are the most hazardous and harmful for the environment. Less hazardous but more frequent are spills of chemical substances, diesel fuel and drill mud and also the used drill mud and drill cuttings, containing petroleum, heavy metals and salts.

Conclusion

The intensity of environmental problems in the regions of oil and gas production continues to grow. Development of new deposits on land and offshore, construction of pipelines, roads, electric mains, oil refineries and gas refineries has a cumulative effect of long-term pollution of the natural environment - water, air, soil, plants and animals. Moreover, environment protection authorities rely too heavily on oil companies' use of advanced technologies, though environmental impact analyses, approved by MNREP, show them having little or no effect on environment. To date, civil society has been inactive in addressing environmental problems caused by these polluting enterprises. Local communities are also passive, mostly due to a lack of alternative employment and the near complete control exerted by these companies on the local economy. The indifference of oilfield workers is at least partially explained by their generally not coming from the polluted area.

2.1.3. The Mining Industry

The mining industry of Kazakhstan includes ferrous and non-ferrous sectors (Annex 2, Figures 1 and 2). Mining enterprises in the Republic are related to the highest category of hazardous. According to the total volume of polluting emissions, they are ranked second after the energy sector.

Extracting and processing mining industries negatively affect the environment due to a significant level of pollutants released into the air and discharged to the surface water sources.

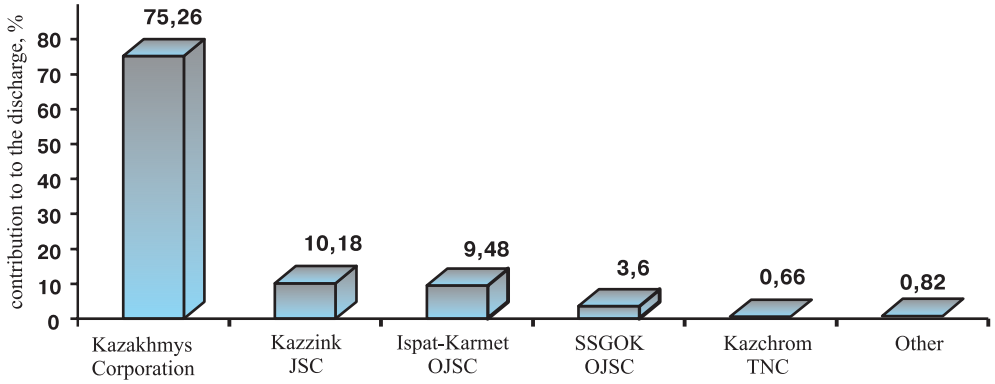
The structure and quantity of pollutant emissions of the mining industry and their hazardous impact on populated areas are determined by a number of factors, such as:

- Capacity and structure of an enterprise, applied technologies, chemical composition of ore and raw materials;
- Types of fuel;
- Capacity of technological units;
- Connection to external infrasructure in order to support on-going technological and transportation processes;
- Types of transportation;
- Location of an enterprise and its plan;
- Location of residential areas and the factory site;
- Regional climate, terrain, etc.

Gross emissions of hazardous substances by the mining industry in 2001 exceeded 1.1 million tons, including more than 672,000 tons of sulfur dioxide, more than 210,000 tons of carbon monoxide, more than 200,000 tons of solid harmful substances (disregarding the gold mining industry) and about 29,000 tons of nitrogen oxide. In addition to these major pollutants are others such as hydrogen sulphide (423.456 ton/year), ammonia (336 ton/year), hydrocarbons (821.5 ton/year), volatile organic compounds (534.45 ton/year) and specific pollutants (897.622 ton/year).

Figure 2.1.3.1.

Share of mining enterprises in total emission of sulfur dioxide



The enterprises listed below make up the category of 'Others' in the above Figure:

Nova Zinc JV Ltd.
Aluminium of Kazakhstan JSC
Zhezkazgan-Ruda CJSC
Vasilkovsky ore Mining and Processing enterprise-GOK JSC
Ust-Kamenogorskiy Titanium-Manganese Complex JSC
Kazsabton CJSC
Uzhpolimetal CJSC
Zhairemskiy Ore Mining and Processing Enterprise-GOK JSC
Ulbinsky Metallurgical Works JSC
Mining Company "ABS-Balkhash JSC""
Alash Ltd.

It is likely that emissions of small mining enterprises not considered in total emissions, may account for 30-40% of estimated emissions. This may lead to some underestimation of pollutant emissions from Kazakhstan's mining industry.

Table 2.1.3.1 provides data on emissions of the main polluter—sulfur dioxide—by larger polluters. Relative emissions can be used to project emission volumes based on indicators of production activities by the industries.

Table 2.1.3.1.

Sulfur dioxide emissions from mining industries

Indicator	Enterprise			
	Kazakhmys Corporation	Kaztsink	Ispat-Karmet	**SSGOK**
Gross emissions, ton/year	599,092	85,931.62	337,688.42	39,818.6
SO_2 emissions, ton/year	505,786.3	68,417.96	63,727.11	24,206.82
Volume of products, '000 tonnes	400.0	390.0*	12340.9**	20000***
Relative SO_2 emissions, tons /tons of all types of products	1.26	0.175	0.027	0.0012
SO_2 share in gross emissions, %	84.4	79.6	18.9	60.8
SO_2 share of total value of environmental damage caused by the enterprise, %	93.72	95.86	56.95	81.23

Note: *zinc - 240; lead - 150 thousand tons; **flat section – 369.1; tinned steel sheet –220.9; zinc covered metal – 370.5; cast iron – 4010.2; steel – 4769.2; gas carbon – 2601 thousand tons; ***pellet - 14000; iron oxide - 6000 thousand tons.

Figures 2.1.3.2 – 2.1.3.5 show contributions of each enterprise-polluter in the total value of estimated environmental damage. Considering only major pollutants, the environmental damage is estimated: by solid substances – 299 million tenge; by nitrogen oxide – 144.67 million tenge; by carbon oxide – 14 million tenge; by sulfur dioxide – 2,688 million tenge.

Figure 2.1.3.2.

Total environmental damage by solid pollutants

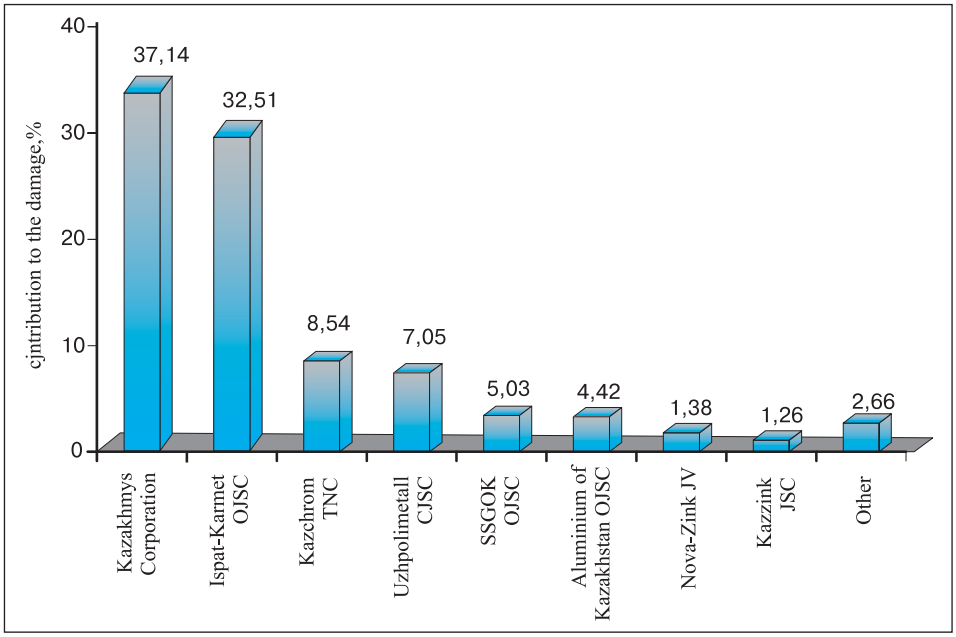


Figure 2.1.3.3.

Total environmental damage by carbon oxide

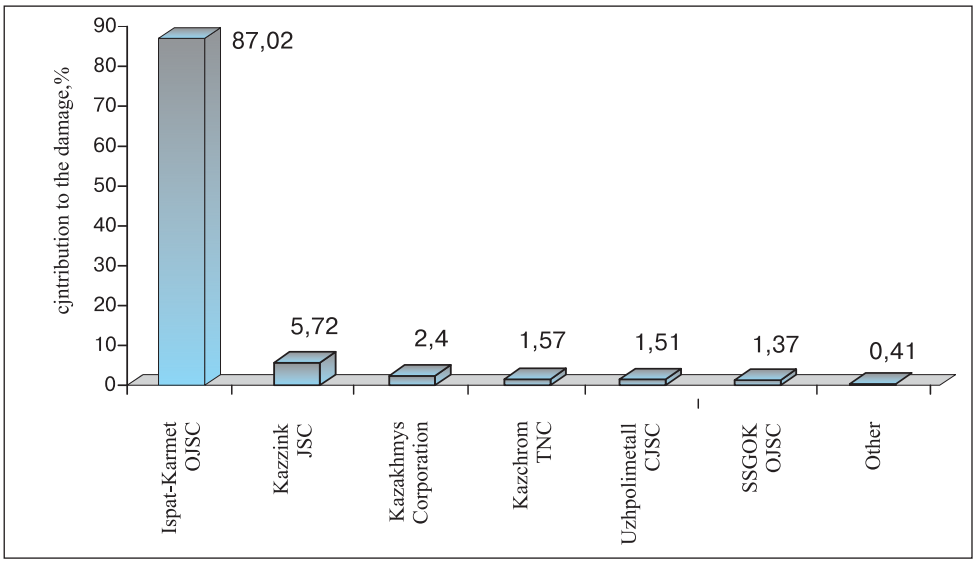


Figure 2.1.3.4.

Total environmental damage by sulfur dioxide

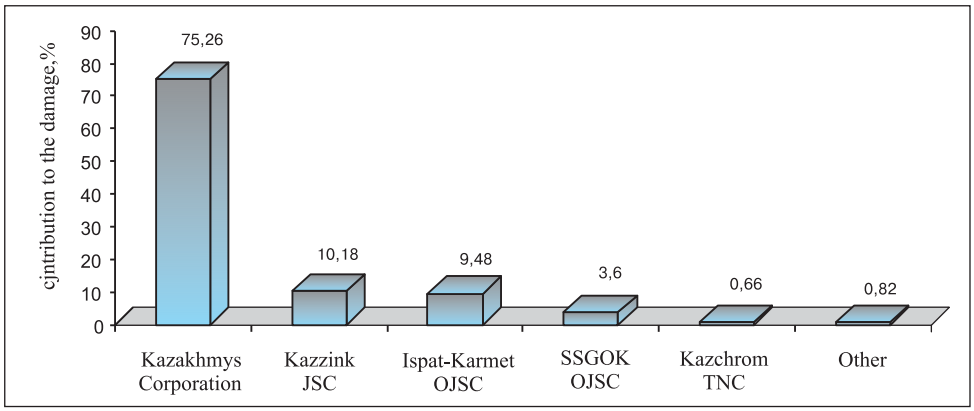
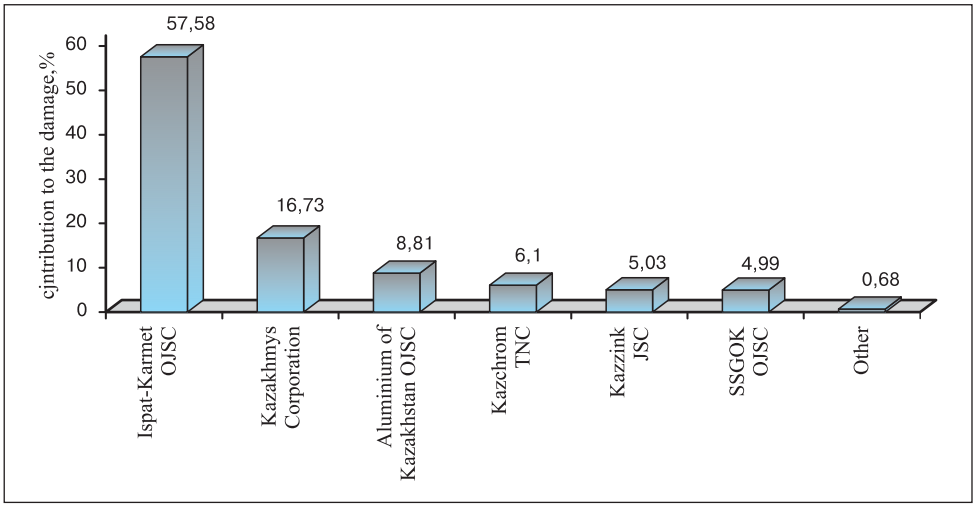


Figure 2.1.3.5.

Total environmental damage by nitrogen oxide



It is clear that the maximum ecological damage is caused by discharge of carbon oxide and nitrogen dioxide by Ispat Karmet OJSC, at 87% and 57.6% respectively; sulfur dioxide – by Kazakhmys Corporation (75%); solid substances - Kazakhmys Corporation (37%) and Ispat Karmet OJSC (32.5%). Kazakhmys Corporation is the main atmospheric polluter: its enterprises cause 68.6% of the total ecological damage.

The particulate pollutants discharged by the enterprises vary in size from around 1,000 to 0.1 microns. The dust discharged by the enterprises contains heavy metals transportable over long distances and detrimental to people's health and the environment (cadmium, lead, zinc, copper, chrome, etc.). The zone of influence zone of inorganic dust (containing 20% silicon dioxide, one of the basic pollutants of the mining enterprises) can spread for 25-100 km and far beyond the boundaries of established sanitary 'buffer' areas, which is not less than 1000 meters for metallurgical plants.

Pursuant to the Protocol "On reduction of sulfur emissions…"[7] the mining industry of Kazakhstan, being the second-largest air polluter after the power sector, should ensure at least a 20% decrease in sulfur dioxide emissions, i.e. the average efficiency of de-sulphurization in the industry should increase from 45.38 to 56.3% and to 91.68% for Kazakhmys corporation. The problem of sulfuric acid disposal is still to be addressed.

Practice shows that among uncontrolled sources of emissions of the mining sector, junctions for lift-on and lift-off of loose goods as well as grinding-sorting facilities are usually the main source of dust pollution of the surface air. Up to 100 gr/sec of dust can be discharged by mineral raw materials when they are handled, loaded and unloaded to and from railway cars and wagons. The annual volume of such discharges can reach 300 tons. Apparently, some of these sources are of short-term effect.

Ferro-alloy production is an example of atmospheric pollution by metallurgical enterprises. Ferro-alloy production in Kazakhstan is carried out by two production plants located within city boundaries. Despite the leeward arrangement of the plants in relation to residential areas, significant dust pollution reaches people's homes. The dust is composed of chrome oxides, manganese, iron, calcium, magnesium and aluminum. Chemical analysis of the dust associated with ferro-alloy production has shown the presence of the following metals: germanium, copper, barium, zinc, nickel, cobalt, beryllium, titanium, scandium, vanadium, strontium, yttrium, zirconium, niobium, molybdenum, silver, tin, wolfram, gallium and lead in small amounts from 0.0001 up to 0.88%.

At present, discharge of solid particles during ferro-alloy production exceeds ***maximum permitted discharges (MPD)***. Ground dust concentration exceeds MPD by 2-6 times. Despite the fact that the overwhelming majority of the dust discharging points at ferro-alloy plants have purification systems, practice and calculations indicate that they are not sufficiently effective to ensure atmospheric quality standards.

Introduction of technologies for the purification and utilization of emitted gases from mining enterprises will help to protect the biosphere and to considerably reduce environmental contamination. Recycling of production waste has huge potential to raise the ecological-economic efficiency of production.

Atmospheric emissions by Kazakhstan's mining industry enterprises are inventoried under the National Environmental Action Plan ratified by government resolution № 878, of June 9, 2000.

2.1.4. Industrial Waste

In Kazakhstan, as elsewhere in the world, liquid and gaseous types of industrial waste are a major concern for environmental organizations. Industrial discharges and gaseous emissions are priorities for state control and regulation of all enterprises in Kazakhstan. Methods of inspection, as well as ecological and economic standards have been developed in the country for all categories of liquid and gaseous waste products. At the same time, solid waste produced by the mining, concentrating, refining and power industries has accumulated all over the country without controls. This is largely caused by the following factors:

- Lack of research on environmental impact assessment (EIA) of solid waste and health risks;
- Absence of legal and economic leverage to control the entities storing waste in breach of sanitary regulations;
- Lack of a regulatory framework and technical equipment for environmental monitoring at the local level;
- Lack of access to information on waste composition and class of hazard

The issue of solid waste accumulation is of special concern in Kazakhstan given its economy's reliance on extraction and processing industries, which produce a huge amount of waste. About 21 billion tons of solid waste of all types has accumulated in the country. Its incremental growth amounts to 1 billion tons a year (Annex

[7] Signed in 1994 in Oslo, effective since 1998

2, Table 1). Most solid waste is stored in Karaganda (29.4%), Eastern Kazakhstan (25.7%), Kostanai (17.0%) and Pavlodar (14.6%) oblasts.[75]

Sources of Solid Industrial Waste

Dumping grounds of industrial waste containing heavy metals and toxic substances produced by the non-ferrous and precious metals industry occupies 9,200 hectares. Industrial wastes occupy 15,000 ha, of which waste piles occupy 8,000 hectares, tails of concentration plants about 6,000 hectares and wastes of metallurgic plants, over 500 ha.

1.3 billion tons of toxic waste has been accumulated by the mining and metallurgy industry in *Eastern Kazakhstan*. Every year approximately 30 million tons of solid waste pollutes the environment, with compounds of copper, zinc, cadmium and lead stored in the oblast without any recycling.

The bulk of the industrial waste in *Almaty Oblast* comes from power plants and the Tekeli concentration plant, which pollute water and soil with copper, nickel, cobalt, cadmium, lead and zinc. During the first six months of 2002 the total wastes of the plant amounted to 570,000 tonnes.

More than 180 million tons of industrial waste of "Achpolymetall", "Phosphor", "Shymkent Lead Plant" and "Shymkentnefteorgsyntez" enterprises and solid municipal waste are stored in dumps, burials and land fills *of South Kazakhstan Oblast.*

The sources of land pollution in *Karaganda oblast* are mainly enterprises of mining, coal mining, metallurgical and chemical industries. Over 350 industrial and municipal waste storage facilities are located in the oblast. The river Nura is well known for being heavily polluted with mercury. Excessive discharge of waste produced by the Balkhash mining and metallurgical works have caused pollution of soil and water with copper, zinc, cobalt, cadmium and lead.

The oil and gas sector is the main source of land pollution, with heavy metals and petroleum products in *Kzylorda, Atyrau and Western-Kazakhstan oblasts*. It is difficult to estimate the total volume of disturbed land, abandoned and buried drilling sludge and water contaminated with fuel oil and characterized by low levels of radiation. In *Mangistau Oblast*, soil polluted with cadmium and lead in excess of established norms was detected in the Arman and Karakuduk fields.

Machine building, chemical, coal-mining and oil-producing enterprises, including the Ekibastuz power plant, are the main sources of pollution in *Pavlodar Oblast*. The increasing accumulation of waste and the lack of storage and burial facilities are resulting in the migration of pollutants into the environment.

In *Zhambyl Oblast* the lands adjacent to the phosphor industry enterprises are polluted with fluorine, boron and, to a lesser degree, with lead. These elements have also polluted adjoining irrigated lands.

Toxic waste is another serious concern. Kazakhstan has an estimated 5.2 billion tons of toxic industrial waste, which comes from mining operations (4 billion tons of dumps), the enrichment of ore and mineral resources (over 1.1 billion tons) and metal production (105 million tons). The 1999 annual volume of toxic industrial waste exceeded 92 million tons, more than 60% of which is waste from metallurgical production.

The world's biggest uranium-ore mining complex is located in Kazakhstan. *Radioactive waste* is accumulated during production and processing of uranium ores. Many years of exploration, production and processing of uranium ores have resulted in the formation of hugely overburdened soils. The off-grade ores and processing waste of the radioactive ores total 50 mln/ tons and occupy 61,400 hectares. The radiation level of these waste products ranges from 35 to 3,000 mr/h, with total radiation exceeding 50,000 curie, which is a direct threat to the population. About 80,000 sources of ionizing radiation, subject to burial, are concentrated at the enterprises of Kazakhstan. Enterprises producing coal, ferrous metals, phosphorites and borates in Kostanai, Karaganda, Aktyubinsk, East Kazakhstan, Pavlodar, Zhambyl, West Kazakhstan and Atyrau oblasts have accumulated huge dumps of industrial waste from mining and processing activities. These waste products are radioactive and occupy about 25,000 hectares.[8]

In addition, waste products can be found at former and existing military bases, the Baikonur space complex, the former nuclear test site near Semipalatinsk, etc. Such waste products are normally referred to as I-III class of hazard and should therefore be buried in special storage facilities.

Waste processing and utilization

Kazakhstan has practically no waste recycling enterprises. The few currently operating recyclers face a number of financial and organizational constraints. For instance, in Pavlodar there are two enterprises employing unique technologies (up to 96% of waste is used in the production process). They are: Pavlodar Ash-Sludge Waste Processing Plant JSC and EMEKO JSC. The base raw materials used by these enterprises are bauxite slime of

[8] Reports of the Ministry of Natural Resources and Environmental Protection, [75, 76]

Aluminum of Kazakhstan JSC and ash waste of Pavlodar TES-1, resulting from combustion of Ekibastuz coal with a high ash content. The plant produces 14 kinds of construction materials, such as brick (including fire-resistant), cement, etc. Provided the plant operates on a two-shift basis, it can annually process 32,000 tons of slime and 38,000 tons of ash. However, it cannot operate at full capacity due to lack of working capital.

Enterprises of the ore dressing and metallurgical complexes, petrochemical, heat-and-power generating facilities, coal pits, etc. use industrial waste for the mining-technical reclamation of tailings, ash dumps, overburden dumps and hosting rocks. Thus, in waste-intensive areas (East Kazakhstan, Karaganda, Kostanai and Pavlodar oblasts) the percentage of industrial waste usage varies, from 1.5-2% in Pavlodar oblast to 25% in Karaganda oblast. A high level of waste utilization has been achieved in this oblast in the last two years mainly due to the use of overburden and hosting rocks for technical reclamation of up to 85% of the used and disturbed land.

The metallurgical slime stored on test sites is usually buried. This is largely due to lack of efficient and cost-effective recycling technologies. A small part of the waste is used in production and construction technologies by Ispat-Karmet JSC (Karaganda oblast), where practically all metallurgical slag is processed and reused. Zhairem Tsvet Met JSC and the Balkhash smelter of Kazakhmys Corporation process all the metallurgical slag accumulated throughout the year, together with ore, in the production of copper concentrate.

The following technologies of waste processing and neutralization are applied at Sokolovsko-Sarbaisky smelter (Kostanai Oblast): crushing of rocks for construction; use of mill tailings in the extraction of collective sulfide concentrate by a floatation unit and its further processing at the mining-chemical integrated works, although this technology has yet to be finalized.

In 2000 Maikainzoloto OJSC (Pavlodar Oblast) started to use off-balance ores from overburdened soil dumps, including dumps located in the Maikain settlement. Maikainzoloto JSC, jointly with Technopark–Stepnogorsk JSC, plans to apply environmentally friendly technology in the production of the copper-zinc concentrate without cyanides.

Ferrochrome JSC (Aktyube Oblast) is an example of successful industrial waste utilization and processing. This JSC has started to produce crushed stone from the scoria of high and low-carbon ferrochrome (more than 150,000 tons per year) and ferrodust (more than 4,000 tons per year) which is further used in the manufacturing of lime-and-sand brick (more than 12,000 pieces per year). In addition, the company plans to use a bin for the reception and sorting out of the waste for further recycling. A dedicated area will be used to store metal scrap.

Private sector participation in solid waste disposal helps to raise significantly the efficiency of recycling. For instance, in Pavlodar the situation improved after solid waste management was transferred to Polygon MDS JSC (accumulator of solid waste of III-IV class of hazard) and Spetsmashiny JSC (the city solid waste land fill). Another private company, which is part of Pavlodar Chemical Plant JSC, is engaged in collection, employing the technology of Tolyatti IFC Chelnok JSC (Russia). The enterprise has so far recycled more than 90,000 lamps. Experimental work has been conducted on 'demercurization' in the use of fluorescent lamps of Petropavlovsk by ZIKSTO JSC. In Almaty oblast the mercury-containing waste and fluorescent lamps are delivered for demercurization to the specialized enterprise Synap JSC (Almaty). A facility for the centralized collection, storage and recycling of utilized luminescent, mercury lamps and devices has been opened in Uralsk, western Kazakhstan.

Recycling efforts are being made in West Kazakhstan also. For instance, Stroitekh JSC has begun to recycle broken glass and produce consumer goods from them. A similar project is being developed by Zheksengaly JSC. Uralvtorma Research and Production Association has designed a project on recycling wood-shavings, scrap paper, wool to produce composite building slabs used in the construction industry.

In order to resolve the problem of waste management, it is necessary to develop a National Waste Management Program, spelling out waste management policies, a legal framework and methodology for waste disposal, an economic mechanism for waste management and monitoring. Implementation of this program requires: an inventory of existing tailings and dumps and assessment of their technical condition; specification and analysis of flows, volumes and components of accumulated and buried waste; assessment of risks for decision-making.

2.2. Agriculture

In order to provide a complex description of the ecological condition of Kazakhstan's agricultural sector, several key factors with the most significant influence on the development of the sector were selected.

Desertification: causes and consequences

Among the states of Central Asia, Kazakhstan possesses the largest area 'captured' by desertification processes - 179.9 million hectares. In fact, about 66% of the country's territory is subject to degradation. Examples

of this degradation are found across the whole territory, a situation caused by negative human impacts against a background of adverse natural phenomena.

In 1997 Kazakhstan joined the UN Convention to Combat Desertification. All ***types of desertification***, described in the Convention, can be found in the Republic:

- Land deterioration and loss of natural vegetation
- Salinization, soil erosion caused by wind and/or water
- Chemical pollution of soil, ground and surface waters
- Unbalanced hydrological regimes

In the regions of the country these *types of desertification* are displayed with various *degrees of intensity* - from *moderate* to *very strong* (Annex 2, Table 2). Under the influence of natural and human factors the process of desertification is continuously progressing. It is causing loss of productive agricultural land (meadows, pastures, and forest areas), dryness of climate, decrease in water supply as well as the loss of landscape and biological diversity. Desertification is also accompanied by a constant decline in living conditions which often ends in forced migration to other regions. In recent years a new term "enviornmental refugees" has appeared in the literature characterizing such groups of the population.

Natural preconditions of desertification are as follows: arid climate; insufficient precipitation and high evaporation; periodic droughts and vulnerability of ecosystems to violation of the hydrothermal regime and other negative external factors, especially in the flat parts of the country. Irregular occurrence of floods, natural disasters, winter's with extremely low temperatures, late spring and early autumn frosts, mud streams, landslides and floods may also cause desertification.

The following anthropogenic factors have the most significant environmental impact resulting in a gradual accumulation of negative ecological changes and aggravation of land degradation processes:

- Extraction of minerals, accumulation of industrial waste, construction of line structures (roads, pipelines etc);
- Intensive livestock grazing (overgrazing);
- Imperfect land cultivation system;
- Regulated run-offs of rivers;
- Extensive timber cutting / felling;
- Fires and burned-out areas (steppe and forest fires)

Extraction activities cause serious disturbance of lands, accumulation of wastes, dumps, etc. Oil and gas development leads to actual withdrawal of lands from regular use due to their complete destruction and pollution. Lands of industry, transport and communication, and defence total 17.3 million hectares. Degradation of about 10 million hectares of these lands' ecosystems has been registered. These lands can be used for agriculture only partially and remain a source of health damage to the population. The construction of line structures—roads, dams, oil and gas pipelines, power, communication lines, canals—causes significant disturbance of lands.

Overgrazing of pastures is related to the overuse of pastures due to the increase in numbers of livestock. During the period 1993-95, the load on pastures was often 2-6 times higher than established norms. Thus, in the mountain pastures, there is one sheep per 0.5 hectares, while the established norm is no less than 2-4 hectares per sheep; in desert land pastures 0.5-1 hectares are allocated per animal compared to the norm of 4-8 hectares. Overgrazing is also observed locally. 49 million hectares of degraded pastures are registered. With these ongoing processes, the structure and specific composition of the pastures also change: valuable fodder crop species disappear and the number of weed and poisonous plants increases. The balance between consumption of forage crops and speed of their recovery is not maintained.

At present, very significant desertification is taking place around wells and settlements, with remote pastures being underused due to changes in property ownership forms, redistribution of land-tenures, significant decrease of livestock as a whole and its concentration in individual farms.

The reasons for land degradation in the irrigated farming system are *imperfect irrigation systems* and *irrigation technologies* that result in secondary salinization of soils, water erosion and sometimes swamping; another cause of desertification is the use of fertilizers and pesticides resulting in chemical pollution.

Under conditions of non-irrigated farming, land degradation occurs in a number of regions of the steppe zone due to monoculture farming, plough of unproductive lands and lands susceptible to erosion and imperfect soil-protection agricultural engineering. All these factors lead to a reduced humus content in soil and the start of erosion. The total area of Kazakhstan's non-irrigated arable land is 24 million hectares, of which desert lands

make up 10.4 million hectares. More than 17 million hectares have been withdrawn from the category of arable lands due to loss of humus, salinization, low productivity of land, chemical pollution, and erosion.[9]

Regulation of river run-off is one of the most hazardous reasons for desertification, threatening Kazakhstan with an ecological catastrophe and capable of causing economic destabilization. Such regulation has resulted in the degradation of floodplain ecosystems of the Tugai forests (vegetation-covered bottomlands) with their biological diversity being reduced and meadows constantly decreasing. The level of water in underground aquifers is decreasing and an extensive aridity process is observed in all river basins. A serious threat of further degradation of land of all categories and the acceleration of desertification processes is related to future likelihood of an additional diversion of water flows of the rivers Ili, Syrdarya, Black Irtysh, Ural, etc. on the territories of the neighboring states.

Excessive forest felling, uprooting of bushes for cattle fodder and fuel, terracing of mountain slopes for farming and construction, unsystematic recreation, organization of dumps around human settlements, pollution of soils and groundwater with household and industrial waste all cause hazardous land degradation processes and are consequently considered the main causes of local desertification. In addition, the military-industrial complex plays a special role in the destructive process, the true scale and real consequences of which have not been fully identified.

Moreover, there are *institutional and legal barriers* restricting the effective fight against desertification, such as:

- Insufficient legal framework for environmental management;
- Absence of efficient management of land and water resources;
- Absence of a system for monitoring and controlling natural processes;
- Absence of programs and funds of the nature protection organizations (Committee of Land Resources, local Committees of Ecology) to carry out their work to combat desertification;
- Dominance of (short-term) economic benefits over environmental considerations in decision-making

The process of impoverishment of the rural population, absence of use of alternative methods of land management amongst the majority of inhabitants of steppe and desert regions play a decisive role in the increasing the use of the natural environment. The simple absence of fuel results in the cutting down of trees and shrubs for heating and cooking. In order to refresh the vegetation, local people regularly (in spring and autumn) set fire to the steppe and near-shore vegetation. This leads to the destruction of trees, shrubs and animals and aggravates desertification.

Loss of meadows and pastures

The trend towards reduction of size of fodder lands and their deteriorating quality are observed in Kazakhstan. Despite a significant reduction of the cattle stock during 1993-2000 the area of pasture trampled by cattle in comparison with 1990 has increased from 14.8 million hectares to 26.6 million hectares. This is related to the unsystematic use of forage lands, concentration and a load increase of cattle on the pastures adjoining human settlements and water pools. The area of destroyed pastures has increased due to transfer of arable lands of poor quality to the category of forage lands. The process of natural vegetation restoration is very slow in these lands. At present these lands, as a rule, have to go through the stage of fallow formation and are seldom used as pastures (Annex 2, Table 3-4). The biggest areas of the destroyed pastures are observed in Atyrauskaya (4.2 million hectares), Aktyubinskaya (3.9 million hectares) and Almatinskaya (3 million hectares) oblasts. Worsening of the diversified composition of vegetation and decline of its productivity are an imminent consequence to be expected as the result of unsystematic and heavy use of natural forage lands. The total area of destroyed pastures in Kazakhstan is 7.7 million hectares (in Karagandinskaya, Aktubinskaya and Pavlodarskaya oblasts) and over 80,000 hectares of hayfields are overgrown with poisonous plants (West-Kazakhstan, Almatinskaya and South-Kazakhstan oblasts).

Loss of arable lands

Within the period 1991-2001 arable lands decreased from 35.6 to 22.3 million hectares as of November 1, 2001. The most significant reduction of arable land areas has taken place in Aktubinskaya, Western Kazakhstan, Pavlodarskaya oblasts, where it decreased 2.5-3.5 times. This was due to the fact that about 13.3 million hectares (37%) were either excluded from the category of arable lands or converted to other categories. As a result, the

[9] Land Management Committee of the Ministry of Agriculture, 2001

total share of arable lands has increased from 52.2% to 64.3%, and the share of lands with negative symptoms has decreased in composition of the arable lands. Thus, the area of the arable lands with high broken rock content has decreased from 2.7 million hectares to 1.2 million hectares, saline lands – from 3.7 million hectares to 2.1 million hectares, solonetz lands – from 6.1 million hectares to 2.6 million hectares, eroded lands – from 1.9 million hectares to 0.9 million hectares, weathered lands – from 1.7 million hectares to 0.6 million hectares

However, analysis of land quality testifies that about 1.5 million hectares of land with negative symptoms at strong or moderate levels, influencing their fertility, are kept in the composition of arable land. Along with the withdrawal of low soil quality lands from the category of arable lands for different reasons, more than 4.2 million hectares of land—not complicated with negative symptoms—have been converted to other categories of arable land.[10] An inventory of plough lands will be completed soon.

Loss of land due to erosion and degradation

Erosion processes. Erosion is one of the most hazardous kinds of land degradation causing destruction of soils and loss of their fertility. According to a report "On quality condition of lands", 'erosion-risk' lands and lands subject to wind and water erosion factors occupy more than 90 million (40%) in the composition of agricultural land in Kazakhstan, including weathered lands – 25.5 million hectares, washed off – 5.0 million hectares, and subject to both wind and water erosion impact – 0.2 million hectares. The main areas of eroded agricultural lands are found in Almaty Oblast – 5.8 million hectares, South Kazakhstan Oblast– 4.1 million hectares, Atyrau Oblast– 3.4 million hectares and Zhambyl Oblast – 3,0 million hectares, Aktubinsk Oblast – 2.7 million hectares, Kzyl-Orda and West Kazakhstan oblasts – 2.5 million hectares respectively.

The extent of development of erosion processes varies and depends on climatic parameters, physical and physical-mechanical properties of soil and bedrock, angle of incline, degree of disturbance of vegetation growth, tillage methods.

Wind erosion is widespread on the territory of Kazakhstan. Erosion processes are most actively displayed on the extensive sand massifs of Karakum, Kyzylkum, Muynkum, and Saty-Ishikotrau, including regions located in desert, semi desert, dry steppe and steppe zones where soils of light mechanical composition and carbonate soils are found. 567,000 hectares (2.5 %) of arable lands are subject to wind erosion. The largest areas of weathered arable lands are in Pavlodar Oblast – 414,900 hectares, Almaty Oblast – 81,400 hectares and Karaganda Oblast – 44,100 hectares; in other Oblasts the share of weathered soils in the arable lands is much less. 12,600 hectares of soils subject to wind erosion are used in the irrigated arable lands – of that, 10,800 hectares are in Pavlodar Oblast. Over the past ten years the area of weathered arable lands has reduced from 1.7 million hectares to 0.6 million hectares due to its conversion to other categories of agricultural land.

The intensity *of water erosion* of soils depends on a combination of such factors as the erosive potential of sediments (energy of rain, and intensity of snowmelt runoffs), soil type, mechanical composition and degree of soil wash off, steepness, layout and form of slopes, length of runoff. Foci of water erosion are found in practically all oblasts, but are predominant in South Kazakhstan Oblast (958,700 hectares), Almaty Oblast (801,900 hectares), Mangistau Oblast (802,800 hectares), Akmolinsk Oblast (559,400 hectares), Aktubinsk Oblast (488,300 hectares), and East Kazakhstan Oblast (419,000 hectares). After the transfer of lands subject to water erosion to other types of agricultural lands, 929,200 hectares of washed off lands, including 12,500 hectares of substantially washed off, 93,500 hectares of less washed off and 823,200 hectares of least washed off lands are still included in the category of arable land across the Republic of Kazakhstan. The largest areas of washed off arable lands are in Akmolinsk Oblast (286,200 hectares), South Kazakhstan Oblast (223,600 hectares), East-Kazakhstan (134,500 hectares) and Zhambyl (90,900 hectares). 55,200 hectares of washed off soils are in the irrigated arable lands, of which 35,300 hectares are in South Kazakhstan Oblast.

Comparative analysis of "Reports on land quality for 1990 and 2000" shows that within 10 years, the total area of land subject to wind erosion in Kazakhstan has increased by almost 5 million hectares (22%). The total area of the washed off lands is practically unchanged. Development of erosion processes is primarily related to the fact that practically all the major required anti-erosion activities such as carrying out of soil-loss control measures with an interrelated application of administrative-economic, agrotechnical, forest amelioration, hydrotechnical measures and techniques ensuring liquidation, prevention or reduction of erosion processes, including recovery of erosive lands' fertility, have currently been stopped.

Pollution by persistent organic pollutants

Persistent organic pollutants (POPs) are a group of chemicals - industrial substances such as poly-chloride biphenyl, pesticides of the dichlorodiphenyltrichloroethane (DDT) type and harmful waste products of dioxin

[10] Land Management Committee of the Ministry of Agriculture, 2001

type - the compounds and mixtures of which have toxic properties, are resistant to decomposition and higher bioaccumulation. As a result of transboundary transfer by air and water, they settle long distances from their emission points, accumulating in water and land ecosystems. The major sources of pollution by persistent organic contaminants in Kazakhstan are agriculture and outdated production processes.

The majority of pesticides used in Kazakhstan are *herbicides* and *insecticides*. In the last two decades the volume of pesticide usage decreased almost fourfold. According to the Customs Committee, a total of 5346 million kg of persistent organic contaminants were imported in 2000, including 4,026,346 kg of herbicides, 64,702 kg of fungicides, 598,645 kg of insecticides, 10,000 kg of defoliants and 646,556 kg of other pesticides. In the first quarter of 2002 more than 6.36 million kg of pesticides were imported.

According to official data, only permitted compounds are imported to Kazakhstan. Import and sale of pesticides in Kazakhstan is carried out by the following entities (with supply volumes of over 100000 kg): the Ministry of Agriculture of the Republic of Kazakhstan; JSC "Kazexport"; JSC "Arai"; JSC "Tumar"; "Astana-Zlak" LLP; "Agrosouyz-Service" LLP and a number of other joint-stock companies and private enterprises. More than 100 firms are engaged in small wholesale trade in pesticides. The producers of pesticides with whom Kazakhstani suppliers mainly cooperate include "Ufahimprom" (Russia), "Zeneca" (Great Britain), "Uniroll Chemical" (USA), "Novartis" (Switzerland), "Ron Poulenc" (France), "Monsanto" (USA). One of the main supply items of 2.4 D-amine is imported from Russia.

However, due to transparent border activities with neighboring countries such as Russia, Uzbekistan and Kyrgyzstan, it is possible to assume that illegal import of pesticides, including DDT, is taking place. This is proven by the availability of DDT or the hexachlorocyclohexane group of drugs in various city markets in Kazakhstan.

Kazakhstan has not so far created an organized, well-defined operating control system for persistent organic contaminant management. There are no specialized organizations providing accounting, control and distribution of resistant organic contaminants. Divisions of the Ministry of Environmental Protection of Kazakhstan, the Ministry of Agriculture, the Ministry of Health and the Academy of Sciences deal with the issues of POC management. A number of activities on POC application are conducted on a sporadic and temporary basis and primarily for the purpose of reporting. Statistical data is not updated for years and actual volumes are not taken into account. This lack of awareness in government circles and among the public about the POC problem is a serious concern.

The total quantity of pesticides of all classes subject to utilization and burial is between 620,000 and 1,200,000 tons. According to data of the Ministry of Agriculture (January 1, 2001) 336,246 tons of pesticides can be found in Kazakhstan that are either forbidden or not included in the list of "chemical and biological agents permitted for agricultural and forestry 1997-2001". Besides, more than 323,032 tons of out-of-date pesticides are stored in Kazakhstan dating from Soviet times. The total stocks of POC pesticides in Kazakhstan is estimated at 39.5 tons; hexachlorocyclohexane at 24 tons (at the Atyrau anti-plague station); toxaphene at 15 tons (in North Kazakhstan region); dichlorodiphenyltrichloroethane (DDT) 0.5 tons (in East Kazakhstan oblast).

However, this data is not quite accurate since a detailed inventory at individual storage facilities and warehouses in the oblasts has not yet been taken and, consequently, the estimates are based on old and incomplete data. Thus, according to data of the government of Almaty Oblast (the Oblast Department of Sanitary Epidemiological Stations (OOC) 76,636 tons of pesticides are subject to burial in the Oblast, while according to data of the regional branch the Ministry of Agriculture, the volume of pesticides in Almaty Oblast totals 126,513 tons.

Despite the fact that in recent years the use of mineral and organic fertilizers has decreased by more than 10 times and pesticide use by 4.5 times, the problem of pollution of agricultural lands and of products cultivated on such lands with toxic and carcinogenic substances still remains. Improper use of technologies in the application and storage of fertilizers and chemicals for protection of plants is one of the main causes of soil pollution in farming.

From 1995-98 the total area of land used for agricultural purposes decreased by 31% and pesticide use fell by 5-6 times. Thousands of tons of pesticides delivered to the country in the 1970s and 80s and not used in due time by state and collective farms are now stored in inadequate premises, or outdoors, frequently dumped in a heap. Precipitation washes poisonous chemicals into the ground water, rivers and ponds, while in dry seasons the wind carries pesticide dust for hundreds of kilometers.

Results of the research show that despite the reduction in pesticide use, the problem of land pollution by pesticides remains as acute as 10 years ago. A high level of soil contamination with residual amounts of pesticides is registered in Kostanai Oblast, South Kazakhstan and West Kazakhstan oblasts, where chemicals were especially intensively applied to increase yields. The POPs used in the 1950s and 60s are still found in test samples - for instance, hexachlorocyclohexane, heptachlor and dichlorodiphenyltrichloroethane. It has been repeatedly noted that persistent organic contaminants are contained in the dust from the drained bottom of the Aral Sea.

As POPs are volatile and capable of moving across boundaries, all neighboring countries have similar

problems related to resistant organic contaminant management, their inventory and cost of their elimination. In May 2001 the Stockholm Convention "On Persistent Organic Pollutants" - an agreement on reduction and termination of ROC discharges - was adopted. Its purpose is public health care and protecting the environment from ROC impact. The convention was signed by Latvia, Lithuania, Ukraine, Moldova, Georgia, Armenia, Kazakhstan, Kyrgyzstan, Tajikistan, the Russian Federation and China.

Disturbance of soil by industries

In Kazakhstan there are 184,200 hectares of disturbed lands, which are a home for dumps of overburden rocks, tailing dumps, gold dumps, coal pits and open cast mines, oil fields and earthen containers [72]. The area of land disturbed in the exploration and construction process of industrial facilities, structures and other businesses, plus development of deposits of mineral resources in the Republic totals 176,300 hectares. 55,400 hectares is used (waste) land to be re-cultivated. The largest area of disturbed land is in Karaganda (44,000 hectares of disturbed land and 13,100 hectares of re-cultivated lands). The respective figures for Kostanai Oblast are 29,500 hectares and 8,400 hectares, for Mangistau Oblast – 21,200 hectares and 3,400 hectares, for Akmola oblast – 16,500 hectares and 7,100 hectares, for Pavlodar oblast – 15,500 hectares and 2,400 hectares respectively. A large area of disturbed land belongs to the enterprises and organizations of the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan: in Aktube oblast: NFC Kazchrome – 1,917 hectares, "Bonita Trading" – 1,852 hectares, Chilisy JSC - 1,127 hectares, OGDM "Oktyabrskneft" - 779 hectares; in Kostanai oblast: Sokolovsko-Sarbaisky smelter JSC - GOK " – 7,256 hectares, Aluminum of Kazakhstan JSC – 2,361 hectares; in Pavlodar oblast: Bogatyr Access Komir JSC – 9,367 hectares disturbed, 724 hectares – re-cultivated; TES-3 - 641 hectares and 114 hectares respectively, TES-1 - disturbed lands - 711 hectares, no land re-cultivated. In Karaganda oblast almost all large coal-mining enterprises and integrated iron-and-steel works with large areas of disturbed land have been transferred to foreign investors' management. Thus, Kazakhmys Corporation JSC has 5,797 hectares of disturbed lands and no re-cultivated lands; Ispat-Karmet JSC - 1,300 hectares and 37 hectares respectively.

At present there is a critical situation regarding disturbed lands of enterprises that have gone bankrupt or have been sold or transferred into partial leasing to new owners, including foreign legal entities, which are not responsible for the disturbed land under the contracts.

4,143 hectares of disturbed land were re-cultivated in the Republic in 2001, of which 231 hectares have been registered as arable land and 3,127 hectares – as farm land (see table). The biggest areas of disturbed land have been re-cultivated in Aktyube (2,000 hectares) and Pavlodar (1,100 hectares) oblasts. In Kazakhstan as of the end of 2001, 317 million cubic meters of topsoil are stored in dumps. The bulk of topsoil is stored in Pavlodar (295.8 million cubic meters), Kostanai (8.1 million cubic meters) and Aktyube (6.0 million cubic meters) oblasts. In 2001, 1.7 million cubic meters of topsoil was utilized and 1,600 hectares of infertile land was improved, of which 251 hectares is arable land.

Pollution by toxic waste products

Out of 21 billion tons of industrial wastes accumulated in the country, 5.2 billion are toxic. In 1999, the annual volume of toxic wastes amounted to 92 million tons, of which 60% were wastes of metallurgic industries.

The development of the mining industry in the Republic determines the quality and condition of the land, causing pollution by such toxic substances as radioactive nuclides, heavy metals, etc. The mining industry has accumulated 4 billion tons of waste; concentration plants have accumulated 1.1 billion tons of waste and metallurgical industries have accumulated 105 million tons. [76]

A major increase in accumulation of toxic waste products in *West Kazakhstan Oblast* started in 1997 as a result of the development of the oil-and-gas sector. Petroleum products and salts of metals are the main soil pollutants. Toxic wastes of class I and II are now accumulated at enterprises, thus damaging the health of the population, polluting not only wide territories but also being a potential threat to the Ural River and the Caspian Sea.

In *Mangystau Oblast* pollution of the soil with cadmium and lead above the MPD was detected in Arman and Karakuduk fields; areas polluted with fuel oil have also been identified.

The lands of the *East Kazakhstan Oblast* are contaminated with compounds of copper, zinc, cadmium, lead and arsenic. 1.3 billion tons of toxic waste have been accumulated on 976 hectares as a result of the operation of mining and metallurgical enterprises. 30 million tons of waste is accumulated in the oblast annually in addition to these volumes, with no system of waste recycling in place. A high level of lead pollution was detected in the northern part of the oblast. Lead anomalies are observed in Shemonaikha, Glubokoye and Zyrjanovsk rayons. The polluted area totals 30,000 square km. [122]

Land in the area of phosphorus industry enterprises in *Zhambyl Oblast* is polluted with fluorine, boron and, to a lesser degree, with lead. Pollution with the above elements is also observed on adjoining irrigated land.

In *Karaganda Oblast* land is mainly polluted by waste products from mining and metallurgy industries, while there are over 350 facilities for storage of industrial waste and human refuse. The Balkhash smelter discharges pollutants in excess of MPD norms, resulting in soil contamination with copper, zinc, cobalt, cadmium and lead.

The oil and gas sector is the main source of land pollution with heavy metals and oil products in *Kyzylorda Oblast*. To date, 15 oil fields have been discovered in the oblast. Particularly hazardous land pollution was caused by an accident in the Kumkol oil field in 1996. In addition to the oil sector, the main industries causing land pollution are the production of non-ferrous metals and naturally radioactive ores.

The land of the industrial production areas of *Kostanai Oblast* is disturbed by human activity and is heavily polluted. The critical issues of environmental pollution by ash dumps of the Troitsky Hydropower plant and tailings of the ore mining and processing enterprise Sokolovsko-Sarbaiskij still remain unsolved.

Machine building, chemical, coal-mining and oil-producing enterprises, including the Ekibastuz power plant, are the main sources of pollution in *Pavlodar Oblast*. Increasing accumulation of waste and lack of storage and disposal facilities has resulted in the transfer of pollutants to other regions.

The development of gold-bearing and complex ore deposits also causes land pollution with arsenic and heavy metals in *North Kazakhstan Oblast*.

The land under industrial centres is, as a rule, polluted with heavy metals and other toxic chemical substances. In urban areas over 400,000 mercurous lamps, thermometers and appliances, of which 80,000 are to be disposed in special conditions, have been accumulated. Storage areas do not meet hygiene and sanitary standards, have negative environmental impacts and cause the loss of landa.

Degradation of soil and plant resources in regions of critical ecological situation

Several large regions with adverse ecological situations have been identified in Kazakhstan. Three of them – the region adjacent to the Caspian Sea (Pre-Caspian region); the region adjacent to the Aral Sea (Pre-Aral Sea region) and the region of the Semipalatinsk nuclear testing ground have been selected for a detailed analysis from the point of view of agricultural viability.

Pre-Caspian region is one of the most unfavorable from the point of view of its natural forage land condition where about 77% (7.9 million hectares) of hayfields and pastures of Atyrauskaya Oblast display symptoms of human impact: various degrees of trampled down vegetation (49%), dockage with poorly edible grass (35%), absolutely inedible (1.3%) and poisonous plants (1.1%). A strong degree of degradation of pasture vegetation is registered on an area of 4.7 million hectares (48%), of average degree on 1.2 million hectares (12%), of poor degree - on 1.9 million hectares (20%). The total area of meadow has fallen by 3 times and of reeds by 14 times. In general, a decrease of forage land productivity is evident, therefore the forage stock is marked across the Oblast.

The change in the Caspian Sea regime has caused a significant negative impact on soil and vegetation structure and composition. It has caused the withdrawal of a significant part of natural forage lands from agricultural rotation, having aggravated the existing critical situation in forage production in the region. More than 1 million hectares were flooded within the period of 1978-1996 in the region, including 0.7 million hectares of agricultural land. Besides, as a result of surge and negative setup phenomena about 800,000 hectares of natural forage lands are difficult to use.

With the aim of improving the ecological situation and in order to execute the Republic of Kazakhstan Governmental Decree of February 28, 1996 № 255 “On realization of the activities on human settlements and economic installation protection against water floods in the coastal area of the Caspian sea within the boundary of Atyrauskaya and Mangistauskaya Oblasts” the Agency on Land Resource Management developed a Scheme of Land-Economic Arrangement of these oblasts to identify activities on the rational use and protection of land, including organization of land monitoring.

Pre-Aral Sea Region. The Kazakhstani part of the Pre-Aral Sea region covers 59.6 million hectares, including the lands of Kyzyl-Orda Oblast (22.6 million hectares), Aktubinsk Oblast (19.7 million hectares), Karaganda Oblast (8.7 million hectares) and South-Kazakhstan Oblast (8.6 million hectares), or some 22% of the total area of Kazakhstan. The ecological disaster zone of the Pre-Aral Sea region is divided into three subzones by the degree of impact of the ecological situation on the natural landscapes: precritical (30.9 million hectares), critical (13.2 million hectares) and ecocatastrophe (15.5 million hectares). With changes in climatic and hydrological conditions the development of wind erosion is observed in the Pre-Aral Sea region. According to a survey, weathered lands cover an area of 5.1 million hectares, while lands with a strong degree of degradation equal 3.6 million hectares. In the last two decades the area of degraded pastures has increased by 25% in the Pre-Aral Sea region while the area of hayfields has decreased by 15%.

In the centre of the ecocatastrophe zone (the Aral district of Kyzylorda Oblast) pastures impacted by

strong and average degrees of land degradation (435,000 hectares) total 22% of the territory. However, if lands with a poor degree of degradation are included this percentage rises to 80%. In the Kazalinisk district, about 17% of pastures (or 263,000 hectares) are severely or moderately degraded. Meadow vegetation of the delta and valley of the river Syr Darya, as the most dynamic area, has undergone the greatest changes. The percentage of degradation of reed hayfields varies from 40.3% in Kazalinisk rayon up to 55.3% in Aralsky rayon. The majority of their territories has been transferred from the category of hayfields to the category of pastures. Analysis of the natural forage lands' condition in the Pre-Aral Sea region, in comparison with data of the previous years, shows an apparent decrease in species' diversity and a decrease in productivity. Sandy-saline heath land is now forming on the drained seabed of the Aral Sea. Based on aerial photography data, salt streams extend for 150-300 km, and in some places for more than 500 km. The area of dust-spreading and the sedimentation zone occupies 25 million hectares. A high chloride and sulphate content in irrigation water results in salinization of arable lands; unsystematic application of pesticides leads to pollution of soils with residual quantities of pesticides. In 2001 forest husbandry (management) activity was conducted in Kzylorda Oblast, confirming that saksaul plantations are in a critical condition. No *saksaul* plants to be found within a 100-km radius of settlements; the wood vegetation is represented by young growths or thin plantings of medium age. The main reason for the uncontrollable cutting of the saxaul plantings around human settlements is the significant reduction of delivery to the region of coal and the increase in its price.

One of the reasons of the abrupt decline of saksaul's condition in Kzylorda Oblast is a change in tree growth conditions caused by the ecocatastrophe of the drying up of the Aral Sea and lowering of the ground water level. The increasing area of the KyzylkKum desert is becoming unsuitable for growth of black *saksaul*, the main species of *saksaul* in Kazakhstan. The total area of the exposed bottom of the Aral Sea is currently more than 3 million hectares. These lifeless areas, coated with salty sand, are constantly growing. Saline lands form here and the drifting sands serve as arena for the spread of salt, dust and sand to adjoining lands of the Pre-Aral Sea region, causing significant damage to the economy of this vast region. Average air humidity has decreased by 18%, while the duration of the frost-free period has dropped by almost a month. The area of natural hayfields and their productivity have decreased 4 times. About 15% of the lands have completely lost their natural productivity. Of 3,000 lakes a little over 100 remain. The vegetation - saksaul, tugai (vegetation-covered bottomland) forests and reed bushes - is rapidly disappearing.

The vegetation communities of the exposed bottom of Aral Sea and, in particular, re-forestation, play an extremely important role in the system of the environmental protection and protection of land. However, only 39% of the area of the formed dry land is occupied by re-forestation, and of that 20% are thin forests. Self-overgrowth of bushes and grassy vegetation is occurring at a slow rate and lags considerably behind formation of heath lands and drifting sands. Without implementation of effective measures to expand the wooded areas and increase their stability, it is quite likely that in the near future a more extensive "Aral" desert will be formed with unpredictable environmental impacts. In order to reveal trends in the change of soil, vegetation growth changes, and the general ecological situation's change and to develop proposals, recommendations and activities on its stabilization, it is necessary to ensure execution of all-around soil, geo-botanical, hydro-geological and other research. These are currently not being carried out due to lack of financing.

Semipalatinsk nuclear testing ground

The total area of the ecological disaster zone is 7 million hectares, including the territory of the test site (1.8 million hectares) and the zones of emergency-level and maximum radiation risk (5.2 million hectares). Some 27.4 million hectares of agricultural land is registered in the impact zone of the Semipalatinsk testing ground (88.3% of the total area of the region).

By the Government Decree of the Republic of Kazakhstan №172 of February 7, 1996 the Semipalatinsk test site lands became reserve lands and measures were identified to improve the ecological situation in the districts located in the zones of emergency-level and maximum radiation risk. The difficulty of full economic land development on the test site is that a radiological diagnostic study has not been completed in the area and the norms of the maximum permissible pollution of the lands have not been established. Due to the transfer of part of the Semipalatinsk test site lands to economic use, the priority objective is to conduct detailed studies and develop measures on the safe implementation of economic activity in these areas. Due to lack of funding such measures have not yet materialized.

2.3. Rocket Launching and Testing Sites

Space and rocket equipment is considered to be among the most powerful source of the man-made impact on the global climate, environment and economies. There are 17 cosmodromes (space-vehicle launching sites or space centers) in the world.

Figure 2.3.1.

World Launching Sites and Space Centers

1 - USA, 2 - Russia, 3-China, 4 - France, 5 - Japan, 6 - Italy, 7 - Australia,
8 - Argentina, 9 - Brazil, 10 - England, 11 - Israel, 12 - Indonesia, 13 - India,
14 - Canada, 15 - Korea, 16 - Norvay, 17 - Pakistan, 18 - Sweden, 19 - South Africa.

At present the following sites are actively operating on the territory of Kazakhstan: Baikonur space center and testing sites Saryshagan, «Summer-Testing»[11]. Over the period 1957 to 2001, 1189 space rockets were launched from Baikonur to put into orbit 1237 space ships on various assignments. These launches also included more than 100 intercontinental ballistic rockets. From 2000 to 2001, 30% of the world's space rocket launching was carried out from Baikonur space center.

The location of space centers on the coasts of USA, France, Japan, Australia and India was done purposefully in order to reduce damage from accidents and prevent the fall of rocket stages and products of combustion in the residential areas. Only three countries – Russia, China and Kazakhstan – launch from landlocked continental space centers exposing the population of their countries to danger and polluting inhabited areas.

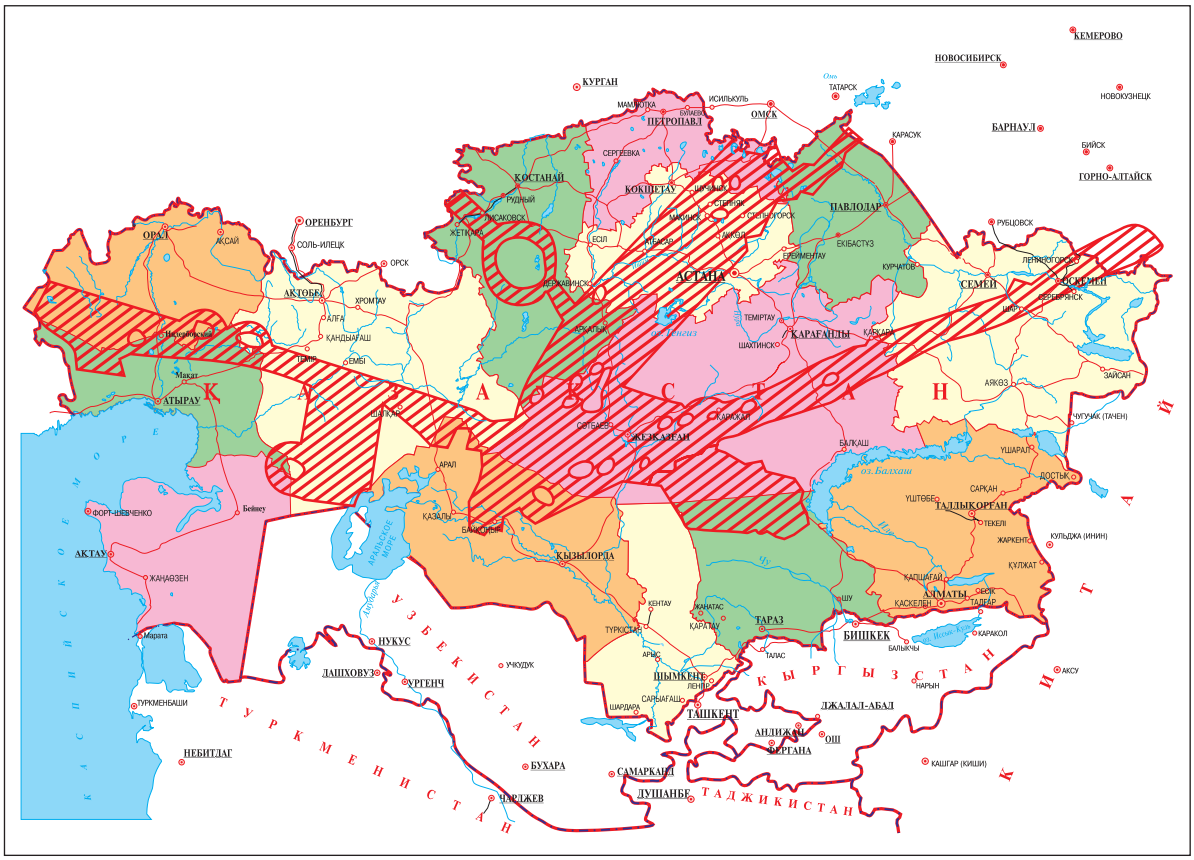
The trajectories of space rockets launched from Baikonur stretch for thousands of kilometers over the territories of Kazakhstan and Russia. Initially the selection of trajectories was based on the principle of choosing poorly inhabited semi-deserts, deserts, and tundra areas. Such territories were referred to as "unproductive" lands but their real role in the landscape structure, as well as their fragility and uniqueness were not taken into account. It is common knowledge that most of the fuel is consumed at the launch and following stage when passing through the dense atmospheric strata to a height of 40-50 km. By that stage some 500-600 tons of fuel is spent, of which 200 tonnes is heptyl. It was orig inally planned that the products of fuel combustion and the rockets' detachable stages might land within the specially set aside zones of 100 km in width. However, the standard and accidental rockets' fragments are generally scattered beyond these zones and such deviations can take items from 80 to 90 kilometers beyond the trajectory borders, while the products of combustion and non-combusted remains of fuel and oxidants falling from the height of 20-100 kilometers spread and land over thousands of square kilometers.

[11] Part of the Russian space center and the nuclear-rocket testing site called Kapustin Yar

The landing area of carrier-rockets' detachable parts occupies huge territories. In the past, small settlements, stock buildings, roads, transmission lines, shafts and objects of social-cultural life were located in these areas. 35,000 square kilometres of Karaganda, Akmola, Pavlodar and East Kazakhstan oblasts were designated as fall areas for rockets' detachable components.[12] Besides the pastures, hayfields and tillage, the fall areas include forests, reservoirs, recreational and protected natural territories, cultural monuments, and in a number of cases – ore fields and even a large section of the Korgaldjinskiy state reserve. Industrial enterprises, cities, electric power stations, railways, big rivers, and channels are located in the ***areas under impact*** of falling rockets, since they are adjacent to the designated fall zones. By their ecological condition the fall areas are referred to as "zones of ecological disaster", while impact zones are "zones of ecological crises". According to expert evaluation their total area constitutes 77.09 million hectares. The evaluation is based on the analogy method, data from five authorized AF-s (1992) and studies of ecological condition (1992-1994) in the former Zhezkazgan oblast, which is now within Karaganda Oblast. The rest of the rayons (approximately 70) were not studied.

Figure 2.3.2.

Landing areas of rockets' detachable parts



Nowadays a wide range of problems is identified. They include methodological, legal, institutional, technical and sanitary-hygienic issues caused by development of the space complex. However, the situation has not changed much from 10 years ago: all-round studies of the ecological systems have yet to be conducted; the impact of the space-vehicle launch site and rocket launching have still not been evaluated on a systematic basis. In fact, there is no approved normative-methodological basis to conduct EIA of such objects. The same can be said in relation to the approved economic indicators for evaluation of damage to the environment. The existing document "Temporary instructions on execution of state control of environmental protection from pollution with nonsymmetrical dimerhyl-hydrazine", makes it possible to conduct an evaluation of the environmental

[12] Ministry of Energy and Mineral Resources, 2001

damage incurred by nitrodimerhyl-hydrazine (NDMH). The calculation method is based on the cost evaluation of the landscape's utility ("price" of the landscape); content of nitrodimerhylhydrazin in the environment and the damage coefficients. In other words, the evaluation will identify which part of the integral "price" is lost due to pollution. Besides, losses to the following economies will be taken into account: agricultural economies, forest enterprises, hunting grounds, fishing industries. This approach makes it possible to solve the so-called "problem of the ecological mapping of the Republic of Kazakhstan in score and price values". In accordance with the given calculations the ecological systems of Kazakhstan are "worth" 30 trillion US dollars. The "price" of all natural mineral resources of the country (oil, coal, minerals) is estimated at 10% of the price of the whole ecological system. The total damage before 1994 due to the impact of the space center and polygons totals 4 trillion US dollars - with Baikonur space center causing 2 trillion US dollars worth of damage. These calculations are confirmed by the materials of the State Report prepared by the Russian Federation on the environmental conditions. According to these data approximately 250 tons of heptyl were spilled on the AF lands of Plisetsk and Kapustin Yar polygons up to 1994, while not less than 2000 tons of heptyl were spilled within the period 1957-2000 from Baikonur.

A holistic ecological-sanitary approach and new methods of research are required to support the surveys conducted over the last three years in order to continue studies on the impact of heptyl pollution in one of the landing areas assigned for the Proton carrier rocket's stages and to evaluate the impact of the space center on health of the population.

Impact of space launching and testing sites on the environment

Operation of the space-vehicle launching sites and rocket launching activities has a negative impact on all components of the natural environment. Disturbance and pollution takes place at the space-vehicle launching sites, in AF-s and along the routes' length. Such impacts are wide-scale and long-term in character.

The area of Baikonur space center and its city is 669,000 hectares according to data of the Land Resources Management Agency (2001). The total area of lands assigned for landing areas in Kostanai, North Kazakhstan, Karaganda, Akmola, Pavlodar and Eastern-Kazakhstan oblasts totals 4.145 million hectares. These areas are subject to withdrawal from agricultural management.

Table 2.3.1.

Total areas of polluted lands

Administrative regions of Kazakhstan	Zone of ecological crisis	Zone of ecological disaster	Administrative regions of the Republic of Kazakhstan	Zone of ecological crisis	Zone of ecological disaster
Aktyubinsk Oblast	7.48	1.22	Zhambyl	1.74	0.75
Akmola Oblast	10.24	1.56	Karaganda	23.53	3.33
West Kazakhstan Oblast	4.16	0.75	Pavlodar	1,41	0.04
Kostanai Oblast	8.72	1.36	East Kazakhstan	4.36	-
Atyrau Oblast	2.71	0.19	Mangistau	0.65	0.06
Kyzylorda Oblast	2.50	0.33	Total: mln ha.	67.50	9.59

Source: B. Yakovlev, State Scientific Union "KazMehanobr"

Kazakhstan's atmosphere, natural and anthropogenic landscapes are being polluted with chemical substances of all classes of hazard. The following substances are referred to as the ***first class*** of hazards: nitrodimerhylhydrazin (NDMH or heptyl), nitrozedimethylamine, nitrogen tetraoxide, formaldehyde. Substances of the ***second class*** of hazard are – nitrogen oxide, tetramethyltetrazene. These substances have carcinogenic, mutagenic and terratogenic effects on biological organisms.

During launches of the carrier rockets "Proton", "Cosmos", "Cyclon" the first stage is generally separated and falls from a height of 50-120 km, entailing a drop of 0.6, 2.0 and 4.0 tons of heptyl and 1.4, 4.0 tons of nitrogen tetraoxide in the atmosphere (soil, reservoirs). The maximum permissible concentration (MPC) of heptyl is 1 microgramm\m3 or 1kg\km3 of air: consequently, 2 tons of heptyl contaminate 200,000 m3 of air. This volume presents a trail of 2 km in height with a cross section of 30x30 km. During the day heptyl is transferred from storage by waterways for 50-80 km. An aerosol trace from a height of 100 km is spread by the air for 300-500 km. Evaporation of the heptyl spot from the land covers an area of radius 200-300 m.

This toxicant is hazardous when it gets into the environment due to its volatility, unlimited solubility in water, ability to migrate and accumulate in soils, solid soils, in silt precipitations of reservoirs and rivers, in organisms of plants and animals, due to its stability in deep layers of soil, as well as in plants, silts and in mineral oil. There are no effective methods to neutralize heptyl and radioactive products. The self-purification period of lands from heptyl is about 34 years, from kerosene - 5 years. On the territory of Karsakpay rural region in the AF for rockets' stages heptyl was detected in 17 samples out of 70. Its concentration exceeded the MPC 5000 times. According to monitoring data (materials of Rosaviacosmos) of 2000, after the launch of 14 «Protons» 10.5 tons of heptyl and 2 tons of oxidant were spilled; due to the launch of 13 «Unions» 14 tons of kerosene were spilled. Launching of 2 «Zenith» rockets caused the discharge of 4 tons of kerosene to the atmosphere from a height of 20 km. During the operational period of the space-shuttle launching site from 1957 to 2000 the total volume of spilled heptyl is about 2,000 tons.[13]

Besides this, damage to surface facilities occurs due to falling rocket parts, devices returning from space such as fragments and pieces of rockets that explode in the air or on the land surface. In total 53 rockets' landing areas have been counted across the country. There are administrative areas where the ecological situation is determined depending on the frequency of the rockets' stage falls. Ulitau district of Karaganda Oblast includes 32 landing areas. The total landing areas comprise 2.5 million hectares. From 1995 to 2000 as a result of 127 launchings 111 stages of the following rocket types fell in Ulitau district: «Proton», «Union», «Energy», «Cyclon», «Lightning» and the rockets' stages contained residuals of heptyl and kerosene. Usually, all the residuals are toxic and cause poisoning if they get into water or if there is direct contact with them. In the past the local population used such residuals for various purposes: in farming, building and in the production of goods. Also, fires often occur where the fragments drop.

Negative impact on the environment also comes from the ground infrastructure of the space centers and launching sites. The territories and water areas are cluttered and contaminated with construction waste, scrap metal, spilled fuel of all types and with all classes of hazardous substances (surface pollution). In 2001 emissions of pollutants by Rosaviacosmos (Russia) equaled 800 tons, discharge of contaminants – 70 tons and wastes – 900 tons. In spite of this, large dumps of construction waste and household rubbish are accumulated around the city and the space center, the total mass of which exceeds 40,000 tons. It should be noted that the representatives of the MEP of Kazakhstan do not have access to the space center facilities and can not really control the ecological situation in the launch area.

Special attention should be drawn to the occurrence of unsuccessful and emergency rocket launchings. From a total of 1189 executed space launches at Baikonur up to 2001, no less than 70 were unsuccessful. In 1999 there were 2 emergency launchings of «Proton» rocket carriers on July 5 and October 27. The latter ended in rocket fall in the area of Atasy village in Karaganda Oblast and led to the contamination of an area of 394,600 hectares. However, according to the follow up report both accidents were ecologically safe. As for the heptyl cloud that formed at the rocket explosion «it has not reached land, and at the height of 3 km., has evaporated» or «4 tons of heptyl have mixed in the atmosphere with rain clouds and precipitated over an area of 1000 square kilometers». Apparently, the report data was used to evaluate the damage incurred as a result of ecological accidents that occurred in Kazakhstan in July and October, and 10.7 and 19 million KZT were charged for each accident, respectively. This fact again proves the non-availability of methods of environmental impact assessment, and payment rates are not available to evaluate the ecological damage in respect to such objects and situations.

Occurrence and development of dangerous meteorological phenomena can be considered as another negative environmental impact, which is being studied. In winter and after every rocket launch the temperature decreases to 2-3C^{o} in the troposphere, close to the lanes, and this lasts about 3 days (region of Zhezkazgan city). In the thermosphere decreases of neutralized gas density are observed along the rocket lanes, leading to the escape into the atmosphere of nearby areas towards the discharged area. This phenomenon is also accompanied by an acceleration of the ionospheric wind at a height of 300 km. A dynamic influence is caused to the air circulation in the lower atmospheric strata. Rocket launching may serve as a catalyst for hurricane winds, snowfalls, snowstorms and rains. According to the results of surveys conducted by Kazgydromet (2000) it was found that the launching of «Proton» and «Union» rockets causes the air temperature to decrease, an intensification of the atmospheric front, an increase in atmospheric instability and the intensification of winds in the surface layer. Such effects cause heavy thunderstorms and precipitation a day after launching, sometimes exceeding norms by 2-3 times. According to Mr. Karamanov, *Mazhilisman* of the RK Parliament, in Kyzylorda Oblast the following changes have been observed over 30 years: the frequency of blowing dust has increased 10 times, total annual precipitation has decreased 2.5 times and the spread of dust ejection reaches 200-400 kilometers, leading to soil salinity of 10%

[13] "Rosaviakosmos" materials, 2000

annually. According to regional SES data during the periods of blowing dust, for 5-8 days the concentration of soil dust in the atmospheric air reaches 60-80 of MPC.

Each launch of rocket devices causes destruction of the ozone layer and creation of ozone 'holes'. Based on calculations during the launch of the 'Energy' rocket, maximal ozone layer depletion occurs after 24 days and forms 1.5% within the range of the vertical trail (column) of 550 km in the diameter. Monthly launches for 4 years running may lead to depletion of the stratospheric ozone of the northern hemisphere by 0.1% at mid-latitudes and by 0.3-0.4% at high latitudes.

Physical and chemical interference in continental atmospheric processes. The launch of rocket carriers initiates a wave in the ionosphere, and will transmit with rapid speed - up to some hundreds of m/sec over 1000 km. Rocket launching impacts the regional ionosphere, causing areas of decreased electronic concentration of 700 x 500 km lasting for 2 hours. Launching also causes changes in the geomagnetic field, lasting for 40-50 minutes and may interrupt communication for some tens of minutes.

There are a wide range of social, ecological and economic issues caused by the impact of polygons' operations. Baikonur space center on average launches 24-30 rocket carriers per year. However, in its 40 year history there has been no full estimation of the impacts produced by rocket launching on the environment and on the health of the population. There is no economic mechanism in place to evaluate the harm to the health of the population and ecosystems. There are no maps of the pollution caused across the country and there is no data concerning the impact of accidents on the health of the population and on agriculture. A program on impact mitigation has yet to be developed, such as vitally important documents including a program of the population's insurance and conduct of rehabilitation activities. Public control over the operations of the space-vehicle launching site and polygons is therefore impeded.

Semipalatinsk nuclear testing ground

The Semipalatinsk Nuclear Testing Polygon (SNTP) was established on August 21, 1947. Covering three oblasts-Western Kazakhstan, Karaganda and Pavlodar, SNTP occupies an area of 18,500 km^2 with a perimeter of 600 km. The Polygon occupies 10,000 km^2 of the former Semipalatinsk oblast. Nuclear tests were performed over the period between 1949 and 1989, with around 470 systems, including 30 surface, 86 air and 340 subsurface devices detonated. The power of the explosions reached 17,400,000 tons of trinitrotoluene equivalent. Initially, nuclear tests were performed to test nuclear explosive systems and armament samples, and later for economic purposes.

These tests resulted in the formation of the "atomic lake" Balapan, plus radioactive gas emissions in the air, environmental imbalance and negative health implications for people living in areas adjoining the SNTP site.

Reports indicate gamma-radiation levels many times exceeding the norm – up to 1,250 mcr/hr in Semiplatinsk in 1960-1980, which exceed the background level approximately 100 times, and up to 60,000 mcr/hr in Sarapan village.[14] Pollution with radioactive isotopes of caesium and strontium exceeding the threshold was identified in Shagan and Aschisu rivers, Balapan Lake and other water sources within the SNTP site. At least 4,500 km^2 of the Polygon area (land, rocks, water) are polluted with Cs-137 and Sr-90 in concentrations exceeding the threshold.

The environmental and agricultural implications and consequences of activities carried out at the Polygon are remarkable. Nuclear tests affected not only the Polygon's natural landscapes, existing ecosystems and agriculture, but also lands adjacent to the Polygon. Radionuclide pollution of milk and meat produced on farms located near the SNTP was sometimes registered at levels exceeding both the background level and safety requirements.

Currently, there is a clear need for the following to be carried out at the SNTP:

- Geological, geochemical, soil, hydrological and exploration work;
- Radiation, biological and chemical tests of the SNTP environment in order to obtain reliable information about the situation at the polygon including threats, risks and positive prospects for the zone adjoining the SNTP;
- Comparison of radiation levels in large and small doses;
- Estimation of carcinogenic, teratogenic and mutagenic risks when such doses are applied;
- Assessment of risks of stillbirth, congenital development and mental disorders, etc.

Azgir and Kapustin Yar testing grounds

Three test sites were operating on the borders of Western Kazakhstan and Atyrau oblasts in the Naryn area: Azgir nuclear testing site, a state test-flight center and a state central testing ground, the last two belong to the Russian complex Kapustin Yar, and are still in operation. 29 nuclear explosions were conducted on the territory

[14] Exceeding hum level approximately 5,000 times

of these sites (18 underground, 11 in the atmosphere). Within the framework of research 10 nuclear explosions were additionally performed: 6 in Karachaganak, 3 in Mangistau and 1 in Aktubinsk oblasts.

Azgir nuclear testing ground

From 1966 to 1979, 17 nuclear explosions were performed on 10 sites. In consequence, 9 underground cavities were formed with a total area of 1.2.million cubic meters, and one dammed lake of 600 meters in diameter. The first underground explosion was performed at a depth of 165 meters within 1.5 km radius of Azgir village, where 300 people lived. For 20 days gas was emitted into the atmosphere from the blast hole and total radioactivity (RA) equaled 190 thousand curie. During subsequent explosions there were gas kicks lasting for 11 months. The total mass of discharges into the atmosphere due to the 10 explosions constituted 10 mln curie. The polygon was closed in the 1980's. The cavities caused by the explosions were filled with saline solutions from the water-bearing horizons and still contain 77-1500 curie of alpha-active nuclide and 450-50000 curie of beta-disintegrating (RA) substances. The contaminated soil volume equals 24,000 cubic meters, with total radioactivity of 50 curie.

In platform 10, soil from other platforms was buried and the level of RA pollution reaches 25 kilobecquerels\kg for the soil, thus exceeding MPC levels by 460 times. The level of gamma radiation of soil and dust on the platforms forms 155-3500 microentgen\hour, at a norm of 8-10 microentgen\hour. Burial works started 10 years after the first explosions. Throughout this period the polluted area was spreading due to the influence of wind and water. Thus, accumulation of caesium-137 in plants reaches 650 Bq\kg, the content of thallium 120-8000 MPC, the content of heavy metals in soils is above background levels by 8.5 times.

Kapustin Yar testing ground

The space rocket test site is located in Astrakhan Oblast in Russia, but part of the areas in West Kazakhstan and Atyrau oblasts are occupied by the summer testing site, the area of which totals 3 million hectares, with its own specialized zones, including the Taysogan polygon of 1.5 million hectares. According to unconfirmed data (due to their top secrecy) 11 nuclear explosions were performed in the atmosphere, more than 24,000 anti-aircraft rockets were launched and detonated, and 177 samples of weapon were tested. During the ground destruction of 619 rockets of SS-20 type with a mass of 50 tons each, about 30,000 tons of highly toxic substances were emitted.

The territories of the following regions have been exposed to radioactive and toxic contamination: Kzylkog (32,000 persons), Karatob, Taypak. For a number of years the natural complexes and population of the Urdin and Zhangolin rayons were exposed to the combined influence of the polygons at Azgir and Taysogan.[15]

Landing Area «HAKI»

This area is located in Western Kazakhstan Oblast and covers 832,000 hectares. For a number of years this territory was used as a test site for rocket launching devices and for testing new weapons. At the same time, it was used as a collection site for destroyed targets and object fragments. The site is characterized by a high concentration of heptyl fuel and AKI oxidant. Heptyl content in the landing area where "devices" are expected to fall exceeds MPC by 158 times, whereas 10 km from the border it is estimated at 2.3 MPC.

The impact of space-vehicle launch sites and polygons on the environment can be summarized as follows:

- In territories of the space-vehicle launch sites and inhabited areas bordering nuclear and biological testing sites polluted with radioactive and toxic wastes of the highest class of hazard concentrations of these substances exceed MPC levels by 10—and sometimes even 1000—times;
- Rocket launches and their destruction in the air, accompanied fuel spillage and oxidants have led to the formation of extremely polluting toxic trails beyond the zone of the testing sites;
- Rocket launches damages the geochemical condition of regions adjacent to space launch sites

Space launching, nuclear and biological testing sites in Kazakhstan form an integral part of the global destruction sites of the atmospheric and ozone layer, destroying natural biological communities and having a negative impact on the economy and health of a significant part of the country's population. It is also worth emphasizing that closing the nuclear test site Azgir and the biggest testing sites (the continental ballistic rocket centers in Derzhavinsk and Zhangiztobe, the Chagan base and the Emba test site) are major achievements in terms of non-proliferation and can be compared with the closing of the Semipalatinsk nuclear test site.

[15] A cumulative effect of the surface nuclear explosions and heptyl trails from the hit mid-range rockets

2.4. Urban Areas

Urbanization in Kazakhstan started during the industrialization of the Soviet Union. Cities first appeared as settlements in immediate location to big industrial sites. As the industries grow so did the settlements, which resulted in development of infrastructure. Industrial enterprises, being the core around which new cities developed, provided their residents with work, housing as well as supported utility services. These cities became economic and cultural life centers. With the growth of cities, however, their environmental conditions quickly worsened. Firstly, industrial production caused pollution of air, soil and water, destruction of landscape diversity, accumulation of big volumes of production wastes. Due to expansion of the cities, industrial enterprises fell into the city boundaries or in their immediate surroundings, which made the urban environmental situation significantly worse. As a result, cities began to have a significant impact on the environment of suburbs and adjusting territories. Secondly, a continuous nature of emissions from industrial enterprises and transport resulted in a negative impact on the health of the cities' residents, with a multiplication effect for future generations. Thirdly, a system for environment monitoring, based on fees and payments, did not propose effective actions to eliminate negative impacts on the environment.

In addition, cities became sources of environmental pollution. Unfavorable changes in the microclimate occurred as a result of a rapid population growth and high industrial concentration. Every year the number of vehicles increases, the production of huge amounts of industrial and municipal waste grows, and the harmful effects of noise and vibration intensify. Poorly planned cities and spontaneous private constructions prevent from gaseous pollutants being carried away by winds outside the cities' boundaries, decrease the level of diffusion of pollutants in the air. Problems of disposal and utilization of industrial and municipal waste, supply of clean drinking water to the city's residents, recultivation and remediation of soil, surface and ground waters remain critical for modern cities.

The urban population of the Republic of Kazakhstan was 8.28 million at the end of 2000. There are a total of 84 cities in Kazakhstan, 39 are federally and regionally regulated. The biggest cities are Almaty (1.13 million people), Karaganda (0.55 million people), Shymkent (0.45 million people), Astana (0.32 million people).[16]

Air pollution in cities

Monitoring of air pollution is carried out in the biggest cities and industrial centers of the Republic of Kazakhstan by specialized subdivisions of the National Hydro Meteorology Service.

The inventory of pollutants to be monitored is established, taking into account the volume and composition of emissions into the atmosphere and the outcomes of a preliminary survey of air pollution in a certain settlement.

The degree of air pollution is assessed on the basis of the outcomes of the analysis and the processing of air samples taken at stationary monitoring posts. The main criteria of quality are the values of ***maximum permissible concentrations (MPC)*** of pollutants in the air. The degree of atmospheric pollution is assessed based on the value of a complex ***index of atmospheric pollution (API$_5$),*** which takes into account five substances with the biggest values regulated by MPC and the degrees of their danger.

It has been observed that the ambient air is most polluted in Ust-Kamenogorsk (API- 14.2), Shymkent (API-11.8), Leninogorsk (API-10.3), Glubokoye settlement (API-10.2) because of the impact of non-ferrous metallurgy enterprises and in the city of Almaty (API-13.1) because the climatic conditions are not favorable for dispersing pollution.

The maximum one-time concentrations of pollutants exceeded MPC in all the cities where monitoring was conducted. Along with this, it was observed that three or more substances exceeded their MPC in 16 cities. (Annex 2, Tables 5 and 6). The average and maximum values of hazardous admixtures have been changing significantly in the cities, depending on the volume of emissions coming from industrial enterprises, as well as the cities' location in different physical and geographical regions. In almost all the cities, the maximum one-time concentrations of one or several admixtures exceeded permissible limits.[17]

According to data of the Almaty City Committee of Environmental Protection, there were 250,000 vehicles registered in the city as of November 2002. In addition, there are between 30,000 and 40,000 cars that come to Almaty from the oblast and other cities. According to estimated data (number of cars being repaired, in garages, parked, non-local unregistered taxi drivers, mini-vans, and buses) there are, in total, between 230,000 and 280,000 vehicles on the roads of the city at any one time. By applying calculation methodology of the Moscow

[16] Agency for Statistics of the Republic of Kazakhstan, 2002

[17] Materials of the Environment Pollution Monitoring Centre of Kazgidromet, 2001-2002

Sanitary Epidemiological Station, it is possible to assess the total impact of automobile transportation on air pollution in Almaty (Table 2.4.1).

Table 2.4.1.

Emitted pollutants by mobile sources in Almaty

Pollutant	Average emission per vehicle grams\ km	Average daily emission per a vehicle (50 km of travel) kg	Total daily emissions of 250,000 vehicles, kg	Total annual emissions of 250,000 vehicles, ton	Types of pollutants
CO	32.6	1.63	407,500	148,700	Carbon monoxide, in small concentration dangerous for health
CH (hydrocarbons) benzol, xylenes, tolene, naphthalene, methyl hexan	5.927	0.3	75,000	27,300	Highly toxic, dangerous for health in small concentrations.
Nitric oxide	1.852	0.0926	23,200	8.400	When mixed with water, form acids
Sulfur oxide	0.148	0.0074	2000	730	
Lead	0.009	0.00045	110	40	Accumulates in blood, bones, brain, causes leukemia, mental deficiency
Ash	0.044	0.0022	550	200	Accumulates in lungs
Total	**40. 6**	**2.03**	**507,500 kg\day**	**185,300 ton\year**	

The main reasons for the high content of harmful particles and emissions come from the use of an out-of-date autopark, late and of poor quality maintenance of cars, low quality of motor fuel.

Auto transportation also plays a significant role in the soil contamination of cities. An eco-geochemical study of Almaty conducted in 2000 showed a high level of soil contamination with heavy metals. To varying degrees, the soil is contaminated with copper, nickel, cobalt, cadmium, lead and zinc.

Drinking water quality of centralized and decentralized water sources

Supply of drinking water of good quality is an extremely challenging task. Anthropogenic impact on both surface and ground water is observed in the country, and as a result chemical and microbial water pollution occurs. Given that water of open reservoirs and artesian wells is used for drinking water supply, the population's health is being threatened (Annex 2, Table 7).

In Kazakhstan, samples of tap water analyzed showed that the percentage of non-compliance with minimum hygienic standards was 4% in 2000 compared to 5% in 1999. The quality of tap water therefore appears to have increased, except in Atyrau and South Kazakhstan oblasts. The percentage of water from decentralized water sources that did not meet the hygienic standards was 10% in 2000 and 11% in 1999.

The number of water supply units has been decreasing in the past few years. Under sanitary service control there were 2749 units in 1999 compared to 2,660 a year later. Out of 2,660 water pipelines, 388 (14.5%) do not work and 586 (25.7%) that do work do not meet sanitary norms due to the absence of sanitary protection zones, cleaning facilities, and anti-contamination equipment. Non-working water pipelines in Zhambyl oblast reach 42.5%, East Kazakhstan oblast - 37.6%, and Aktubinsk oblast - 24%. The supply of pipeline water to the population is decreasing every year. In 2000, this indicator was 73% nationwide; it significantly decreased in South Kazakhstan oblast to 48%, Zhambyl oblast 57.7%, West Kazakhstan oblast 58.2% and in Atyrau oblast-62.7%. More than 3 million people (20.9% of the total population) use water from decentralized water supplies, 2.4% drink water from open water sources and *aryks*, while 4.2% use transported water of un-guaranteed quality.[18]

[18] Report of the Republic Sanitary and Epidemiological Centre, 2001

Municipal wastes

Problems of the evacuation of solid waste outside the borders of residential areas and their further extirpation have long been the main issues connected with solid waste.

It is very challenging to determine the actual amounts of solid waste produced nationally, as it is connected with different systems of registering collected domestic refuse used in different regions of the country. In a number of towns and city districts, waste is collected by way of loading solid domestic waste on dump trucks, in which case it is calculated in tons. In 1999, according to these calculations, the total amount of solid waste collected in Kazakhstan equaled 4.63 million tons.

In big cities with developed public utility systems, which use specialized transport, the amount of waste is calculated by a number of trucks loaded using cubic meter volumes. In rural towns and small villages collection of waste is done on an individual basis without proper calculation. However, the total volume of solid waste accumulated in the country every year is estimated to be 13.9-15 million m^3.[19]

Major challenges in collection and treatment of solid waste*:*

- Unpredictable changes in the number of urban populations;
- Outdated system of organization of public utility services;
- Tariffs for garbage collection do not correspond to the cost of services – a generally low income population in terms of their willingness and ability to pay for waste collection services;
- Unauthorized dumping or burial of garbage within inhabited areas.

Inflow into the major cities of a considerable number of rural dwellers has led to unplanned growth of urban populations, occupation of outskirts of the city, and consequent increases in the amounts of solid waste generated. It is often the case that the suburbs of larger urban areas have systems of public utility services that cannot keep pace with the needs of the growing population.

Introducing a fee-paying system of municipal services raises the problem of non-payment for garbage collection service. This problem was particularly expressed in the districts of the so-called "private sector" where a whole new system of organization of this work was needed. On the other hand, inflation, an increase in prices for transport services and lack of control over activities of commercial companies, which collect garbage, hamper the efficiency of collection of solid waste. Municipal services constantly experience shortages of transport, petrol and staff.

Expenses for the collection of garbage outside city borders often exceed the amounts allocated for these purposes, which leads to stoppage of the services and the accumulation of huge amounts of waste within residential areas, or even the establishment of unauthorized garbage dumps in immediate proximity to the city borders. Very often abandoned buildings, frozen construction sites, foundation pits, vegetable gardens, streets, blind alleys, ravines, river banks / river-beds, open pits, and railways are used as trash dumps. The issue of elimination of such trash dumps remains unresolved due to lack of financing. Existence of unauthorized dumps around cities and rural settlements is the most widespread ecological violation in Zhambyl, Shymkent and Almaty oblasts and in Almaty city.

Additional problems in relation to ***storage and processing of domestic waste*** exist, including the following:

- Increasing amounts of solid domestic waste produced and accumulated in the country;
- Absence of the required number of plants for waste (re-) processing;
- Organization and utilization of solid waste landfill sites that do not comply with technical and sanitary norms;
- Accumulation and storage of all types of solid waste without separation, including medical and hazardous waste;
- Absence of measures for disinfection and desensitization at landfill sites;
- Absence of control over the return of some solid waste from landfill sites back to cities in the form of goods or raw materials.

The amount of domestic waste has increased considerably in recent years with changes in trading methods, increased volume of packaging materials, and the import of large quantities of foodstuffs/industrial goods. Example: each year around 300,000 m^3 of waste is produced annually in Shymkent; 364,500 m^3 in Astana and 1.9 million m^3 in Almaty.

Due to the absence of modern technologies for effective re-processing of solid waste the amount of waste

[19] Ministry of Natural Resources and Environmental Protection, 1998

is constantly growing and accumulating in a number of landfill sites. Solid waste landfill sites are especially allocated/equipped plots of land used for the storage of solid waste, and normally their location is beyond the boundaries of the sanitary protection zones of settlements. Landfills have no contact with natural water currents and operate under the control of respective sanitary institutions.

In Astana, annually, 0.37-0.40 million m^3 of waste is delivered to the city's landfills, and as of April 1, 2001 more than 11 million m^3 of domestic and industrial waste have been accumulated. In the course of growth and development of the city these amounts will increase considerably. In the city of Taraz, the situation of the storage of solid waste is very difficult, where accumulated wastes amount to 1,782,400 tons.

In Almaty, the Karasai landfill receives 700 tons of solid waste *daily* and by 2010 this is expected to rise to 1000 tons per day (66,600 tons/year). The technological capacity of this landfill site is far from sufficient for utilization of the produced waste. In 1999, Almaty accumulated 1.9 millions.m^3 of garbage and only 300,000 m^3 (16%) of it was delivered to a waste re-processing plant. The remaining solid waste was stored in open landfills near the city [76,98,124].

At present, the majority of urban landfill sites and places of the solid waste management system do not meet required ecological/sanitary norms and lack the work standards and technological equipment to enable the effective storage and burial of solid waste in the country. Landfill sites often adjoin housing estates, rural settlements, river water currents, water reservoirs and lakes. The system of storage means simply a compression of newly brought garbage by tractors. As a result, lightweight components (paper, polyethylene) are taken by the wind a considerable distance, polluting underground water, water reservoirs, soil and greenery.

Statistical data shows that solid domestic waste in urban landfill sites consists of the following components (of the total volume of waste):

- Waste from foodstuffs 40-57%
- Paper, textiles, leather, old clothes 17-37%
- Waste wood 4%
- Metals, ceramics, sand, glass 8-16%
- Construction waste and household refuse 10-30%

Biodegradable organic substances such as wood and cardboard are being replaced as packing materials by plastic and other synthetic materials. Considerable amounts of construction waste (especially in Astana and Almaty) consist of new plastic materials, such as: siding, solid carbonaceous plastic, linoleum, carpeting materials, film coating and laminates which are either durable for a long time or are totally non-degradable. Constant emissions of smoke and frequent ignition caused by both natural forces in the process of decomposition and decay and intentional burning (reducing the volume of the trash dump) are a source of air pollution and plastic burning is a source of heavy and dangerous air pollution with hydrocarbons containing chlorine and sulfur.

Waste sorting and separation during collection are not practiced in Kazakhstan. Moreover, there is no system of registering garbage. Collection and storage of solid waste from individual organizations at landfill sites leads to an accumulation of biologically active waste substances, which are dangerous for epidemiological reasons. Utilization of wastes with toxic substances, such as luminescent lamps and instruments containing mercury, remains a serious problem. Once they are full, landfill sites and trash dumps are not re-cultivated and for a long time remain sources of environmental pollution. It is often the case that old unused garbage dumps are not marked on city maps and the risk remains that the ground could later be used as construction sites, for pasture or other agricultural purposes.

The need to take measures to disinfect and reduce the potential for harm of landfill sites is well justified for various reasons: waste from foodstuffs makes up over 40% of solid waste. Regularly these are supplemented with expired foodstuffs withdrawn from sale and waste from medical institutions, which should be subject to special destruction procedures. Animals and insects may eat the waste foodstuffs and then become carriers of epidemiological diseases dangerous to humans. Birds, rodents, predators, domestic animals, sanguivorous and 'domestic' insects are all carriers of disease and pathogenic organisms. In order to prevent the spread of infection, it is necessary to conduct disinfection measures in compliance with sanitary requirements. Gray rats inhabit 168 settlements in Karaganda oblast. Having migrated in 1993 from the East Kazakhstan oblast, the rodents inhabited Osakar and Nurinsk districts, and later the oblast center. In 2001, in Karaganda 3.5 million Tenge was spent on combating rats; in 2002, 20 million Tenge was spent in two rounds of complete and entire rat extraction in spring and autumn. Packets containing poison were distributed to residents of private houses and the heads of housing cooperatives free of charge. Unauthorized garbage dumps and basements of houses continue to be typical locations for rats to feed and propagate.

The absence of clearly marked boundaries of solid waste burial grounds, and the lack of control over their usage and the presence of materials of a certain value, all these make garbage dumps and landfills attractive

places for the poorest parts of the population. This situation is dangerous because: (a) garbage collectors are not only catch infections themselves, they also become carriers of viruses and infectious diseases; By visiting markets, canteens, using public transport they spread infection and inflict danger of infection on a significant number of people; (b) items collected from garbage dumps return to cities and villages (e.g. clothes, footwear, household utensils, dishes, glass containers, alloys and non-ferrous metals, wood) thus also becoming sources of infection and diseases.

Methods of solid waste disposal

Involvement of private enterprises in solid waste treatment allows considerable increases in the efficiency of waste treatment and re-processing. In Pavlodar city, the management of solid waste was given to "Polygon MDS Ltd." company (a store of waste classified as III-IV danger category) and to "Special Machines Ltd." company (a garbage dump in the city).

Private enterprises successfully resolve the problem of collection and de-mercurization of utilized lamps and instruments containing mercury: private company "Abdulkhakimov" in Kostanai oblast; in Petropavlovsk - "Zixto" joint-stock company; in Almaty oblast "Synap Ltd."; in Uralsk waste is successfully accepted and re-processed, and the same is done by "Pavlodar Chemicals Plant" joint-stock company in Pavlodar.

The experience of "Ilin Ltd." can serve as a positive example. This company was trusted with the management of a landfill site in the town of Lisakovsk (Kostanai oblast) and has introduced the technology of re-processing and neutralization of waste, which envisages map and trench methods of waste burial after its preliminary compression, allowing the volume of waste to be reduced threefold.

In West Kazakhstan oblast work on re-processing of secondary raw materials has started. For instance, "StroiTech Ltd." company recycles broken glass and (re-)produces consumer goods. "Zheksengali Ltd." company has developed a similar project. "UralVtorMa" company has developed a project to process waste from the production of wood chipboards, recycled paper and wool, and to use the output material to produce composite construction slabs.

Noise pollution

Extensive use of new technologies, the growth of fast moving power equipment, the use of various household equipment – all these lead to an increased impact of noise at work, home and at leisure.

As a result of noise impact, the level of illness has risen by 30% in Kazakhstan's cities. The first noise standards in the world were adopted in the USSR in 1956, while the standards recommended by the International Standardization Organization ISO appeared at the beginning of the 1960's. The US's first noise standards were implemented in 1969.

According to the Russian standards, the noise generated by a plane in an airport area cannot exceed 65 decibels during the day and 45 decibels at night. The noise standards in the area of an apartment complex are strict: noise cannot exceed 55 decibels during the day and 45 decibels at night. By comparison, sounds from a birch grove and birds singing are 35-45 decibels.

According to data from the Kazakh State Sanitary-Epidemiological Service, the noise situation in Akmola, Almaty, Atyrau, West Kazakhstan and North Kazakhstan oblasts is estimated as propitious, whereas in Aktubinsk, East Kazakhstan, Karaganda and Kostanai oblasts an intensive amount of noise pollution on population is observed. The highest noise pollution indicators are observed in the cities of Almaty and Astana.

Conclusions to Chapter 2

1. *The large resources and raw materials potential of the country forms a basis for the development of a powerful industry and several strategically important production sectors. At the same time, extensive use of natural resources, ignoring the basic principles of sustainable nature use, has caused significant changes in Kazakhstan's environment. Industrial enterprises are major sources of pollution, and, in some regions, caused major environmental destructions.*
2. *Location and operation of the Soviet era nuclear/missile launch sites in Kazakhstan has resulted in the loss of these areas for human living for the next decades to come.*
3. *Using extensive methods in agriculture, plowing of the virgin and derelict lands, regulation of river flows, excessive use of chemical fertilizers and insecticides, have resulted in the loss of productive lands and meadows/pastures and the low quality of agricultural products.*
4. *Storage and disposal of industrial and municipal wastes is remaining a challenge. Accumulated wastes pose a real threat to the environment and health of the population.*

CHAPTER 3. CURRENT STATE OF THE ENVIRONMENT

3.1. Air

The atmospheric air not only has a direct impact on humans, but also serves as a transport medium that causes the pollution of soil cover, water sources, vegetation, and foodstuffs. In almost all countries of the world the quality of atmospheric air has undergone serious changes over the last 100-150 years. The 20th century was a period of active and unprecedented human interference in the state of natural environments.

Monitoring of ambient air pollution is carried out on a regular basis in 20 major cities and industrial centers in the Republic of Kazakhstan. The analysis confirms a quite high degree of atmospheric air pollution. The negative impact on the environmental state of air is mainly emissions and wastes caused by:

- Cities and industrial centers of the Republic (stationary sources of pollution);
- Vehicles (mobile sources of pollution);
- Rocket and testing sites;
- Forest and steppe fires;
- Flaring of gas and petroleum products at production sites.

On average, 163 kg of various chemical compounds are released annually per capita into the Republic's atmosphere. In Karaganda Oblast this figure is 793 kg, Pavlodar Oblast – 547 kg, Atyrau Oblast – 279 kg.

Stationary sources of emissions

Emissions from stationary sources amounted to 2,429,400 tons in 2000, which is slightly higher than the levels of 1998 and 1999 (2,327,600 and 2,309,660 tons respectively). 17,292,200 tons of pollutants, i.e., 87.7% of the total volume of pollutants emitted by stationary sources, were trapped and neutralized. Emissions by the enterprises of Karaganda, Pavlodar, and East Kazakhstan oblasts are the most significant. Furthermore, in 2000 there was a substantial increase of omissions in East Kazakhstan, Kostanai, Almaty, Mangistau, Aktubinsk and South Kazakhstan oblasts, and the capital city Astana.

Table 3.1.1.

Emissions of air pollutants from stationary sources, thousand tons/year

	1996	1997	1998	1999	2000
Kazakhstan	2,365.7	2,368.7	2,309.7	2,308.7	2,429.4
Akmola Oblast	73.5	67.3	50.5	59.8	41.0
Aktobe Oblast	34.5	41.7	44.6	23.2	31.4
Almaty Oblast	94.5	77.1	63.2	58.6	63.1
Atyrau Oblast	93.7	137.3	135.3	174.7	123.8
East Kazakhstan Oblast	199.5	190.5	160.3	177.9	243.8
Zhambyl Oblast	30.7	27.4	19.8	11.8	11.5
West Kazakhstan Oblast	15.3	13.3	13.0	22.7	22.6
Karaganda Oblast	792.6	950.9	1,009.2	1,049.5	1,108.1
Kzyl Orda Oblast	57.1	70.9	68.5	54.7	49.8
Kostanai Oblast	138.5	89.2	52.6	54.7	109.5
Mangistau Oblast	62.7	59.6	53.4	51.0	59.4
Pavlodar Oblast	609.7	515.8	49.6	435.2	433.7
North Kazakhstan Oblast	122.6	87.7	69.7	60.4	53.5
South Kazakhstan Oblast	25.2	26.6	15.3	15.6	19.1
Almaty City	15.6	13.4	17.3	13.2	13.0
Astana City			41.5	45.8	46.3

Source: Center for Environment Monitoring, Kazgidromet

By assessing the physical composition of emissions, it should be noted that over the recent years, versus 1991, there has been a decrease in the content of solid particles (from 33.9% down to 27.7%) while the content of hydrocarbons increased from 3.0% to 7.5%. The content of hazardous admixtures containing sulfur also increased: sulfur dioxide from 34.7% to 41.0%, and hydrogen sulfide from 0.003% to 0.1%. The content of nitrogen oxide has remained almost unchanged.

Table 3.1.2.

Emissions of hazardous pollutants from stationary sources in 2000, thousand tons

Region, City	Total	Including					
		solid	gaseous and liquid	Including			
				Sulfurous anhydrite	Nitrogen oxide	Carbon monoxide	Carbon hydrates
Kazakhstan	2,429.4	668.5	1,760.9	1,080.0	161.7	390.7	112.8
Akmola Oblast	41	23.1	17.9	10.0	2.5	4.4	0.1
Aktobe Oblast	31.4	5.6	25.8	6.5	3.6	10.8	4.46
Almaty Oblast	63.1	20.9	42.2	26.9	3.5	4.6	0.079
Atyrau Oblast	123.8	2.3	121.5	19.0	13.4	51.1	35.4
East Kazakhstan Oblast	243.8	41.8	202	151.9	14.5	33.2	1.6
Zhambyl Oblast	11.5	4.4	7.1	2.0	1.9	1.7	0.6
West Kazakhstan Oblast	22.6	3.3	19.3	6.3	1.4	10.1	1.37
Karaganda Oblast	1108.1	247	861.1	626.3	37.2	195.8	0.7
Kyzylorda Oblast	109.5	61.7	47.8	33.4	4.7	9.1	0.4
Kostanai Oblast	49.8	5	44.8	1.5	1.2	29.0	13.04
Mangistau Oblast	59.4	3.3	56.1	0.3	9.4		
Pavlodar Oblast	433.7	191.4	242.3	160.4	51.7	22.0	7.35
North Kazakhstan Oblast	53.3	32.4	20.9	12.2	4.8	3.5	0.3
South Kazakhstan Oblast	19.1	2	17.1	3.3	1.0	4.3	8.2
Almaty City	46.3	21.5	24.8	15.7	7.5	1.4	0.14
Astana City	13	2.8	10.2	4.0	3.1	1.8	0.7

Source: Center for Environment Monitoring, Kazgidromet

Analysis of how individual types of economic activity contributed to the overall pollution of air (1998-2000) shows that the main polluters were (See Figure 3.1.1):

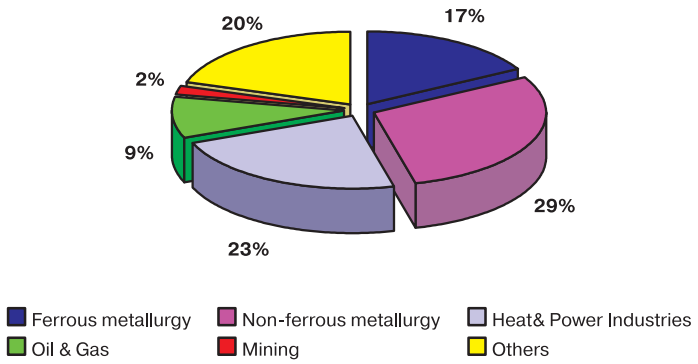
- Production and distribution of electricity, gas, water;
- Processing industry;
- Metallurgic industry;
- Mining industry;
- Extraction of fuels for the energy sector;
- Extraction of crude oil and natural gas;
- Transport and communications

The enterprises of *oil and gas industry* ***contribute significantly to air pollution.*** On the whole, the specific share of pollutants emitted in Kazakhstan without treatment amounted in 1999 to 7.7% of the total volume. In the

oblasts where oil and gas producing industries are concentrated the indicators are as follows: Atyrau – 99.9%, Kyzylorda – 96.7%, Mangistau – 94.1%, West Kazakhstan – 89.7%.

Figure 3.1.1.

Share of industries in total emissions

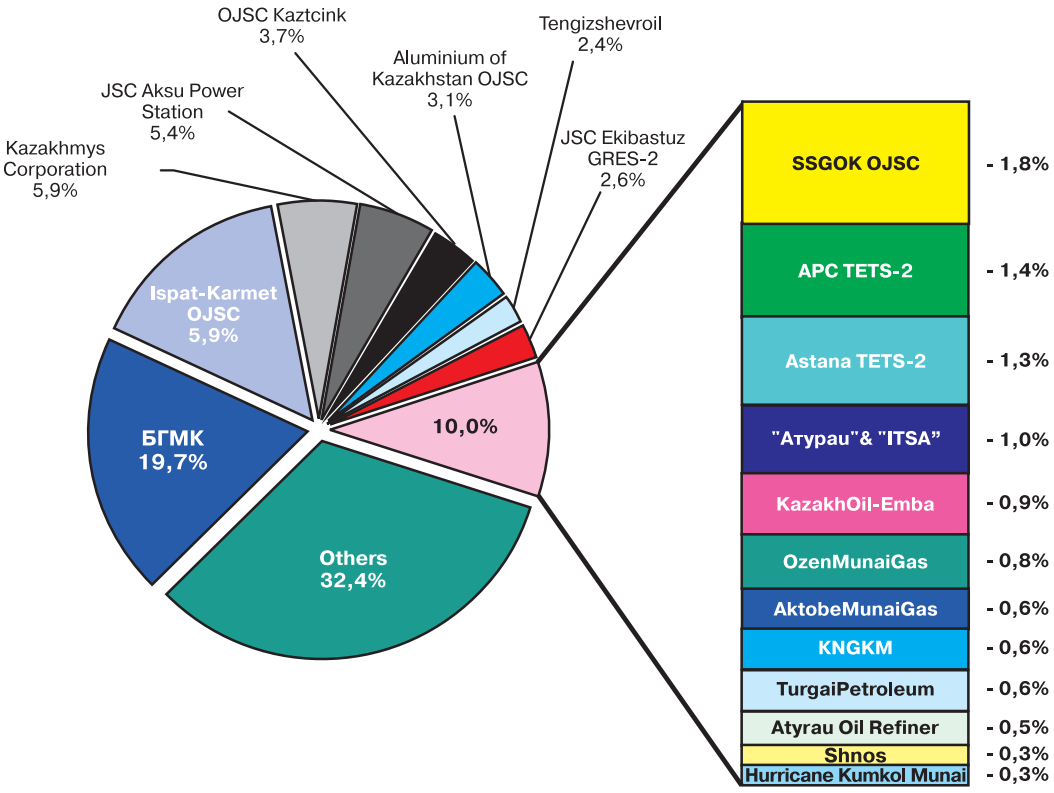


Source: Center for Environment Monitoring, Kazgidromet

Among major enterprises of the mining and metallurgic industries, the following enterprises have the biggest impact on air pollution: Balkhash Mining and Metallurgical Combine Plant (19.7% of emissions) and Ispat Karmet AOOT (14.9%). The share of emissions from the enterprises Kazakhmys Corporation, Aksuisk Electric Power Station JSC, KazZinc OJSC, Aluminum Kazakhstan OJSC, Ekibastuz Hydro Electric Power Station-2 JSC, Tengizshevroil LLP varies within the range of 2 to 6 per cent. In comparison with 1998-1999, some increase in emissions is observed in the cities of Aktubinsk, Ust-Kamenogorsk, Taldykorgan, Karaganda, Zhezkazgan, Balkhash, Kyzylorda, Arkalyk, Rudnyi, Aksu, Ekibastuz, Shymkent, and the urban-type settlement Glubokoye.

Figure 3.1.2.

Contribution of large enterprises to total emissions in Kazakhstan



Source: Center for Environment Monitoring, Kazgidromet

Mobile sources of emissions

Vehicles that emit tons of pollutants cause a severe negative environmental impact. The total amount of such pollutants exceeds 1 million tons per year (1,098,000 tons). In recent years, in most big cities, the share of overall air pollution caused by vehicles has risen to 60% and more. In Almaty, vehicles produce 90% of overall emissions.

Compared with 1990, total gross emissions from vehicles have reduced by 2.4 times, despite the fact that the vehicle fleet that has grown during this period This situation is explained by the following factors:

- Change in the vehicle fleet's composition. The number of trucks and buses has dropped by 14.4% and 9.0% respectively. At the same time, the number of passenger cars has increased by 21.8%. The share of diesel trucks and buses has also increased, and diesel passenger cars have become very popular;
- A decrease in the volume of passenger transport by 1.9%, of cargo transport – by 3.0%;
- A decrease in the consumption of auto-motor fuel (gasoline – by 3.2 times, diesel fuel – by 1.5 times)

The largest amounts of hazardous emissions from vehicles are observed in the city of Almaty (170,000 tons per year) and in the following oblasts: Kostanai (163,200 tons), Almaty (131,000 tons), South Kazakhstan (106,000 tons), and Karaganda (100,000 tons).

Table 3.1.3.

Emissions of pollutant from mobile sources (vehicles) 1990-2000, selected years, thousand tons

Region, City	1990	1995	1998	1999	2000
Republic of Kazakhstan	2610.6	997.1	1055.4	1099.8	1098.0
Akmola Oblast	186	66.8	42.8	25.4	25.4
Aktobe Oblast	107.1	49.1	34.9	36.4	36.0
Almaty Oblast	323.3	113.4	160.0	112.7	131.0
Atyrau Oblast	58.8	28.9	27.0	23.1	20.2
East Kazakhstan Oblast	266.3	71.5			
Zhambyl Oblast	143.9	40.2	35.0	34.5	35.0
West Kazakhstan Oblast	104.2	38.4	41.0	57.9	68.0
Karaganda Oblast	224.9	81.6	100.0	100.0	100.0
Kzyl Orda Oblast	76.1	36.4	60.2	51.2	50.0
Kostanai Oblast	243.3	128	334.5	195.4	163.2
Mangistau Oblast	41.8	28.9	85.6	88.6	88.0
Pavlodar Oblast	172.4	74.7	29.9	31.5	32.0
North Kazakhstan Oblast	274.4	101.7	48.1	48.6	49.0
South Kazakhstan Oblast	224.4	87.3	99.6	101.3	106.0
Astana City			21.5	23.8	24.2
Almaty City	163.7	50.2	200.0	169.4	170.0

Source: Center for Environment Monitoring, Kazgidromet

Rocket and testing sites

The air in Kazakhstan is impacted by at least three factors in relation to rocket and testing sites: burning out of oxygen, poisoning of the atmosphere by unburned fuel, transboundary migration of dust and depletion of ozone layer.

It is known that most fuel is consumed during launch and up to a height of 40-50 km. During this process, 500-600 tons of fuel is consumed, including 200 tons of heptyl. Fuel combustion is accompanied by the burning out of atmospheric air, including oxygen, and by the formation of decay products. The volumes of oxygen that are being burned, as well as the composition of the combustion and rocket fuel oxidation products, are not known.

Special calculations based on knowledge of fuel composition and used oxidants are required. However, it is possible to assume that, as a result of rocket launches, air will change its natural composition and consequently become unsuitable for living organisms to breathe.

For more detailed information on impacts of rocket launching and testing sites, please refer to Section 2.3.

Activities to address air pollution issues

In 2002, the Law "On Protection of Atmospheric Air" was approved. However, effective mechanisms to reduce emission levels are not yet in place. Measures to protect the air aim to control emissions from enterprises and to collect environmental charges from stationary and mobile sources. Unfortunately, these measures failed to decrease emissions of pollutants because the costs of "environmental payments" for enterprises are included in the final cost of products (heating, power, services) paid by consumers.

The mechanism of environmental payments does not consider the use of clean technologies in production and support for clean technologies and cycles.

Draft laws on Environmental Audit and Environmental Insurance, which are currently being developed by MEP, should consider new mechanisms of resource allocation for rehabilitation of the environment and improved public health.

Table 3.1.4.

Payment rates for emissions, 2000

Oblast, City	Volume of Pollutant Emissions, thousand ton	Relative weight of total volume, %	Payment rates for stationary sources, mln tenge	Relative weight of total rates, %
Total in Country	2,491.42	100.0	2449.9	100.0
Industrial sector, total: ***Including oblasts :***	1936.7	77.7	1403.9	57.3
East Kazakhstan	260.0	10.4	460.1	18.8
Karaganda	1,188.8	47.7	104.4	4.3
Atyrau	132.9	5.4	405.6	16.6
Pavlodar	355.0	14.2	433.8	17.7
Agricultural sector, total: Including oblasts :	494.72	19.9	917.3	37.4
Akmola	58.8	2.4	79.5	3.2
Aktobe	23.0	0.9	72.3	2.9
Almaty	68.0	2.7	238.8	9.7
Kzyl Orda	44.32	1.8	17.1	0.7
Kostanai	88.0	3.5	154.2	6.3
Mangistau	75.0	3.1	82.4	3.4
North Kazakhstan	72.1	2.9	84.5	3.5
Zhambyl	11.6	0.5	68.9	2.8
Western Kazakhstan	27.9	1.1	68.2	2.8
South Kazakhstan	26.0	1.0	51.4	2.1
Cities, total Including:	60	2.4	128.8	5.3
Astana	47.0	1.9	48.7	2.0
Almaty	13.0	0.5	80.1	3.3

Source: Center for Environment Monitoring, Kazgidromet

At present, the Almaty City Environment Department, with the assistance from the EU's TACIS Program (1 million Euro) is conducting a project on the "Mitigation of Adverse Impacts of Vehicles on the Environment and Public Health in Almaty." The goal of this project is to establish appropriate conditions for improving the state of vehicles and fuel quality, as well as to enhance the traffic behavior culture and the efficient management of traffic flow. It is expected that the project will be supported by the World Bank within a "Clean Air" Initiative.

With the aim of improving air quality in the country and in accordance with NEAP, it is necessary to carry out work in the following directions:

- Decrease the level of atmospheric air pollution by hazardous chemical, physical, and biological factors in residential areas (urban and rural);
- Carry out studies on the impact of air pollution on public health and hence develop appropriate prophylactic activities;
- Use appropriate instruments to monitor air pollution: % of hazardous chemical compounds and physical factors such as noise, vibration, ionizing and non-ionizing radiation, ultra- and infrasound);
- Create a single network for monitoring the quality of ambient air; ensuring a timely access of the monitoring agencies and the population to data.

3.2 Water Resources

According to the Water Code of the Republic of Kazakhstan, the State Water Reserve of the Republic includes all water objects and water resources contained within the territory of Kazakhstan, registered or subject to registration in the State Water Cadastre.[20]

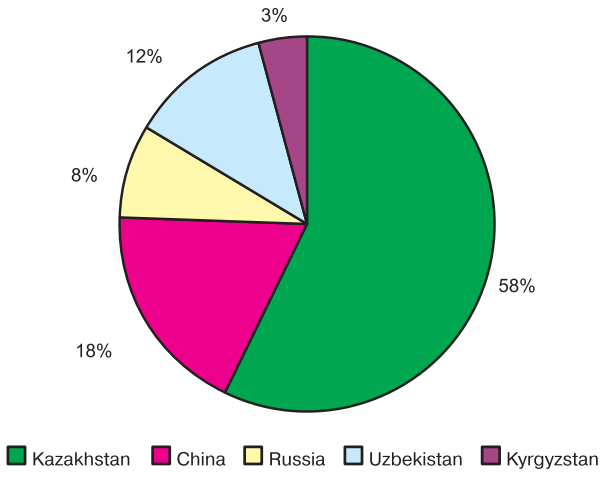
The state water reserve includes rivers, lakes, swamps, ponds, water reservoirs, other surface water resources, as well as waters of canals and main waterways, underground waters and glaciers.

Surface waters

The total volume of surface waters (by average water content) amounts to 100.5 km^3, of which only 56.5 km^3 originates in the country's territory. The remaining 44.4 km^3 comes from neighboring states: China – 18.9 km^3, Uzbekistan – 14.6 km^3, Kyrgyzstan – 3.0 km^3, Russia –7.5 km^3.

Figure 3.2.1.

Kazakhstan's Dependence on Water Resources from Neighboring Countries



Source: Water Resources Committee, 2002

In terms of water supply, Kazakhstan is the least well provided for among the CIS countries: water supply amounts to 37,000 m^3 per 1 km^2 or 6,000 m^3 per capita, annually.

[20] Water Code, 2003

Large natural water bodies as the Caspian and Aral seas and the Lake Balkhash are located on the territory of Kazakhstan. There are about 39,000 rivers and temporary waterways, more than 48,000 lakes, about 4,000 ponds, and 204 water reservoirs. The most important water arteries are the rivers Irtysh, Ili, Syrdariya, Ishim, Tobol, Ural, Turgai and Chu.

By virtue of various climatic conditions, up to 90% of water flow from surface sources occurs during spring. The distribution of surface waters is also uneven: their levels and volumes fluctuate from year to year as well as during a year, and, therefore, cause an uneven water supply to different regions and industrial sectors. The biggest supply of water is in East Kazakhstan Oblast: 290,000 m^3 per 1 km^2. However, a permanent deficit of water is evident in some other oblasts, such as: Atyrau, Kyzylorda, and, particularly, in Mangistau oblast, where there are almost no rivers or lakes.

For a number of reasons, water resources of river flows cannot be efficiently used for economic needs. In particular, the cumulative volume of obligatory water releases for agricultural, industrial, municipal and fishery needs from the rivers Syrdarya, Ural, Ili, Tobol, Irtysh, Ishim, Turgai, Chu is about 29.0 km^3 per annum. Water releases from the Irtysh River for transport and energy needs in Kazakhstan and Russia amount to 9.0 km^3. Loss of the water flow due to evaporation and seepage in water reservoirs and river-beds is estimated at 12 km^3. The spring high water flow from the rivers of the Central Kazakhstan valleys, estimated at 4.5 km^3, has been almost lost because of dispersion, scattering and regulation difficulties. Thus, with a total demand for water resources of 54.5 km^3, the availability of water does not exceed 46.0 km^3. In the average low-flow (75% of the total demand) and the low-flow (95% of the total demand) seasons, the total volume of water resources drops to 76 km^3 and 58 km^3, respectively, while the resources available for economic needs reduces to 32 km^3 and 25 km^3, respectively.

Quality of Surface Waters

The quality of surface waters in Kazakhstan can be ranked as medium level. The most polluted watersheds are basins of the Ural and Irtysh rivers, due to inlet waters from the enterprises of chemical, oil-refining, machine-building industries, and non-ferrous metallurgy. About 120 million m^3 (146 million m^3 in 1999) of "polluted" release waters goes into the Irtysh river basin every year.

Among the highly polluted rivers (low-water rivers) are the rivers Nura and Sherubai-Nura. These two low water rivers are heavily polluted by mercury and are ranked in the secondary polluted category for this pollutant.

The water of the rivers Irtysh, Ural, Syrdariya, and other rivers that originate in the territory of neighboring states flow into Kazakhstan already polluted.

In addition to pollution caused by industrial, mining, and oil-refining enterprises, there are additional pollution sources such as urban construction, livestock farms, agricultural irrigation fields, various precipitation tanks and storage places for solid and liquid waste, as well as for petroleum products. The degree of pollution caused by lead, zinc, cadmium, iron, selenium and manganese amounts to MPC 10-100 at major industrial facilities.

Ground Waters

The reserves of forecasted underground waters with salinity of up to 10 grams per liter are estimated in the Republic to be about 45 km^3, of which fresh waters with salinity of up to 1 gram per liter amount to 10 km^3. The volume of 'fresh' underground water available for utilization amounts to 15.1 km^3. However, these underground resources require significant expenditure in order to access and develop them. The level of underground water utilization is still low and amounts to 1.2 km^3, or 7.9% per annum.

The main directions for utilization of underground waters are:

- to use as technical waters for manufacturing industry;
- to satisfy agricultural needs;
- to use as drinking, therapeutic, and mineral waters.

Table 3.2.1.

Surface Water Resources of Kazakhstan, km³

River, Sea, Lake Basins	Average Annual Flow		Including:						Water Supply Flow		Resources Available in Low-Water Years	
			Mandatory Consumption of Flow					Available Flow				
	Total	Flow from adjacent countries	Environmental, Fishing Farms, Sanitary Discharges	Transport and power releases to Russia	Evaporation and Filtration Losses	Unregulated Flow	Total consumption		75%	95%	75%	95%
1. Aral-Syrdarya	17.9	14.6	3.1	-	2.8	-	5.9	12.0	14.7	14.2	9.8	9.3
2. Balkhash-Alakol	27.8	11.4	14.6	-	1.1	1.8	17.5	10.3	22.8	17.8	7.0	5.4
3. Irtysh	33.5	7.5	4.3	8.8	4.9	0.8	18.8	14.7	26.6	19.7	10.8	8.0
4. Ishim	2.6	-	-	-	0.5	0.7	1.2	1.4	1.1	0.3	0.4	0.1
5. Nura-Sarysu	1.3	-	0.1	-	0.4	0.1	0.6	0.7	0.4	0.1	0.3	-
6. Tobol-Turgai	2.0	-	0.1	-	0.1	1.0	1.2	0.8	0.8	0.3	0.3	-
7. Shu-Talas	4.2	3.0	0.1	-	0.1	-	0.2	4.0	3.5	2.8	3.0	2.3
8. Ural-Caspian	11.2	7.5	6.5	-	2.2	0.4	9.1	2.1	6.2	3.0	1.0	0.3
National Total	100.5	44.0	28.1	8.8	12.1	4.8	54.5	46.0	76.1	58.2	32.6	25.4

Source: Water Resources Committee, 2002

Table 3.2.2.

Ground water resources reserves by basins

Total, km^3	By Basin:							
	Aral-Syrdarya	Balkhash-Alakol	Irtysh	Ishim	Nura-Sarysu	Tobol-Turgai	Shu-Talas	Ural-Caspian
15.1	1.6	6.0	3.5	0.2	1.1	0.5	1.6	0.6

Source: Water Resources Committee, 2002

Quality of ground waters

More than 700 potential sources of pollution of underground waters have been discovered in the territory of the Republic, including 241 that have a direct impact on the hydro-geochemical properties of underground waters. The biggest numbers of pollution sources have been found in the Almaty, Karaganda, and East Kazakhstan oblasts. Most sites of polluted underground water are characterized by a high degree of salinity, increased hardness, sulfates and chlorides that exceed their MPC. The presence of nitrogen compounds was registered in underground waters at the 75 discovered sites and is permanent at 55 of them. Pollution by petroleum products is present at 49 sources (permanently at 35 of them); by heavy metals – at 59 (permanently at 40); phenols – at 41 (permanently at 35); organic compounds – at 29 (permanently at 22).

According to danger types of discovered pollutants, the following classification can be presented:

- 127 sites -Dangerous types of ground water pollutants;
- 63 sites - Moderately dangerous types;
- 48 sites - Highly dangerous types; and
- 3 sites - Extremely dangerous types

An existing threat that the quality of underground waters will deteriorate has been ascertained in 70 settlements, 113 fields, and 41 intakes of underground waters that are designated for commercial and drinking needs.

The supply of drinking water to the citizens of Kazakhstan is deteriorating every year. At the same time, the consumption of water from decentralized water sources - open water bodies and irrigation ditches - is increasing.

At present, the quality of drinking water from underground sources of proven aquifers, within whose impact zones pollution has been observed, corresponds to the State Standards (GOST) for “Drinking Water”. However, if pollution processes continue the extracted water quality could deteriorate even further and exceed the MPC values. Therefore immediate measures should be taken to eliminate the possible pollution of underground waters.

Return Waters

Return waters are formed by collecting drainage and discharge waters, from industrial and agricultural facilities, and by also collecting sewage waters from the public utilities sector. At present, the volume of return waters in the country amounts to 9.0 km^3. Along with this, the replenished resource portion of 2.0 km^3 flows back to the basins of the rivers Syrdariya (47%), Irtysh (34%), Ili (8%), and Nura (5%). The remaining flow is dispersed throughout the territory, disappears, is partially used in the filtration fields and is directed to industrial and public utilities’ precipitation tanks. The challenge of total utilization and treatment of return waters has yet to be addressed. Therefore a huge portion of these resources remains inaccessible.

The volume of return waters currently increases by 3-5% per annum. This is caused by increased water consumption and low technological level of production. The return waters are a serious source of pollution of surface and underground waters, as well as the environment. Return waters that feed into rivers are major sources of trans-boundary environmental pollution.

3.3. Biodiversity

The vast territory of Kazakhstan, its unique geographic location, and the number of climatic zones have brought about a diversity of natural conditions and a wide variety of flora and fauna.

Over 6,000 varieties of top vascular plants have been registered in Kazakhstan, as well as nearly 5,000 mushrooms, 485 lichens, over 2,000 seaweeds, and nearly 500 Bryophytes. The animal world is represented by

835 species of vertebrates, including 178 mammals, 489 birds, 49 reptiles, 12 amphibians, 104 species of fish, and just under a million species of invertebrates. In 1994, the Republic of Kazakhstan acceded to the Convention on Biodiversity to preserve and ensure the sustainable use of biodiversity. Under the Convention's framework, a number of commitments have been fulfilled: a Strategy and Action Plan on conservation and the rational use of biodiversity (1999) and national reports were prepared.

As a result of human interventions that affected the environment, desiccation and desertification endanger the biodiversity of Kazakhstan. The destroyed natural ecosystems, changes in aerial water treatment, loss of forests, the extreme use of bio resources, wasted industrial-irrigation waters, and the appearance of extraneous plants/animals all undermine the biodiversity of the country. Biodiversity depletion negatively affects the mountains, forests, deserts and coastal ecosystems.

Forest Resources

Kazakhstan is not rich in forested areas. According to the State Register, as of January 1, 2002, the forests and special protected areas totaled 26.08 million ha, including 11.47 million ha covered by forests.

The forests have unequal distribution. Kazakhstan's woody resources, including *saksaul* and common bushes add up to 4.2%, while forests account for 1.2%. The 'woodiness' index of certain regions varies from 0.1 to 16% of the total regional area. The majority of the total area covered by forests (69.3%, including *saksaul* and bushes) is concentrated in the south, southeastern and northern borders of the country.

Deciduous hardwood makes up 61.8% (nearly 7 million hectares) of the area of forest resources; coniferous forests 15.5%, and bushes 22.7%. Hardwood forests include *saksaul* and occupy nearly 50% of the area covered by forests.

The 'store' of wood in forests equals 383.67 million cubic meters, including coniferous forests 236.6 (61.7%); soft-wooded forests 123.9 (32.3%); *saksaul* 10.4 (2.6%), and bushes 8.5 (2.2%). The storage of ripe and over-mature wood pulp amounts to 29% of the total reserve.

In general all Kazakhstan's forests are a natural protector of the environment. They perform water protection, recreation, hygienic and environment functions.

Kazakhstan's forests can be categorized according to their level of protectiveness:

- Band coniferous forests, forest outliers, steppe ravine forest, forests in desert, semi-desert, steppe, forest steppes, and sparse forests, which occupy 21,191,000 hectares (81.3%) of the forest resources;
- Forests of special protection areas (SPAs) – 3,186.4 ha (12.2%), including: state reserves 887,800 ha, state national natural parks 1,344.400 ha, reserved forest areas, forests of scientific significance, genetic reservations 1,234; nature sanctuaries 888,700 ha, and forest fruit plantings 52,300 ha;
- Natural parks, most valuable forest mass 13,300 ha (below 0.1%);
- Forests with water protection functions add up to 711,600 ha (2.7%);
- Forests with sanitary-hygienic and health functions occupy 182,200 ha (0.7%).

Only 36.5% or 4,170.600 ha of woodlands are considered exploitable. Most woodland areas (63.5%) have been eliminated from production use as they perform an exclusive protective function following Kazakhstan's Forest Legislation.[21]

From the total area of forest reserves and SPAs (26,080,700 ha) forestlands amount to 70.7% (18,450,700 hectares), including areas covered by forests, 44% (11,474,7 hectares). Non-forest lands equal 29.2% (7,630,000 hectares) including cattle pastures 17.1% (4,458,200 hectares), hayfields 1.4% (359,100 hectares), and pastures 0.4% (109,300 hectares). Since January 01, 2002 a total of 2,954,500 hectares of forestlands have been in use.

Economic Valuation of Forest Resources

The role of forests for ecosystems and human life is obvious. Trees growing in mountains, deserts, steppes, on the shores of water sources and around urban areas perform soil-conservation, climatic management, water protection and regulation as well as recreational functions. It is the forests that the country's biodiversity is about. However, we do not know the actual economic value of the forest we have. Recognizing their irrefutable national value, we still appreciate them in terms of cubic metres of wood. The lack of economic evaluation of wood resources causes numerous mistakes when making managerial decisions. Incomplete appreciation of economic and environmental value of woods lessens responsibility for the conservation of this globally important resource and national property.

It is known that an additional 10% of forest land contributes to a 4-8% increase in the annual river water flow and stimulates an additional 4% of precipitation. Also, every 10,000 square metres of forest land helps to

[21] Materials of the State Forest Management Enterprise, 2002

increase the rivers' feeding supply of groundwater by 0.7-0.8 cubic metres every year. In 2002 the State Forest Enterprise carried out the first assessment of Kazakhstan's wood resources based on Russian methodology.

Table 3.3.1.

Economic value of wood resources in Kazakhstan

Wood species	Reserve of trees, millions of cubic metres	Costs of						
		Standing wood*		supravital** utility of wood		total (nonmarket) cost of wood		
		million tenge	million dollars	million tenge	million dollars	million tenge	million dollars	%
Conifers	230.84	13,1847.4	867.4	1,626,118.4	10,698.1	1,757,965.8	11,565.5	83,0
Soft-leaved	122.12	20,455.4	134.6	252,283.0	1,659.8	272,738.4	1,794.4	12,9
Hard-leaved	2.98	823.4	5.4	10,155.6	66.8	10,979.0	72,2	0,5
Saksaul	10.14	5,070.0	33.4	62,530.0	411.4	67,600.0	444,8	3,2
Other	1.47	435.1	2.9	5,366.5	35.3	5,801.6	38,2	0,3
Bushes	1.69	135.2	0.9	1,667.5	11.0	1,802.7	11.9	0.1
TOTAL	369.24	158,766.5	1,044.6	1,958,121.0	12,882.4	2,116,887.5	13,927.0	100
%	-	7.5		92.5		100		-

Notes:
* Calculations are based on the base cost rates for standing wood, Decree 3431 dated 15.04.2002.
**The calculation of this cost is based on the average ratio of this cost and standing wood cost, which is 9:1.

The actual monetary contribution the Government makes towards wood conservation is only 0.07% of the wood resource cost, while the annual return of the forestry in the form of timber, associated taxes and duties is only 0.02% of the cost of wood on the stem.

Contemporary status of forests

The reference of bushed lands and degraded deserted pastures into the forest category in 1998, allowed a formal increase of the area of the national forest resources by 1.68 million hectares. However, forest rehabilitation events were not financed over the same period and forest preservation and protection was extremely insufficient. The area of young (unclosed) forest cultures grew by 132,300 thousand hectares; open forest increased significantly by 70,000 thousand hectares, fire sites and perished vegetations by 140,500 thousand hectares, deforestation by 139,600 thousand hectares, and glades/waste lands by 283,300 hectares.

The volume of re-forestation has dropped 15-20 times over past few years, in comparison to 1990. By the year 2000, the status of the forest resource had worsened considerably. Hence, areas with forest cultures dropped by 96,100 ha, and unclosed forest cultures by 53,200 ha. The areas of open forests grew by 28,800 ha, fire sites and perished vegetations by 52,100 ha, glades and waste lands by 101,300 ha. These figures demonstrate the rapid degradation of the national forests as a whole.

The ***birch forests*** of the North Kazakhstan region challenge over-mature plantings as they occur. A relatively small portion of saplings illustrates the weak natural regeneration of such forests, as a result of their natural ageing and increased human intervention, unmanaged cattle pasture, violated forest area technology, and extremely scarce works for the cultivation of forests.

Saksaul forests occupy a special place in the forest resource sector. Since *saksaul* forests within the land were intended for agricultural use, in 1998 the management of degraded pasture areas were transferred to forest resource lands and therefore the area of *saksaul* forests grew by 591,200 ha. For the time being, a part of *saksaul* plantings are located within the forest resources and have been transferred to local administrations and to farming entities in breach of Land and Forest Legislation. The republican forest register showed recently that on the whole the status of *saksaul* forests has fallen sharply, with reserves dropping by 490,000 m^3 and is falling below 30-40% of the optimal standard. In 2001, forest improvement actions were undertaken in Kyzylorda oblast, and a ripe saksaul was found in a 100 km range. However, the current rate of Saksaul deforestation exceeds that of forest rehabilitation, which is leading to the deforestation of the entire country.

Strip pine tree forests. The intensive development of pine forests as well as large-scale forest fires in 1997-2000 lead to a significant loss of environmental and water protective functions of the strip pine forests in the Irtysh area. The real scale of this disaster has not yet been identified.

Coniferous forests suffer from the unsustainable consumer behavior of farmers, land owners, entrepreneurs, tourists, and summer houses residents. We can observe extensive construction works and fencing in of forests and water protection areas. Proximity of residential areas and cities, irresponsible behavior of rural population that results in poaching, and corruption of regulatory bodies—these all contribute to degradation of the coniferous forests of the Tian Shan.

Wild fruit trees (18,500 ha) contain the gene pool of valuable apple, apricot, nut, pistachio and other fruit plantings of the world collection in the southern mountainous regions of Kazakhstan at heights of up to 1800-2200 m. These plantings also need more consistent protection from uncontrolled private building and garden construction works triggered by uncontrolled agricultural fires, common fires, and irregular cattle pasture. Over the past 30 years, up to 70% of the wild fruit forests - a globally significant genetic resource – have been lost.

Reasons for loss of woodland

Timber-trade. The opening of unlimited timber market in China, Kyrgyzstan and Uzbekistan in 1995-96 triggered the emergence of a network of private logging and timber-selling enterprises in Kazakhstan, that include *Les Vostoka* company (Ust-Kamenogorsk) that with the consent of local executive authorities gained an almost exclusive right for timber sales, and *Interles* sales firm (Semipalatinsk) that handled shipments of timber made in vast burnt woodlands. Export of raw timber increased by 2.4 times in 2000 versus 1999 and reached 65,942.7 m^3. There is also an established illegal export of 200,000 m^3 of wood from Semipalatinsk region.[22] The Government of Kazakhstan adopted Decree #1571 "On prohibiting export of round softwood and fuel wood in coniferous timber" (for three years). However, it did not bring about any change as wood started to be exported as squared beam and other types of timber.

Governmental Decree #785 put a permanent veto on the export of certain types of timber, carving wood and articles made of soft and hard woods. There are plans to amend Decree #431 "On approving baseline rates for standing timber and rules for calculating payment for utilisation of wood resources" dated 15.04.02. The situation has necessitated such measures as there are cases of deliberate wood burning on sites, especially in coniferous forests of the Irtysh River basin with the intention of logging operators' obtaining a license for harvesting fire-damaged wood at lower rates.

Forest fire. Wood is remarkable for its combustibility in Kazakhstan. Over 1989-2000 there were on average 647 forest fires occurring per annum throughout the country with the average annual area of each fire-site reaching 18.9 hectares. In total, over 20,500 hectares of woodland were wiped out or damaged by fire between 1989 and 2000 (Annex 3, Figure 3).

According to some statistics provided by the forestry authorities, as of 1 August 2002 the acreage of fire-sites in coniferous forests of the Irtysh River basin was 71,000 hectares in Pavlodar oblast and 155,000 hectares in East Kazakhstan oblast over 1995 – 2002. The stock of fire-damaged plants and trees on these sites was 5,632.4 and 11,197.9 thousand m^3 in Pavlodar and East Kazakhstan oblasts, respectively. Taking into account supravital commodity composition, the cost of the stand damaged was 2,528 and 5,482 million tenge in Pavlodar and East Kazakhstan oblasts, respectively, if calculated at 2002 rates.

In 2001 there were at least 370 forest fires affecting around 21,000 hectares of woodland. 11,000 hectares of forest were completely destroyed by fire, causing 38 million tenge of damage.

Over $US 660 per hectare are required for planting and wood recovery. Over the period of 1995-2002 the overall damage was estimated to be over 80 billion tenge, including supravital utility of the Irtysh basin pine woods.[23]

Over the period between April and August of 2002 6,000 hectares of forest and steppe land suffered damage worth 80 million tenge. In fact, only 16% of the fires occur for 'natural' reasons, with the main cause of fire being human activity, including arson. The following story is very illustrative. On May 27 2002 the Bogenev forestry of East Kazakhstan Oblast was on fire "due to a cigarette stub thrown from the motorway". With a wind speed of 10-12 m/sec 1,200-1,500 hectares of 15 forest blocks were enveloped in flames, including the Dongulek forestry. Fire-engines, helicopters and fire-brigades from Semipalatinsk and Ust-Kamenogorsk were engaged in extinguishing the fire. A forestry officer was killed and 2 special vehicles destroyed.

As a result of uncontrolled chopping of burnt wood, wood and timber were extensively plundered and

[22] Programme for restoration and development of wood-working and furniture-producing industry for 2001-2003. Report "Status of natural resources and the environment in the Republic of Kazakhstan. Overall environmental situation and progress towards Action Plan for 1998-2000" by the RK MNREP, 2001

[23] Note: Damage was calculated by the standard ratio of stumpage cost to supravital utility of wood, which is 1: 9, without account of radiation situation in the region.

exported out of the country. Official statistics alone report that Kazakhstan has lost 2 million m^3 of wood over the last 4 years, worth approximately 84 million dollars, if calculated at $42 per cubic metre.

Utilisation of aircraft for patrolling and extinguishing forest fires reduces the percentage of wood affected by fire. Over 1989-1991 the acreage of burnt woodland ranged between 500 and 3,400 hectares per annum, with annual provision of 7,400-8,400 hours of air patrolling. Whereas in 1995-1999 the acreage of burnt woodland reached 7,500-191,900 hectares with a decrease in annual air patrolling down to 1,500-200 thousand hours. Plans are in place to provide 1,063-1,276 hours of air patrolling annually to oversee 519,500-623,600 hectares of woodland in order to enhance forest fire prevention efforts over 2003-2007.

Wood vermin. Wood vermin and disease protection efforts do not appear sufficiently effective. The acreage of affected green plantations has increased 2.5 times, while the need for wood vermin control efforts increased twofold over the period between 1997 and 2000. Wild fruit woods of Jungar and Zaili Alatau have not seen any sanitization since the 1990s with 100% of their area affected (Topolev forestry and Lepsinsk forest reserve). The pine wood of the Bayan-Aul National Park has been affected by viruses and is incurable. The sanitary status of strip pine woods has been gradually deteriorating since 1997: the percentage of woodland affected by wood vermin has increased by 2-2.5 times, with 36,600 hectares affected by pine silkworm (Dendrolimus pini), 11,900 hectares by star-shaped saw-fly (Diprion pini) and 91,000 hectares by pine noctuid (Panolis flammea). The burnt wood is affected by secondary stem vermin such as pine Capricorn beetle (Monochamus galloprovincialis), apical bark beetle (Ips acuminatus) and pinebeetle (Blastophagus piniperda, Blastophagus minor). In order to remove vermin and disease breeding grounds vermin control and treatment efforts will need to be applied over at least one million hectares of woodland. The cost of pesticide sufficient to treat 1 hectare of woodland is estimated to be 50 dollars, plus the cost of aircraft rent should be added to this and account taken of the remoteness of forests from aerodromes, as well as the mountainous terrain.

Felling. The Altai forests have been affected by long-term intensive clear felling with cutting sites rapidly overgrowing with grass, bushes and birches afterwards. In recent years even officially-authorized timber harvesting has been completely neglected environmental laws. This applies to locations of felling sites, felling intensity (percentage of cut wood), time required for two felling sites to merge, rapidity of felling site clearance and preservation of undergrowth. Such violations cause rapid deforestation. Felling occurs in easily reachable places such as along frequently used roads, near human settlements and river-beds, which is strongly prohibited by the Forest Code. All violations tend to increase. In addition, felling by poachers has become common and the damage it causes can only be detected when carrying out scheduled assessments. Over the period of crisis, flood-plain forest, forest within water conservation areas, windbreaks and road forest-belts have almost all been cut away. During economic growth, submountain forestland of Semirechie region have been extensively developed and used for “elite” house-building. For decades, forestry officers have practiced excessive severance felling when undertaking main or treatment felling. Mature or middle-aged standing wood is often felled, which is a violation of the principles of ‘shelterwood’ and gradual main felling. Submountain and collective orchards have been completely removed in this way, while the fruit forests of Jungar and Zaili Alatau, Western Tien Shan and Karatau have been largely destroyed. An assessment carried out in Kyzylorda oblast in 2001 disclosed a lack of mature saksaul within a radius of up to 100 km from settlements. Cutting of saksaul wood has contributed to a decrease in the saksaul reserve by 490,000 m^3, which now constitutes only 30-40% of the optimal reserve.

Wood felling exceeds forest regeneration throughout the country, leading to deforestation. The damage this causes to the economy has not yet been assessed, while the regeneration needs are beyond calculation. Current resource allocation for forest renewal is inadequate.

Forest rehabilitation and forest cultivation measures

From the period 1948 to 1991, over 1.0 million hectares of ‘artificial’ forests were planted in Kazakhstan. Until 1990, for the purposes of forest rehabilitation and cultivation nearly 140 million seedlings and saplings were grown annually, and up to 80,000 ha of forest cultures were generated. 252 forest sanctuaries were located within a 4,600 ha area. For seed procurement, a selective inventory of coniferous and deciduous plantings was generated within 819,000 ha. 1,366 ha of seed plantations were selected and as result 83 ha of seed plantations were grown, 242 ha of standard trees allocated, 10 ha of clone archives and 28 ha of test cultures prepared.

As the funding was cut by 2001, the volume of forest seedling and sowings dropped by 5,800 ha. Works on the dry bed of the Aral Sea basin were stopped with only 54,800 ha created on the eroded lands from a total of 329,000 ha of forest-suitable areas.

The volumes of work for generating sanitary protective areas are extremely inadequate. With 155,700 ha of such vegetation around the cities and industrial centers, the existing standards require an extra 100,000 ha, though in recent years these were generated only around the country’s capital, Astana.

Endangered vegetation species

Unbalanced economic activities, desertification, and changes in the general environmental conditions mentioned in previous chapters all contribute to the extinction of species and loss of vegetative diversity. Sprouting areas for certain communities are therefore reduced and disappear completely from those areas most affected by agriculture (Annex 3, Table 1).

An illustration of this is the drying of Central Asian juniper forests on the northern slopes of the Aksu-Dzhabagly sanctuary from 1970 to 1980. This was caused by wastes from Dzhambul phosphorus and Shymkent lead-zinc concerns spread by winds some 100 km to the mountains. Only some trees on the slopes and areas inaccessible to cattle or people remain from the previous swathes of pistachios and almond coniferous groves of South Kazakhstan. As a result of extreme loads, the forests' natural potential for self-regeneration has been weakened.

Between 1940 and 1960, continuous thickets of winter-growing trees and berry bushes - apples, apricots, barberry, plums, hawthorn, raspberry, currant, dog rose and others, covered the slopes of the Dzhungar and Zailiski Alatau ranges. Some of these are relatives and even primogenitors of many cultural varieties and are valuable genetic material of global significance. However, 40 years of irrational development of cattle breeding, cultural horticulture, uncontrolled construction and fires has caused these areas of wild mountainous fruit forests to reduce by 40% on average, and up to 80% in places. The remaining masses are sparse and characterized by small isolated sections affected by pests and viruses.

The danger of losing such valuable landscapes, as well as genetic resources of global significance will be revealed in the future. In 1981, Kazakhstan's list of endangered species added 279 species of top plants, and the 2001 publication (not yet released) contains more than 400 species, including 81 species protected within sanctuaries.

Irreplaceable losses of wild nature

Current situation and tendencies

A considerable part of the mammal population occupies mountainous and piedmont areas (South, South-East, and East Kazakhstan). A large proportion of the fish population inhabits the Caspian basin. A significant amount of birds migrate various distances from water-marsh/steppe areas and leave the country in autumn and winter.

Kazakhstan's List of Endangered Species (LES) includes 125 species of vertebrates and 99 species of invertebrates. Each edition of the list is more extensive than the last. Many animals listed in LES, such as cheetah, red wolf, ratel, dziggetai, Syr Darya shovel-nosed sturgeon, Ili marinka (fish), have already been extinct in nature for 30-50 years. A number of species such as white crane, remnant gull, fish hawk, long-tailed sea eagle, snow leopard and otter have tiny remaining populations and chances of the self-rehabilitation of their populations are slim.

Table 3.3.2.

Biodiversity Indicators (number and status of species)

Taxon\ Biota group	Total species in the World	Total endangered species	REPUBLIC OF KAZAKHSTAN				
			Total species	Endemic	Endangered Species	Total in LES/% of total in LES	Biodiversity density, q-ty of species per 10 000 km^2
Mammals	4,629	1,130/ 24%	178	4	15	40/ 22 %	0.65
Birds	9,672	1,183 /12%	396 nestling	0	15	56/14%	1.5
Amphibians	4,522		12	1	1	3/25%	0.042
Reptiles	6,900		49	0	1	10/ 20%	0.18
Freshwater fish	25,000		104	0	5	17/ 16%	0.38
Higher plant species	270,000	25,971 /9.6 %.	6,000		36	207/ 4%	22.2

Source: Review on "World Resources" for 2000-2001, WCMC (World Conservation Monitoring Center) and UNEP Report (United Nations Environment program) 2002, GEO-3 (Global Environment Outlook-3)

Causes of fauna reduction

The number and type of animals - primarily large animals of commercial significance - continue to decline. The main causes of the reduction in the number of animal variety in Kazakhstan are:

- Weak control over the volume and quota of extracted bio-resources;
- Issue of permissions and quotas for rare species;
- Lack of alternative livelihoods;
- Illegal timber purchasing;
- Low cost of lands allocated for industries and waste storage;
- Waste storage in productive lands;
- Construction of roads and pipelines;
- Discharge of industrial, agricultural and utility sewages and waste into rivers and lakes;
- Pollution of water bodies and regulation of river flow.

The examples below illustrate the scale and detail of the situation.

Example 1: "Wastes to water flows and reservoirs of industrial waste and municipal waters, chemical poisoning. Regulation of the river flow." The Aral, formerly the largest fishing area, appears to be a dry reservoir. As a result, the first SPAs were contaminated with nitrates and fertilizers from irrigated fields and then, as the water level fell and the level of sea salinity grew, 28 species of indigenous fish disappeared. Fish from the Syr Darya River contains a dangerous concentration of SPAs and metals due to basin water contamination.

Example 2: "Extreme natural extraction without taking account of the genuine number and reproductive ability of the populations." Over the past decade, plankton's special diversity halved, whilst the biomass of zooplankton dropped tenfold. Over the past 20 years, the official sturgeon catch in the Caspian Sea dropped from 22,000 tons to less than 1,000 tons. However, CITES evaluated that the poaching catch exceeded the official record 10-15 fold at least. In 2001, there was a disastrous perishing of the Caspian sprat – over 250,000 tons was recorded, equaling the annual catch of all Caspian states, and 40% of the marine reserves. In 1997, 6,000 and in 2000 nearly 10,000 Caspian seals died. The catch volume of fish fell sharply: in the 1st half of 2002, with a general limit of 63,493 tons, the actual catch was 15,713 tons, or just 25% of the total quota. As a result of reduced storage of sturgeon, on 15 March 2002 a special Caspian expedition was initiated to identify the quantity of sturgeon. According to a resolution of the heads of the Caspian states a moratorium was declared for the 2003 sturgeon catch.

Example 3: Over the past 10 years, the number of steppe antelope (Saiga) fell by 99%, from 2,000,000 individuals to 24,000 head. As a result of intensive state procurement of male horns of certain species for export to China and hunting by the local population, there have been observed a severe drop in the saiga population and a change in the population structure.

Table 3.3.3.

Population of Saiga in Kazakhstan, 1975-2002

Years	Number of saiga	Governmental actions	Causes of changes in number
1975	2,000,000		Re-hunting by manufacturers and poachers, mass perishing.
1985	600,000	Ban on procurement	Complete oversight of ban compliance
1990-93	1,000,000		Field compliance with moratorium
1998	380,000		Procurement by state organizations and poachers to obtain horns
2000	250,000	Adoption of a Statement on Saiga Protection	
2001	79,000		Shooting of horned male individuals, undermining of population structures
2002	24,000		Degradation of saiga population

Example 4. The extraction of rare animals (e.g. mountain goat, argali, falcon, bustard) from nature is regulated by governmental decrees (N 2273 of 11 September and N 969 of 28 June 2000) on the limited catching and exclusive use of certain animals. According to the documents in question, hunting quotas are issued for

catching endangered birds and mammals (argali, mountain goat). In 2001, a permit was issued for catching of 40 falcons and 425 bustards (in 2000, they were 10 and 350 respectively). The crucial factor for the issue of permits is the actual state of the population of each variety. The quotas are established by resolutions of the Institute of Zoology of Kazakhstan's National Academy of Sciences, a CITES scientific body.

In 2000 ten permits for falcons and 350 for the bustard. In 2002, a quota for the falcon catch was not established and the quota for bustards fell considerably. Kazakhstan's MEP issues the capture permit, thus violating the agreement on protection and use of migrating birds signed by CIS on September 9, 1994.

Hunting, trade, agricultural interventions, use of poisonous chemicals, and destruction of habitat has seriously damaged the status of Kazakhstan's various birds of prey and a number of species are endangered. In fact, 15 of 39 birds of prey are on the List of Endangered Species. Amateur hunters, traders, and local inhabitants regularly take out golden eagles and falcons with the aim of reselling them. So in 2002 in the foothills of the northern Tian Shan only 1 nesting site remained of 12 falcon sites which had existed for 10 years. No more than 7 nestlings flew out of 15 known nesting sites of the golden eagle. In 1999, poachers robbed all 7 known nesting sites in Betpakdala. In 2000, only 2 pairs of the falcons nesting in Almaty oblast in the beginning of 90's, actually reproduced. In East Kazakhstan, only 1 of 10 nesting sites remained occupied. Along the 5,000 km extension down the foothills of Tabragatai, Manrak and South Altai, only 9 occupied nests were discovered.

The number of golden eagles exported to the Near East has grown. The most remarkable and 'reachable' mountainous and steppe eagle populations are frequently affected. In the spring of 2001, up to 60 eagles confiscated from Kazakhstan and Russian smugglers in the airport of Shardzhi, Dubai and Abu Dabi, were kept in Abu-Dabi zoo.

Conservation of biodiversity in special protected areas

For the purposes of ensuring the biological diversity of the vegetative and animal world, as well as typical, unique and rare landscapes, *special protected areas* (SPAs) have been established in Kazakhstan. The main law regulating the status, functions, rights, and duties of SPAs is the 1997 law "On Special Protected Areas". There are 13 types of special protection areas of republican and local significance.

Table 3.3.4.

Special Protected Areas of National Importance

Indicators \ Types of SPAs	Number	Square million hectares	Proportion of country's territory, %
Total SPAs (sanctuaries, reserves, reserve areas, nature sanctuaries)	104	12,33	4.52
Nature sanctuaries	26	0,006	-
Sanctuaries	9	0,95	0. 34
National parks	7	1,4	0.51
Reserve areas	5	4,4*	1.61
Reserves	57	5,58**	2.0
Number of SPAs with an area over 100 000 ha	21		
Number of SPAs with an area over 1 million ha	4 including the reserve area of the Caspian Sea		
Facilities of Ramsar Convention (water-marsh areas of international significance)	3		
Facilities of world nature heritage	0		
Transboundary SPAs	0		
Biosphere reservations \ sanctuaries	0		
Marine SPAs	0		

*Not included in the area of reserve area of the Caspian Sea.
** Excludes the reserves Almaty and Rakhamovskie Kluchi which are in the content of national parks.

As over 70 years of SPA operation showed, the most efficient form of landscape and biodiversity protection is a *state natural reserve. State natural reserve* means the complete allocation of an area to exclude economic use and the banning of any other activity harmful to the reserve. A 2 km (standard) 'buffer zone' around the reserve reduces the negative influence of economic activities on the nature of the reserve. According to various evaluations, nearly 70% of Kazakhstan's total biodiversity is concentrated in nine reserves, totaling 1 million ha (0.4% of the country's territory). This is explained by a number of factors:

- Aerial selection of sanctuaries was carried out with a view of maximum concentration of biodiversity and minimum territorial fractures.
- Available scientific and inspection staff, introduction and compliance with strict protection, keeping of records of the number of protected species
- Correlative natural protection of the reserve territory from human intervention (relief, distant location from settlements)
- Growing human pressure on areas adjacent to the reserve, accompanied by destroyed areas of occupancy for plants and animals.

Despite the obvious efficiency of the reserve form for protecting the biodiversity, the establishment of new reserves stopped in the mid-1990s. The last to be planned was the Alakol sanctuary (a lake and wetland area of international significance) of 20,000 ha with a 60,000 ha declared design area. The arrangement of the sanctuary was stopped due to:

- Unwillingness of economic entities and local administration to take out of use highly productive areas considered as pasture, hayfields, forest procurement, hunting, fishing areas etc.
- Unavailable budget funds to support the new state reserve and national park
- Underestimation of the socio-economic, environmental and national significance of the preservation of natural landscapes and biodiversity by the ministries charged with Fishing, Forestry and Hunting Committee management

Over the past decade, *state national natural parks* were developed in Kazakhstan and currently number seven. Hopes are pinned on Kazakhstan's youngest and largest national park, Katon-Karagai, in the Kazakhstan section of the Altai, with an area of 670,000 ha. This is an extremely important transboundary area of the environment verified by international evaluation in the Altai-Sajan Ecoregion.

Government resolution N877 of 27.06.01 retrieved the status of *57 state natural reserves* and *26 state nature sanctuaries of republican significance.* The purpose of the reserves' retrieval is the preservation of natural resources as places of germination, occupancy and reproduction of native flora and fauna. The situation in the reserve, as opposed to that in the sanctuary, has less effect whilst it does not ban basic economic activities and aerial protection is seasonal. Government statement N382 of 25.05.01 established three *state reserve areas of republican significance:* Kenderli-Kayasan (1,231,000 ha) and Karaktau and Aryssk (404,000 ha) and Zhusandalin (2,757,000 ha) designed to protect the areas of occupancy and nesting site of houbara bustards in the steppe and semi-desert landscapes and south west Kazakhstan.

Nevertheless, Kazakhstan lacks some internationally-recognized SPA categories. Without a doubt, some unique areas in the republic could be included in the world heritage list. The republic's nature capacity is sufficient to arrange biosphere reserves, to extend the Ramsar list, and to establish marine, steppe and mountainous transboundary reserves (the delta parts of Ural and Volga rivers, Tulenia islands) on the Caspian sea, Tian Shan, Altai. There is an urgent need to arrange reserves in the delta and spawning areas of the largest rivers of Ili, Syrdaria, Irtysh, Lepsy and Karatal, with an extension to cover the coasts of the Caspian, Aral, Zaisan, Balkhash. The mountain and forest masses of Dzhungaria, Tarbagatai, Karatau, the steppe area of Ermentau, oak forests along the Ural River and a number of other areas shall be preserved.

An equally important element of natural resource preservation is adequate funding, staffing, and the conferring of a state institution status for SPAs. Lack of funds for scientific research, maintenance of laboratories, nature sanctuaries, offices, anti-fire equipment, transport, communications and uniforms all adversely affect the protection of natural reserves and the efficiency of scientific research and environmental activities. Some reserves and national parks have no scientific or excursion departments and neglect work on information and environmental education of the public.

The inspection efforts of SPAs protection services are minimal because they lack the necessary economic incentives for both staff and administration. Income such as fines and payments for SPA use, are not used to rehabilitate and protect the natural resources, but are simply subsumed into the state budget. Poaching, hunting of rare animals, tourism entertainment, deforestation, fishing and land use for agriculture all take place. National parks pursuing their economic interests deliberately do not zone the territory. The arrangement of national parks within the forest area is not accompanied with allocation of adequate budget funds.

Easy access to protected areas to perform economic activities has resulted in increased levels of oil and gas extraction in the Reserve Area of the Caspian Sea over the past 25 years, and over the past 3 years this has taken place within the shelf area. Kazakhstan's legislation confirms the status of the Reserve Area, though the absence of administration to provide the management and protection of the area makes the law inefficient. Noticeably, not a single state reserve has been proposed along Kazakhstan's entire Caspian coast, including the delta of the Ural River, although these do exist in other Caspian states and successfully contribute to the conservation of regional biodiversity. A similar situation exists on the thousand km Kazakhstan section the Ili River and the water area of Balkhash Lake. These facts illustrate clearly the continued predominance of economic priorities over environmental issues in Kazakhstan.

Conclusion to Chapter 3

1. *Kazakhstan's principal sources of pollution are industrial, municipal, agricultural and transport emissions. The air basin and water resources of the Republic are extremely polluted.*
2. *Water scarcity is aggravated by the constant and widespread manmade pollution of surface and ground waters.*
3. *Due to the destruction of natural ecosystems, the productivity of the land is decreasing. The destruction of ecosystems occurs during mineral development, the construction of industrial and agricultural facilities and regulation of river flows, as well as the inundation of the territory by industrial, mining and irrigation waters.*
4. *The overuse of biological resources (cutting of piedmont and flood-plain forests, procurement of game, fish and medicinal raw materials) and lack of adequate fire-fighting measures have caused the loss of significant sections of piedmont, forest, flood-plain and coastal ecosystems.*

CHAPTER 4.
IMPACT OF ENVIRONMENT ON HUMAN DEVELOPMENT

4.1. Health Risks

4.1.1 Air Quality

Impact of air pollutants

Atmospheric air is a major habitat for humans, and its poor quality significantly affects the health of the population, its physical state, reproductive capabilities, susceptibility to diseases, and life expectancy.

During the 19th and 20th centuries, the chemical composition of air in populated areas changed rapidly, leading to serious, if not disastrous, consequences for human health.

It must be noted, however, that as the social sphere was changing rapidly and intensively, so was the quality of the environment. Economic activity and living standards grew while healthcare and medical services improved. In this regard, the impact of intensive air pollution during urbanization and industrialization was to some extent offset by improved social well-being. We should also mention here about humans adaptive behavior in a new environmental environment.

Problems of air pollution have been acute in Kazakhstan for a long time. Emissions of hazardous substances into the atmosphere in Kazakhstan stand at around 2.5 billion tons a year. Today, about 5 million people in Kazakhstan live in areas of polluted air, and about 2 million live in areas of highly polluted air. This situation is aggravated by a fact that many settlements and residential areas were actually planned to be centers of major industrial facilities, leading to inevitable pollution by industrial emissions.

The potential effects on the population's health originates from air pollution in residential areas caused by dust, sulfur dioxides, nitrogen dioxides, phenol, lead, formaldehyde, chlorine, anhydrous hydrogen fluoride, ammonia, carbonic oxide, hydrogen sulfide and hydrogen chloride. Each of these pollutants affects the population's health in a particular way.

For instance, **dust** affects the bronchi and lungs (causing progressive fibrosis of lung tissue), affects the liver, and possibly affects the blood, causing weakness, fatigue and sweating. The cities most affected by dust pollution in Kazakhstan are Zhezkazgan, Aktau, Semipalatinsk, Shymkent, Atyrau, Pavlodar, Temirtau and Ust-Kamenogorsk.[24]

Carbon oxides in high concentrations cause nervous system disorders in the form of headaches, memory loss, tiredness, sleeping disorders, etc. The following cities are risk zones: Shymkent, Almaty, Karaganda, Kostanai, Uralsk, Petropavlovsk, Taraz, Ust-Kamenogorsk, Aktobe, Pavlodar, Semipalatinsk and Ekibastuz.

Nitrogen oxides in high concentrations cause irritation of the upper respiratory tract, bronchitis, and may be related to the spread of anemia and may also aggravate the course of a heart disease. Possible effects may be seen in the cities of Ust-Kamenogorsk, Balkhash, Leninogorsk and Almaty. Fewer amounts of these types of pollutants were observed in Aktobe, Zhezkazgan, Kostanai, Petropavlovsk, Taraz, Shymkent and Karaganda.

Hydrogen sulfide may cause catarrh of the upper respiratory tract, bronchitis, headaches, eye diseases, dyspepsia, vascular vegetative disorders as well as weak resistance to skin infections. Cities affected with this type of pollutant are Temirtau, Uralsk, and less noticeably, Pavlodar.

Sulfur oxides irritate the respiratory tract causing bronchial spasms. They disturb albuminous and carbohydrate metabolism processes, suppress oxidizing processes in the cerebrum, liver, spleen and muscles, and irritate haematogenous organs, leading to reduced content of vitamins B_1 and C. Residents of Glubokoye village, some cities such as Ust-Kamenogorsk, Leninogorsk, Balkhash, and to a lesser degree Zhezkazgan, are experiencing these negative affects.

Ammonia causes reduced ability to work, headaches, irritability, and the reduction of vitamin C in the

[24] Data on cities is based on reports of the Ministry of Environmental Protection

organism, catarrh of the upper respiratory tract, angina, and tonsillitis. Some effects may be noticeable in the cities of Temirtau and Shymkent.

Lead causes decreased intellectual development in children, increases the risk of diseases of the nervous system, and affects the circulatory system and gastrointestinal tract. The problem of lead is typical for many regions of Kazakhstan, and especially in the cities of Shymkent, Ust-Kamenogorsk, Balkhash, Kentau, Taldykorgan and Tekeli.

Persistent Organic Pollutants (POPs) can be the cause of a number of serious deseases, including malignant tumors, mental disorders, impairment of learning abilities, immunity decrease, decrease of masculine hormone, diabetes, impotence, endometritis. Children, and especially babies, are much more exposed to POPs influence.

The effects of these air pollutants are considerably aggravated for the following reasons:

- Laboratory control over the air condition in the areas of increased pressure on the environment is insufficient and in some cases relies on outdated equipment;
- Research efforts cover only parts of a limited number of residential areas;
- Some pollutants that may have even more damaging effects on people's health are out of control (e.g. dioxins, hydrocarbons as well as a number of particulate pollutants of heavy metals);
- The multiplication effect—cumulative effects of several pollutants—is not being calculated.

Air pollutants may have a particularly strong negative effect when several chemical substances are present in the air simultaneously. The aggregate pressure of pollutants may affect the immune system, leading to oncological diseases. Residents of Almaty, Ust-Kamenogorsk, Shymkent and Leninogorsk maintain a particularly high risk in this regard.

In 2001, 814 cases of neoplasm per 100,000 were revealed among the people in East Kazakhstan oblast, for the first time, while the national average incidence is 485 cases per 100,000. The highest incidence of respiratory disease is observed in East Kazakhstan oblast and Almaty city (28,235 and 43,871 cases per 100,000 respectively).

Prevalence of these diseases is not only an indicator of the level of environmental pollution but also shows the risk of emergence of negative effects. This is due to the fact that regions with a high incidence of a particular disease among the population run the additional risk that the negative effects may lead to ever more serious consequences.

At present, the problem of medical and biological monitoring of environmentally depressed regions is particularly acute. The existing sanitary norms do not reflect the actual morbidity situation, since they were mainly related to occupational diseases. The effect of air-borne pollutants on the population was barely covered or studied at all.

Kazakhstani scientists have developed a model of assessment for the damage to the population's health, due to the deterioration of the environmental situation, taking into account the total cost of treatment, diagnostics/ prophylactics of pathologies in the population, average life expectancy, sick pay and pensions to the disabled. According to estimates of specialists from the Health and Environmental Projection Centre, Kazakhstan incurs costs up to 55.7 US$ per citizen annually and 60US$ per ton of emissions. This means that in Kazakhstan the negative effect of air pollution on the population's health costs nearly 1.5US$ billion every year.

To monitor and reduce risks of polluted air healthcare, Kazakhstan's authorities advise taking the following priority measures to help remedy the situation:

- Development of hygienic norms of maximum permissible presence of new chemical substances, compounds, biological agents and physical factors in atmospheric air;
- Sanitary and hygienic assessment of the electromagnetic situation in urban and rural residential areas;
- Sanitary-epidemiological expert examination of pre-construction and construction documentation of programs of social and economic development, projects of development and location of means of production.
- Medical and ecological zoning of urban territories. Establishment of borders of sanitary protected zones of industrial enterprises, ensuring their development, etc.;
- Development of indicators to assess the health status, morbidity rate and impact of chemical compounds on the population's health, which take into account their *combined* effect;
- Systematic control over the toxic content of transport exhaust gases; introduction of methods to purify emissions and reduce their negative effect on atmospheric air.

Air basin status and health indicators

An unfavorable situation in terms of atmospheric air quality is observed in many of Kazakhstan's cities and industrial centers. The atmospheric pollution index (API) in Ridder was 22.6 (1996) and 10 (2000); Ust-Kamenogorsk 14.3 (1997) and 17.8 (2000); Almaty 14.9 (1996) and 9.9 (2000) while the API norm is one. A high API was also noted in the cities of Shymkent, Zyryanovsk, and Zhezkazgan.

Air quality in these cities jeopardizes the population's health status. The highest morbidity rate in the Republic with regards to types of diseases is that of respiratory diseases – 17,793 patients per 100,000 (1996). Analysis of 1995-96 data shows a high incidence of respiratory diseases in oblasts with considerable air emissions

and poor quality of atmospheric air, i.e. East-Kazakhstan, Karaganda oblasts and Almaty city (Annex 4, Table 2 and 3). The most frequent complaints of residents of Almaty city concerns pollution of atmospheric air with dust (80.1%), soot (68.7%), bad odors (87.56%), general negative effect on health (87.56%), cough (36%), headaches (77%) and insomnia (23.3%).[25]

Anthropogenic pressure on the population remains high. Air pollution prevents the penetration of the sun's ultra-violet rays in sufficient amounts, which in turn hampers synthesis of vitamin D and slows down human growth. Children in polluted urban areas are characterized by changes in body proportions and weight. In addition, the rate of respiratory diseases in the country has not declined: in 1997 – 17,623; in 1998 – 19,497; in 1999 – 18,708; in 2000 – 20,549 patients per 100,000.[26]

As a result of various and comprehensive research, a connection has been found to exist between the incidence of respiratory diseases, neoplasm, kidney disease and cardiac infarction and the level of air pollution.

4.1.2. Quality of Water Resources

Quality and availability of drinking water are the main factors pertaining to the health of the population. According to established norms, the volume of drinking water demand in Kazakhstan stands at approximately 1.7 km³ a year. However, by 1995 the actual volume of water demand had decreased to 1.3 km³ a year and for the last 5 years has remained at around this level. In 2001, supply of drinking water in Kazakhstan amounted to 74 % of the total demand. Volume of water allocated for housing and drinking use totaled 650 mln.m³ /year.[27]

Centralized water supply sources

The provision of water pipelines to the urban populations of different regions varies from 35% to 85%. On average, across the Republic, 70-75% of the municipal population is supplied with water by pipeline, 15-18% by water from decentralized water sources, and the remainder (more than 500,000 people) uses imported water and water from open reservoirs.

There are more than 2,000 water pipelines in different towns to provide water to the populations of villages, towns, district and regional centers. The majority of these first came into operation 20-25 years ago. At present the service period of a number of pipelines and their separate branches has elapsed, and for the remaining pipelines the wearing out of pipes and installations has reached over 70%. This is the cause of localized disasters and can cause secondary pollution of the drinking water supply, lengthy interruption to its transfer and major leaks in the network, which in some cases can be up to as much as 30% of the volume of water transferred. Therefore many operational water pipelines in the country do not meet sanitary requirements. In particular, among operational water pipelines 28.5% do not meet sanitary requirements, and in Zhambyl Oblast this figure reaches 89.7%, in Pavlodar Oblast it is up to 57.1%, in East Kazakhstan – 55.8%, in West Kazakhstan – up to 46%, and in Karaganda Oblast up to 36%. The situation is no better in the cities of Astana and Almaty where 50% and 31.2% respectively of water pipelines do not meet sanitary requirements. Despite regular repairs the number of water pipelines is decreasing: in 2001, 48 water pipelines were completely destroyed. Of the remaining 2605, 528 (24%) do not meet sanitary requirements. The number of non-operational pipelines is constantly growing [346].

A serious problem exists in the provision of drinking water to rural populations. Centralized water supply in rural areas has been resolved by either local water pipelines (for one village) or group water pipelines (for a number of villages).

In regions with scarce water resources, water pipeline networks of 50-2000 km were constructed to serve to tens and hundreds of rural settlements. The total length of constructed networks of water pipelines at the beginning of the 1990s was 17,100 km, serving 1,276 rural settlements.

All major pipelines in the villages are supported by state subsidies. 2,600 rural areas have been provided with local water pipelines. The total length of internal village networks amounts to 29,000 km. Up to 60% (approximately 3.5 million people) of the rural population are provided with water by pipeline nationwide. The rest use water from tubular and shaft wells, as well as open reservoirs and imported water. The extent of technical and sanitary reliability of this type of water provision is extremely low.

Increase of rates for water cleaning and preparation has also decreased access of the rural population to drinking water. The cost of 1 m³ of water supplied to the population in different regions fluctuates between 18 to 60 tenge. The practical cost price of water supplied to water pipeline networks in North Kazakhstan in 1999-2000 rose to 102 tenge, in comparison with previous rate of 52.05 tenge. As a result, many rural areas have stopped using the water

[25] Materials of Health and Ecoprojection Centre

[26] Materials of the Republican Sanitary and Epidemiological Station

[27] Materials of the Water Resources Committee, 2002

pipeline networks. Many populated areas have been disconnected from the water supply due to chronic non-payment. Populations in remote regions are experiencing severe water shortage and use untreated water for drinking.

Actual water consumption for the economic and drinking needs of a single urban citizen averages 167 liters per day. This varies from 206 liters per day in Almaty Oblast to 120 liters per day in Kyzylorda and Atyrau oblasts. Specific water consumption for a single inhabitant of a rural populated area amounts to 68 liters per day: from 70-75 liters per day in Kostanai, North Kazakhstan, Almaty and East Kazakhstan oblasts to 25 liters per day in Mangistau Oblast.

Average water provision in Kazakhstan (in % from the "norm") is 85% for towns (maximum value of 92% in Almaty Oblast and a minimum of 62% in Kyzylorda Oblast). In rural areas, this figure, on average, amounts to 71% (from 84% in Almaty Oblast to 42% in Mangistau Oblast).

Decentralized water supply sources

More than 3 million people (21%) use water from decentralized sources, more than 300,000 people consume water from open water reservoirs and aryks and 500,000 people drink water which is brought in from outside, the quality of which is not guaranteed. Up to 62% of the population of semi-desert regions obtains water from decentralized water sources. Almost half of all wells and spring wells in Almaty, West Kazakhstan and Kyzylorda oblasts and in the city of Atyrau do not meet hygiene requirements.

Disease incidence. The results of a complex analysis of the state of the water supply, the quality of drinking water and land improvement, have shown that in the majority of settlements where disease outbreaks caused by water transmission were registered, the level of provision of the population with tap water is lower than the national average, and in some settlements of Almaty, Akmola, Kyzylorda, and South Kazakhstan oblasts, residents do not have any tap water.

In every third settlement affected by outbreaks of disease, over 10% of the population use water from open water reservoirs for drinking purposes, and in some settlements of Kyzylorda and Atyrau oblasts, water from rivers and aryks is the only source of drinking water for local residents.

Table 4.1.2.1.

Percentage of water samples not of sanitary and chemical standards

Oblasts	% of Total Tests
Akmolinsk	23.40
Aktobe	22.58
Almaty	4.56
Atyrau	17.69
East Kazakhstan	10.86
Zhambyl	3.67
West Kazakhstan	13.72
Karaganda	29.08
Kostanai	15.35
Kyzylorda	76.92
Mangystau	No data available
Pavlodar	1.02
North Kazakhstan	16.19
South Kazakhstan	6.69
Almaty city	2.17
Astana city	16.22
Average in Kazakhstan	15.54

Source: Materials of the Health and Ecoprojection Centre, 2002

The problem of providing good quality drinking water to the population in conditions of manmade and anthropogenic pollution of the main sources is one of the most pressing for Kazakhstan. Pollution with microbes and viruses, plus chemical, radioactive and toxic pollution of surface and underground waters, as well as the low quality of drinking water remain one of the fundamental reasons for deterioration of the nation's health.

Mixture of drinking water with sewage and water from power stations is a typical characteristic of such water pipes. This is due to the deterioration of pipes and because they were laid in common trenches, resulting in intensive suction of subsoil waters, water from basements and waste water into the drinking water supply. As a result, the probability of mass infection among the population is very high.

A high incidence rate of acute intestinal infections (AII), infectious and parasite-borne diseases is consistently observed in some regions of Kazakhstan. In 2001, the national incidence rate of AIIs increased by 2.9% compared to 2000. In Mangystau oblast, incidence rates increased by 250%, in Pavlodar Oblast by 11.5%, in Karaganda oblast by 22.5%, in Almaty oblast by 15.1% and in South Kazakhstan oblast by 11.7%. Two-thirds of AII cases are registered among children up to 14 years of age and in Astana this figure is 83.8%.

Despite the fact that over the past few years incidence of AIIs among the population has declined nationwide, the situation is still disturbing. This is due to an increase in incidence rates in a number of oblasts, and in some regions the percentage of new patients varies within a range which exceeds the national average. Geographically, this is typical for Akmolinsk, Almaty, Atyrau, Kyzylorda, West Kazakhstan, South Kazakhstan, and Mangystau oblasts i.e. the regions where water supply and quality of drinking water are not satisfactory.

Group infectious diseases are regularly registered in Kazakhstan, conditioned by the water transmission factor. Cases of disease are registered 5-7 days after the outbreak start. When examining the sources of AII, means of transmission are established only in 55-77% of all cases. Steps are taken to eliminate sources of contamination and infection during the peak of the AII outbreak in settlements, which is 10-15 days later than necessary.

Table 4.1.2.2.

Incidences of infectious and parasitical diseases in Kazakhstan, per 100,000 inhabitants

Oblasts	Adults		Teenagers		Children	
	1997	2001	1997	2001	1997	2001
Kazakhstan	2190.9	1971.1	2214.3	2131.7	4523.6	4254.0
Akmolinsk	3219.9	1663.1	2736.1	1451.0	3541.1	5281.4
Aktobe	1862.6	2694.7	3376.8	2934.0	3764.0	4778.0
Almaty	1409.7	658.6	1535.6	980.6	3220.6	2662.0
Atyrau	5161.4	3057.5	1381.3	1105.9	5605.4	5166.3
East Kazakhstan	2124.4	1742.3	3016.4	2928.8	4764.3	4800.8
Zhambyl	1514.3	1342.5	1156.3	1521.7	3496.6	2715.5
West Kazakhstan	2119.0	2878.9	2262.7	2410.7	11313.1	7515.8
Karaganda	1785.4	1708.6	1563.3	3030.9	3370.3	3918.3
Kyzylorda	2607.7	2398.6	2600.0	2512.2	8685.1	7092.0
Kostanai	1264.4	1823.6	1818.0	3195.7	2965.5	3405.3
Mangystau	2656.5	1851.4	1865.9	1233.3	8447.6	6315.6
Pavlodar	2609.3	2785.2	3281.9	3992.6	3896.3	4233.6
North Kazakhstan	1476.4	2264.5	1810.0	2525.9	3059.7	5547.8
South Kazakhstan	1799.2	1956.4	1885.3	1343.0	2728.3	2196.4

Source: Materials of the Health and Ecoprojection Centre, 2002

For example, on 7 February 2001 in the town of Arkalyk there was an outbreak of AII reaching its peak on February 17 (up to 34 new cases per day). The outbreak was registered only 10 days later; its reasons and the source were discovered and eliminated even later. A severe violation of water supply regulations and the improper use of sewerage systems were the reasons for the outbreak: numerous breakages of water pipes and the absence

of disinfection measures after elimination of previous damage. The water pipeline was connected to the heating system and the supply of drinking water was shifted to a thermoelectric power station. In 2001 in the town of Temirtau, 250 people suffered during a similar outbreak (breakages of water pipes and suction of waste water from the sewage into the water supply pipe). Nationwide, a total of 14 outbreaks of AII occurred in 2001, with 1100 people infected.[28]

In the past seven years AIIs made up 1/5 of all registered group diseases - 66% were in North Kazakhstan, South Kazakhstan, Almaty, Atyrau and Kyzylorda oblasts. Viral hepatitis A was registered most frequently (48%), less frequently (37%) typhoid fever and acute intestinal infections and dysentery, 15%. The vast majority of cases (up to 82%) of viral hepatitis A are related to violations of waste water treatment systems and decontamination of drinking water; all mass outbreaks of typhoid fever were caused by taking water for drinking from open water reservoirs and *aryks* (irrigation ditches) while the cause of outbreaks of dysentery is unsatisfactory sanitary and technical conditions of water supply and drainage systems. Clear seasonality of outbreaks was observed, with majority of incidences taking place from August to November.

In 2001, more than 85,000 sources were examined and 76,000 laboratory tests of drinking water were conducted. However, this work has not yielded the expected results. Everywhere, water tests show that exceeding of bacteriological norms remains high. Calculations show that for every 10% increase in bacteriological norms shown by water tests, morbidity rates increase by 236 new cases per 100,000 citizens.

On average in 2001, 8.4% of all tests of water from decentralized sources did not meet microbiological standards; including 14% in Pavlodar oblast, 12.6% in Akmolinskaya, 12% in Kostanai, and 11.9% in Zhambyl oblasts.

The level of contamination of water with human intestinal microflora and cholera vibrios, which cause dangerous infectious diseases, serves as an indicator of the ecological condition of water sources and human health [26]. Results of laboratory tests of people and samples of water from different sources, conducted by Kazakhstan Institutions for combating plague in 1986-1996, found cultures of cholera vibrio. A direct relation between water contamination, open water reservoirs and sewage was noted in Almaty, Mangystau and South Kazakhstan oblasts. The presence of cholera vibrios in water was registered from May until September (22-29%). In 1997 the epidemiological situation in the Republic worsened, and a particularly high number of patients with acute intestinal infections were registered in South Kazakhstan, Mangystau, Kyzylorda and Atyrau oblasts, where people were infected with cholera. In Shymkent oblast four cultures of cholera vibrio were found in water supply sources. In Uralsk oblast, a culture of cholera vibrio No. 0139 was found in open water reservoirs, which has caused outbreaks of cholera in many countries. Using wastewater which has not been decontaminated and disinfected, for watering vegetable gardens in the suburbs of Aktau city in 2001 led to the infection of melons and gourds and vegetables with the cholera vibrio. The infected vegetables were sold on the market without the required control and treatment, and as a result the outbreak of cholera lasted for 30 days and 29 people were taken ill.

Realizing the primary reasons behind the high morbidity rate in the country, in 2001 healthcare services undertook joint efforts with other public utilities, environmental agencies and Committee for Water Resources to actively implement the programs “Population’s Health”, “Drinking Water” and “Clean Water”. As a result of the campaign, 26 water pipes were repaired, 398 wells were cleaned out, and 3000 street water pumps were restored. In addition, water pipes were restored in 48 settlements and 133 sanitary protection zones of water objects were repaired.

According to figures from the national Medical Epidemic Center (MEC), in 2002 water supply by pipeline had increased and now stands at 75.5% as opposed to 74.2% in 2001.

At the end of 2002, provision to water treatment facilities of drinking water disinfection and cleaning reagents was 98.5%. 128 water extraction facilities have been restored in populated areas, and in 52 populated areas artesian boreholes have been drilled. Fifteen populated areas have been connected to the water pipeline network so that repair and restoration work can be carried out on water pipelines installed by brigade 1361.

In addition, centralized transportation of drinking water to 90 of the 359 populated areas where the population takes drinking water from open reservoirs was organized. As a result, the number of water pipelines which do not meet sanitary requirements has fallen from 23.4% in 2001 to 17.3% at the end of 2002 and the specific gravity of drinking waters not meeting requirements for bacterial content has fallen from 3.9% to 3.8%, and for chemical composition from 8.5% to 7.1%.

Desertification and its impact on health of the population

Considering the impact of water quality on the health of the country’s population, it is obvious that in many cases this problem is part of a wider and more complicated issue – desertification as a factor that affects the living standards of people. Quality of life decreases considerably in arid regions and in many cases reaches critical levels in terms of standard of living. The desertified regions of the Aral Sea are an example, as well as arid

[28] Report of the Republican Sanitary and Epidemiological Centre, 2001

territories in parts of Atyrau, Mangystau, Kyzylorda, Almaty and South Kazakhstan oblasts. The way in which desertification processes impact on the health of the population and on the medical and demographic situation can be summarized as follows. 'Aridization' significantly aggravates the economic situation in the agricultural sector. Income from agricultural production decreases as a result of reduced crop capacity. Livestock breeding first becomes less profitable and then totally unprofitable due to the shortage and high cost of fodder. Insolvency and poverty of the population grows, young people and qualified personnel leave for other regions, and therefore the local economy and power supply to settlements are affected. Living conditions worsen dramatically and even minimal provisions for life sustenance are strictly limited. Sanitary compliance and hygiene become unsatisfactory and medical services are either minimal or absent.

The deterioration of environmental conditions in the region is another important factor. The high degree of solar radiation, the absence of precipitation for long periods, strong winds, continental climate, salinization/pollution of soil, utility/drinking waters with metal salts, chlorides, nitrates and pesticides all result in food contamination. Most agriculturally viable soil in the region becomes depleted of vital microelements. Aridization processes, combined with changes in microelement composition of natural biotopes, cause changes in the viral and microbe environment of humans, further aggravating the sanitary epidemiological situation.

The impact of a wider range of environmental factors in regions of desertification is expressed in serious cellular changes, such as chromosomal aberration. At the same time, weakened immune systems among the population reduce the chances of damaged cells being removed from the organism and can cause genetic disturbances which, among other effects, can provoke the growth of neoplasms, particularly in children.

Deterioration of the health of the population, in turn, has a negative impact on the social and economic situation in the region, impeding reform processes and increasing demand for medical services.

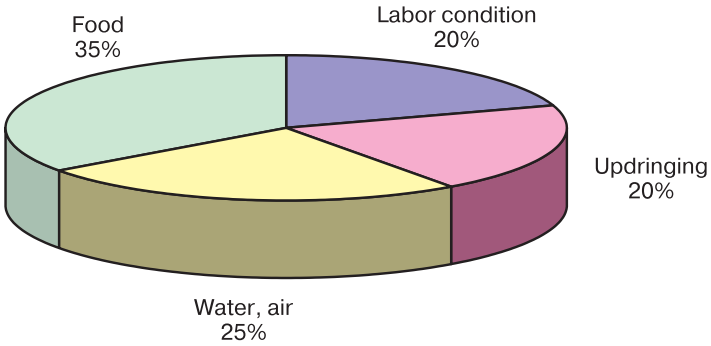
As a result of this complex cause-and-effect chain, medical and demographic stability is upset and specifically the average life expectancy of women is reduced and infant mortality rate grows.

Comparing the desertified areas as a whole to the rest of the country, indicates that in desertified areas the incidence of endocrine system disorders, diseases of the blood and haematogenic organs of children, anemia in adults and children, bronchial asthma of adults and stomach and duodenal ulcers in children are all much higher than in areas untouched by desertification. Besides, in desertified areas the incidence of poliomyelitis (child cerebral palsy), diabetes, tuberculosis and infectious diseases are higher. The incidence of diseases of the blood and haematogenic organs of children in Kyzylorda oblast in 2001 was 5,859 cases per 100,000 people, 2.5 times higher than the national average. In the Aral Sea area the process of haemopoiesis and immunity of the population is considerably weakened. A lowered immune status has resulted in a high incidence of infectious diseases among the population of the region, including acute intestinal infections, typhoid fever, paratyphoids as well as salmonella and meningococcal infections.[29]

4.1.3. Food Quality

Ensuring the quality and safety of food products for our own health, the health of our children and of future generations is of paramount importance for the state. Food quality is also a decisive factor in the economic competitiveness of the country on international and domestic markets.

Figure 4.1.3.1.
Factors and conditions influencing health



Testing of food quality and safety addresses and identifies the most probable and widespread toxicants, the manufacturers, the country of origin and its natural characteristics, technical capacity, preservatives and disinfectants used.

Toxic elements are the major food contaminants, specifically, microorganisms and their metabolites, heavy metals, nitrates, nitrites, N-nitrosoamines, radionuclides and certain hormones, residual amounts of pesticides, polychloride biphenyls and dioxines. All these compounds pollute the environment and penetrate food products, thus posing

[29] Materials of the Health and Ecoprojection Centre, 2002

a threat to human health. These substances - depending on their amount and the condition of the immune system - may cause acute and chronic toxic poisoning if they penetrate the human body. Most can accumulate in human organisms and cause various chronic diseases. They impact strongly on the digestive and central nervous systems, affecting future generations and causing various forms of ontological diseases.

Microscopic fungus and their toxic metabolites are the most dangerous contaminants in raw food materials and food products since most of them are resistant to physical and chemical impacts and do not die during traditional culinary processes.

Research conducted in different parts of the country by CJSC Kazakh Nutrition Academy/Quality and Safety Control Laboratory has revealed considerable contamination of basic food, particularly, bread, macaroni, processed cheese, tomato paste and others, including baby formula, some vegetable and fruit juices, puree, pastes with toxic fungus and other carcinogenic micotyc toxins. The results explain why such a high percentage (up to 14.2%) of grain, seeds, grouts and flour-grindings does not pass quality control. If they get into the human organism via food, they may cause micotyc toxicosis, an acute and chronic poisoning. Medical literature describes various biological effects of micotyc toxins, including oncogenic, mutagenic, embryotoxic, teratogenic and gonadotropic. Research conducted in Asia and Africa confirms a direct dependence and a high incidence of primary liver cancer connected to a high content of aflatoxins in food. Findings of research in Kazakhstan on the presence of micotyc toxins in basic food products are as follows: 3,731 of the total samples contained 484 micotyc toxins (13%); in 25.4% of samples their content exceeded MPC.

Data on the contamination of raw food materials and food products with *pesticides* show a decrease in their detection. This is explained by the suspension of centralized procurement and treatment of farmland under agricultural crops, which consequently reduces pesticide penetration of food. There is a strong need to revise the list of pesticides subject to mandatory control, which includes 100 items, and POPs are in this list (See Chapter 4.1.1). The list of pesticides applied includes more than a hundred items. Lack of information about the pesticides most frequently used in a certain country makes it worthless to look for pesticides in food products specified in domestic regulatory documentation. This becomes especially important in relation to imported products, since the use of pesticides is more widespread abroad than in Kazakhstan.

Medicines and hormones added in animal feed are another health risk. They might contribute to the emergence of drug-resistant forms of microorganisms, which later leads to problems in treatment of different infectious diseases. They may also negatively impact the microbiological balance of the intestines, causing symptoms related to a complex set of diseases: the so-called disbacteriosis of the intestines, metabolic disease, and other harmful consequences. They are typically detected in imported food products.

Food additives (preservatives, stabilizers, colorants, etc) are another potentially dangerous class of substances. However, by rating it to the population's health risk, they are the least dangerous, given their content in the end products and the RDA (recommended daily allowance).

Food Poisoning

According to World Health Organization data *microbial etiology* poisoning accounts for about 90-95% of total food poisonings. Recent decades have seen a significant growth of diseases caused by conditional-pathogenic microorganisms (CPM), such as staphylococcus, enteroanastomosis, enteropathygenic colon bacillus, blue pus bacillus, yeast-like and mycelial fungus, etc.

In the 1970s, in Kazakhstan, CPM accounted for just 5-8% of food poisoning, while in the 1980s the numbers varied from 14% to 22% of all food poisonings. However, during 1990-2000 their percentage reached 40-60%. The remainder of poisonings of a bacterial nature is related to food contaminated with salmonella. Between 1994 and 2002, the incidence of botulism in Kazakhstan decreased from 54 cases with 105 victims to 31 cases with 52 victims. Mortality due to botulism ranged from 1 to 14 people per year[30].

Epidemiological analysis of food poisonings in Kazakhstan shows that the profile of their etiology has changed dramatically in recent decades. For instance, in the 1980s the highest number of food poisonings was microbe-originated, with the prevalence of botulism and salmonella; in the 1990s major food poisonings were caused by vodka and alcohol. It should be noted that this type of poisoning was due to the consumption of 'underground' or 'uncontrolled' products. Quite often the content of microscopic admixtures (aldehyde, ethers, methanol, and fuel oils) in counterfeit products exceeded MPC by 5 to 160 times.

Food Quality Control

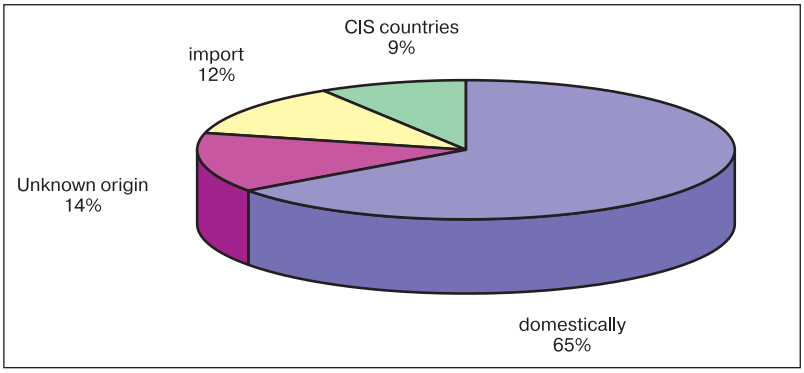
Kazakhstan takes a proactive approach in the area of quality domestic and imported food products.

[30] Food quality as a result of development of agriculture, processing and food industries. Its impact on health. T. Sharmanov, L. Kalamkarova, O. Bagryantseva. Materials of the Food Institute, Almaty, 2002.

During 1998-2001, 65% of food products that did not pass quality control were produced domestically. This is mainly due to lack of up-to-date conveyers, unstable production and low quality of raw materials, as well as the absence of appropriate laboratory control.

Figure 4.1.3.2.

Shares of rejected products 1998-2001

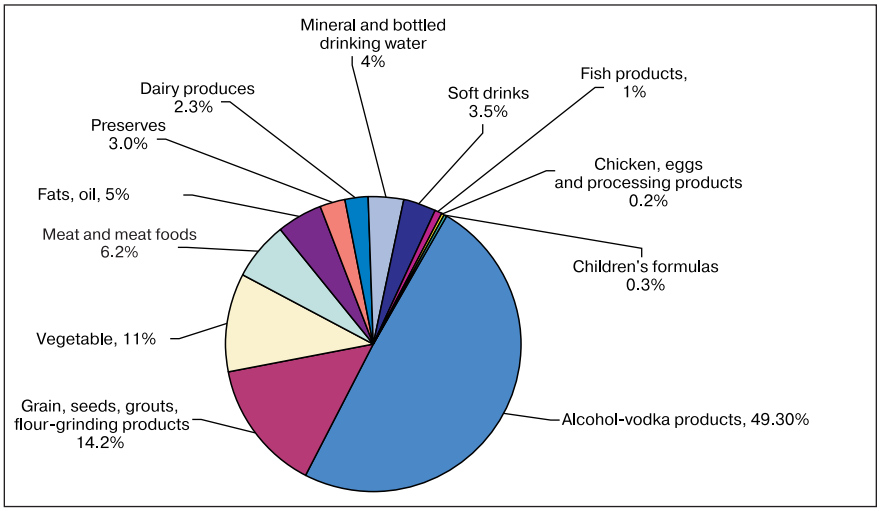


Analysis of the volume of food that did not pass quality control and was thus destroyed shows that alcohol and vodka are a major health risk. In 1999 more than 50% of beverages did not comply with quality standards and were prohibited from sale. The share of alcohol and vodka was 49.3%, that of grain, grouts and flour-grinding products – 14.2%, vegetables, melons and gourds -11%, meat and meat foods – 6.2%, fat and vegetable oil – about 5%; food for children, chicken and eggs were less frequently destroyed for reasons of non-compliance – 0.2%-0.3%, respectively (Figure 4.1.3.3)

Despite the low percentage of dairy and meat products in terms of non-compliance, it must be stressed that the content of salt, heavy metals, particularly those of lead, are at a critical level, though they do not exceed the MPC.

Figure 4.1.3.3.

Volumes of rejected and destroyed food raw materials/ food products in Kazakhstan 1999 - 2001



In order to prevent food-poisoning and ensure safety of the population, specification #1789 "On Quality and Safety of Food Supplies" dated 29.10.2000 and the standard "Certification of Biologically Active Food Supplements" (ST RK 3.24-2001) were elaborated and implemented. These papers determine liabilities for the quality and safety of food supplies, practices for statutory supervision, registration, licensing and certification of food supplies, as well as food production, import, storage, sale and consumption.

The new economic conditions as well as the need to integrate into the global economy necessitate reform of the existing standardization system. In this respect, priority areas in standardization are:

- harmonization of state standards with international ISO standards, Alimentarius Code and EU Food Safety Directives;
- elaboration of standards for domestic products;
- elaboration of standards for methods of testing, including express tests, which help to detect hazardous and counterfeit products;
- introduction of quality assurance systems in the food and food processing industry.

4.1.4. Impact of Rocket Launches and Testing Sites

In most cases rocket launches have a direct influence on human health. The direct effects are primarily: atmospheric fuel spills, dust carried by storm winds, weather condition changes and the contamination of the living environment. In addition, the following are among the threatening factors of rocket launches:

- transportation and storage of rocket fuel and its various components;
- contamination of land;
- aquifers and atmosphere with toxic rocket and other fuel components;
- downfall of rocket parts with unprocessed fuel, falling rocket parts, dropping of some parts and targets, apparatus returning from space;
- explosions in the air and on the ground;
- fires;
- irradiation of living organisms from cosmos through ozone "holes".

These factors can have a long-term effect and cause negative consequences, impacting arable lands, ecosystems, the environment and the regional population.

One of the most studied and observed factors is the contamination of natural and economic complexes with rocket fuel of **all hazardous types**. These are compounds of the first hazardous class: asymmetrical dimethylhydrazine (ADMH, nitrozodimethishydrazine, heptyl), nitrozodimethilamine, nitrogen, tetrahydroxegen and formaldehyde. These compounds have carcinogenic, mutating and teratogen effects on biological objects. The compounds of the second hazardous class are: nitrogen, oxygen, tetramethyl; tetrazene and the fourth hazard class: kerosene fuel types.

Heptyl is dangerous in all methods of transmission to people: through the digestive system, respiratory organs, skin and lymphatic system. Clinically, if poisoned by ADMH, the following occurs: increased excitement, breath disturbance, convulsions, functional changes in the central nervous system, kidney and liver failure and peripheral blood composition changes. Once in an organism, ADMH gets quickly absorbed and distributes evenly in the tissues and organs; it is secreted through the kidneys and lungs, possibly with milk.

Three days prior to rocket launching, appropriate military services evacuate the population due to the high risk of falling rocket parts in residential areas. After dropped equipment is removed and the fuel spills are detoxified the inhabitants are allowed to return to their homes. However, the areas surrounding these residential areas are already modified by the impacts of launches. This will affect the living environment and threatens life, which will be displayed either immediately or in the longer term.

The most general effect of rocket launching is the "aerial" dispersion of pollution from the tail of a launched rocket or its falling part that contains fuel, oxides and compounds. Wind and water disperse the pollution hundreds and thousands of kilometers away from the source area. On average, 24-30 rocket-bearers are launched from the space center "Baikonur" annually. In total it is estimated that no less than 2000 tones of heptyl has been spilled during the 1200 launches from the space center to date.

After the crashes of "Proton" rockets in July and October of 1999, the program "Impact assessment of rocket launches from the Baikonur space center on the population's health" was established. According to the program, medical examinations of the population of Karaganda, Akmola and Kostanai oblasts were conducted; in total, 48,000 people were examined, including 16,500 children. The examinations showed the following results for the below two groups:

Children

- high frequency of pathology in physical development
- 83% of children under 1 year have rachitis
- anemia found in all age groups
- low body weight at birth and later in life
- 17% have urine related diseases

- weakened immune systems
- 23% suffer from iodine goiter; 37% from tooth decay

Adults and teenagers:
- astenovegetative syndrome and dyspepsy
- 35% have digestive system illnesses
- 21% have cardiovascular illnesses
- 17% have goiter
- 30% have anemia

As a result of these health examinations, only 26.5% of the adult population can be characterized as healthy people, the rest had various types of pathological illnesses. Thus, 68-79% of the population over 30 suffers from cardiovascular illnesses. A high level of skin and breast cancer, throat, stomach, and lung diseases were found in Zhezkazgan and Karaganda oblasts. Birth rate decrease was revealed by the observation of both an increase in death and decline of natural population growth.

Impacts of Semipalatinsk, Azgir and Kapustin Yar Testing Sites

Semipalatinsk ground testing site

The module approach to evaluating damage to the population of nuclear tests at the Semipalatinsk testing site has not yet been finalized. There exists a methodology that allows for the assessment of the health impacts of the nuclear tests, through an analysis of the possible effects of certain nosological forms and incidences on the demographic situation taking into account the total dosage of radiation and the number of people exposed to radiation.

In 1992, a joint Governmental Commission with specialists from the military unit that conducted nuclear tests retrospectively restored the data concerning radiation doses received by the population of 711 settlements exposed to radioactive clouds during the entire nuclear testing period at SNTS. The inhabitants of the following villages received the highest levels of contaminated doses: Karakoryk, Dolon, Bodene, Sarzhal, Zhana-Kush and a number of villages where the population received radiation doses ranging from 1 to 5 Zivert.

The reconstruction of doses leads to the assumption that the following effects could occur: lenticular opacity (17,000 people), ovary sterility (10,000 people) and marrow depression (4,000 people). According to the country's Sanitary Epidemiological Service (SES), the population's collective dose at SNTS during atmospheric nuclear testing periods amounted to 100,000 persons /Zv resulting in the loss of 100,000 person-years of life.

In addition, small doses of radiation with potential long-term effects are difficult to detect in individuals. Forecasts on the collective dose of the population have been studied. These forecasted effects are represented by malignant tumors and congenital diseases. Given that the population's collective dose is 100,000 persons/Zivert tests at the Semipalatinsk site could add 5,000 cancer cases and 1,000 cases of hereditary complications to the spontaneous mortality.

Small doses of radiation may cause suppression of the immune system and reduction of immunity among the affected population's offspring and therefore make people more susceptible to pathogenic factors. This generally leads to increased incidences of all nosological forms and an aggravation of demographic indicators. A pronounced decrease in the immune status of the population has been observed in Semipalatinsk Oblast where immunological indicators are critically low. Besides which, the population suffers from a high level of allergies.

A high incidence of anemia has been observed in Abay, Abral, Beskarag and Zhanasemei rayons of East Kazakhstan Oblast. In most cases younger children, including those under 3 years, are exposed to anemia and leuca-lympho(cyto)poiesis. The frequency of neurosis and other mental disorders is high in Semipalatinsk Oblast. In the past 10 years the number of such patients in the oblast increased by 30%, while it almost doubled in Abay, Abral, Beskaragay and Zhanasemei rayons.

The law "On Social Protection of Citizens" dated 18.12.1992 states that 1.2 million people were affected by radiation as a result of operations at the Polygon. Of these, 1.1 million still live in East Kazakhstan, with 48,000 residing in Karagandy oblast and 52,000 in Pavlodar oblast.

Of this group, 67,000 have been identified as affected by the highest level of radiation (over 1 Zivert). Only 27,000 of these people have survived, plus 39,600 of their second generation and 28,900 of their third generation. The overall number of the population most affected by the Polygon activities is as high as 103,500 people.[31] This group can be called a high risk group.

[31] Materials of the UN General Assembly's 53d Session. November, 1998.

Semipalatinsk region faces the most unfavorable situation in terms of health and morbidity indicators due to the impact of nuclear tests. Since 1989 various comprehensive surveys have been carried out in order to assess the population's health status. The Kazakh Research Institute of Radiation Medicine and Ecology was established in Semipalatinsk and a diagnostic and treatment center was opened in Kurchatov. The National Nuclear Center conducted surveys at the nuclear test site to assess the radio-ecological situation and its impact on the population's health. These findings were used during the preparation of Resolution 53 of the United Nations General Assembly and the development of rehabilitation projects for the population of the Semipalatinsk site region.

Azgir Nuclear Testing Site

During the period 1966-79 there were 17 nuclear explosions at 10 sites. The level of illness of the Azgir population is high compared with the oblast average: tuberculosis 6.8 times greater, endocrine problems 19 times, ulcers 16 times, tonsil and adenoid sicknesses 6 times, digestive system sicknesses 6 times, gastritis 3 times, pneumonia 3 times, rheumatic sicknesses 15 times, chronicle bronchitis 5 times greater. The expected lifespan of the population is low: only one herdsman out of 40 reaches retirement age. The total number of sicknesses is increasing: the number of ulcer and lung diseases has increased 10 times over the past years; 95 % of children suffer from anemia, including 12% at levels 2 and 3.

Kapustin Yar Testing Site

Kzilkoginski, Karatobinski and Taipaksi are areas that were exposed to radiation and toxic contamination. Natural zones and inhabitants of Urdinski and Dzhangolinski areas have been affected by both testing sites Azgir and Taisogan i.e. above-ground nuclear explosions and heptyl tails of long distance rockets. Heavy metal contamination of the Cagiz River and the wells of Miyali village exceed MPC for: tallium- 1,000, cadmium- 20, lead- 10, copper- 10-15, fluorine- 1.5-4 times. The nickel, tin, zinc, cobalt, silver, and lead content in plants also exceed critical levels.

A health examination of 32,000 inhabitants of Kzilkoginski rayon showed increased sickness levels compared to the oblast average: tuberculosis 5 times greater, malignant cancer 2.5 times, cardiovascular disease 5 times, respiratory system disorders 5 times. The test site at Taisogan, contaminated with rocket fuel, has a significant impact on inhabitants' health.

"KHAKI" landing area

In this area, the rates of children with mental illness, respiratory, blood circulation, and skin diseases are 2-3 times higher than the oblast average. The "yellow kids" effect - those born with genetic mutations as a result of heptyl contamination - is observed.

Biological weapon testing sites

In Soviet times, the territory of Kazakhstan was used not only as a nuclear test site but also as a biological weapons testing site. One such place was Vozrozhdenie Island in the Aral Sea. Testing of biological objects (bacteria, viruses, toxins) and chemical matters, including aerosols, has inevitably led to biological and chemical soil contamination, infection of animals (mammal, birds, insects and water/sea animals), creation of anthropogenic sources of bacteriological-virus born illnesses and the preserving of biological objects in space and time.

Expedition studies in 2002 carried out by the Center of Quarantine Infections (named after M. Aikimbaev) showed that the Vozrozhdenie Island remains a potentially dangerous territory for the population of Kazakhstan and Uzbekistan. A major danger comes from the seed culture of vegetation and infectious disease carriers that are not found in the region.

Infectious diseases carriers, designed to be used as biological weapons, can differ from natural equivalents in the following ways:

- Changed structure that makes it difficult to diagnose in the laboratory;
- Changed antibiotic resistance;
- Changed genetic structure, through adding genes of other microorganism to the bacteria so it changes typical characteristics or provokes a second disease while using this healing method.

Diagnosis and treatment of such infectious diseases is difficult due to lack of experience and necessary conditions to work safely with the propagators of the sickness, as well as lack of appropriate equipment.

According to data of the participants, laboratory and field testing on various biological objects was conducted in order to determine the effectiveness of the propagation of the plague, anthrax, smallpox, tularemia, Venezuelan horse encephalitis and others. The island served as a waste disposal site for similar organizations and institutions of the Soviet Union for a long time.

4.1.5. Impact of Radioactive Sources

In Kazakhstan areas such as Aktau, Zhanauzen, Zhetybai, Atyrau, Aktobe, Kostanai, Rudny, Petropavlovsk, Pavlodar, Astana, Kokshetau, Volodarskoye, Schuchinsk, Balkhash, Zhezkazgan, Kzylorda, Shymkent, Taraz, Almaty, Taldykorgan, Ust-Kamenogorsk and Semipalatinsk are among those where radionuclide sources of various origin have been detected. This situation poses a serious health threat to the population of these areas. Due to the unfavorable radio-ecological situation in 1997- 2001 the average incidence of malignant neoplasm increased by 8.3% and reached 195.9 per 100,000 inhabitants. Furthermore, the unfavorable radio-ecological situation contributes to an increase in cancer.

There are two sources of radioactive pollution in the environment:

- Natural zones with a higher radiation level;
- Man-made radiation sources resulting from economic, military and testing activity.

Radioactive wastes. Radioactive waste disposal is a serious problem nowadays. Burial of waste is performed at three sites, which are Baikal of the Nuclear Institute, stations of the Nuclear Physics Institute and Mangyshlak Nuclear-Energetic Complex. The agencies of the State Sanitary and Epidemiological Department oversee 2,955 establishments utilizing or keeping radioactive sources, X-ray generators and other sources of ionizing radiation.

According to the annual inventory of radioactive matters, there are now 47,385 sources of ionizing radiation kept within the territory of the Republic of Kazakhstan. In 2001 34,207 of radioactive sources were to be buried with the actual implementation of only 9,991 sources. Particular difficulties are encountered when burying large-sized wastes such as polluted equipment, transport facilities and soil because the existing burial station will only accept ampoule sources. Another serious threat is posed by industrial remains and non-reclaimable mining sites where uranium mining and processing is open-caste. Easy access of the population to tons of radioactively polluted equipment leads to its illegal usage and a great threat being posed for people's health.

All these factors significantly aggravate the radiation situation and increase the risk of adverse effect on the environment and people's health as well as radiation sources beyond control. Between 1998-2001 some 42 radiation accidents were registered., with 90% of these due to loss, theft or detection of previously lost radiation sources.

The situation is aggravated by the more frequent cases of illegal relocation of radioactive sources and radioactively contaminated materials, which is linked primarily to a greater flow of scrap metal exported from Kazakhstan.

Natural sources of radiation are the main cause of the population's exposure. These sources have a negative impact on those engaged in the public utilities and industrial sectors. The level of radiation varies significantly from region to region and within the same region. Registered regional average doses vary from 2.6 to 22 micro Zivers per year. Exposure of certain groups to radiation exceeds the average regional level by 10 times, and even more in some circumstances.

Radon is the most widespread natural radioactive nuclide. Concentration and flows of radon are extremely uneven; they depend on the geological and geographic characteristics of the environment, building design, ventilation and many other factors. For example, in West Kazakhstan Oblast concentration of radon varies from 4 to 160 Bq/m; in Aktyubinsk Oblast 1-163.2 Bq/m3 and Zhambyl Oblast 7-336 Bq/m.

The effects of radiation from natural radionuclide sources are similar to those from man-made radionuclide sources. The health impacts of radiation from natural radionuclide sources, including radon and its derivatives, are mainly expressed in increased cancer morbidity.

The housing surveys conducted by the SES in a number of cities have revealed a high concentration of radon in the basements and first floors of buildings. This indicates poor ventilation and the presence of a source of radiation. For example, an extremely high level of radon, in excess of MPC, was detected in 10 houses located in different districts of Uralsk. Improvement of air ventilation in these houses helped to reduce the concentration of radon and keep it below MPC level.

Activities to ameliorate consequences of radioactive contamination

According to the Ministry of Nuclear Industry, 1.154 million US dollars is required for the management of land, populated areas and equipment contaminated with radioactivity. The cost of processing and burial of the radioactive waste accumulated in the country (except the Semipalatinsk testing site) is estimated at about 931 million US dollars. Kazakhstan has all the necessary conditions for the burial of radioactive wastes in compliance with international standards: its abandoned open-cast uranium mines are recommended as disposal facilities. These mines are located near Semipalatinsk and also 30 km from Aktau. Construction of an industrial radioactive waste processing complex requires 170 million US dollars and a further $53.2 million is needed for the storage facility.

4.1.6. Impact of Industrial Waste

The problem of industrial waste is one of the most complex aspects of a systematic approach to the impact of environmental processes on human health. The entire set of impacts is considered in this approach. It is generally believed that industrial wastes are not only solid wastes stored in specially assigned sites, but also include air pollutants, as well as discharges of waste waters. At the same time, toxic industrial wastes formed as solid matter have their own medical and ecological aspects due to the fact that they are sources of secondary pollution of soil, ground water and atmosphere.

Processing secondary waste has for decades been regarded as ineffective. Nowadays the volumes, content, and distribution of accumulated wastes have become so significant that are now beyond the competency and control of private industries and state enterprises (ministries and associated departments) and have become a national problem. As a result of this, a significant part of the wastes presents a real threat to the environment, the health of the population and can also have trans-boundary characteristics, particularly in the case of toxic and radioactive wastes.

Soil contamination by harmful chemicals is considered by modern science as a very important factor impacting on health. The quality of vegetable products depends on the level of soil pollution. The smallest particles of soil or dust accidentally getting in the mouth can be harmful, no less than when inhaling micro particles and dust with the air. Since soil - a depositing environment - is more stable than air, the risks are, therefore, higher and longer-lasting.

Consequently in Kazakhstan, it is expected that in the coming decades there will be more attention paid by local and international environmental organizations to:

- decrease in the level of industrial wastes accumulation;
- secondary waste processing;
- prevention of dust emissions from operating depositaries and storages

Scientists in Kazakhstan have already attempted to relate the (first-time revealed cases) population's morbidity caused by neoplasm to the volume of toxic industrial waste. Preliminary results and the given ratio are of a mediated secondary character. However the research indicates a need for further analysis of the possible consequences of the combined pollution of the environment.

4.1.7. Sanitary Aspects of Improper Storage and Disposal of Solid Waste

Solid waste landfill sites are dangerous to human health and are among the main sources of infections and epidemiological diseases affecting humans and animals.

An example of these landfill sites - which occur in or around almost all cities of Kazakhstan - that has a negative effect on human health is a typical garbage dump near Astana city.[32] The dump is located 5 km to the northeast of the city and occupies an area of approximately 60 ha. It has been used since the 1960s. The total amount of waste is 10 million m^3. An ash disposal area and water reservoirs of a thermoelectric power station are also situated nearby.

Currently around 50 medical institutions operate in Astana and in total contribute 8,000 m^3 or 2,000 tons of waste to the dump annually, 600 tons of which are substances dangerous to health, i.e. they require disinfection or incineration. In Almaty the overall waste produced by all medical institutions amounts to 9,600 tons a year, 2700 tons of which contain substances dangerous to human health (all figures from 2000).

Based on research, this category of waste is not subject to special treatment before its release, making it a high risk source (epidemiological and pathogenic) for nearby residents, livestock, birds and wild animals. Animals inhabiting the sites thrive among the waste, eat, catch infections (predators and parasites) and pass it on to species surrounding them. Disease carriers (flies, lice, sanguivorous insects, fleas, mice, rats, dogs and cats, pigeons, sparrows, water-fowl, birds living nearby and birds of prey), pathogenic organisms, and parasites spread viruses over tens and hundreds of kilometers, and at all stages of development. Pathogenic organisms get into water reservoirs, sources of drinking water, live farms, into people's food, provisions storehouses, bread-baking plants, meat-packing factories and infect humans and animals. Considering that some landfill sites are located only 10 km from the city center, it is possible to state that this contributes to the high morbidity rates of inhabitants. Thus, from a sanitary point of view, all operations related to the existence of solid waste landfill sites are dangerous for city residents due to the huge risk of disease carriers.

[32] Materials of the Kazakh Agency for Applied Ecology, 2002

Constant monitoring of the state of fauna on landfill sites and their surroundings is necessary in order to prevent outbreaks and the propagation of species dangerous to human health. It is essential to develop and finance new measures for cleaning medical and food waste before its release, as well as timely and effective measures to combat infection-carrying animals and organisms.

Fundamental reconstruction of dumps and retrofitting them into operational sites is vital. Such activities for the Astana dump are planned by the Kazakh Agency for Applied Ecology, together with Spanish partners. In Almaty a JICA project for the Karasai polygon also addresses these issues, including separation of wastes by fractions and content, hydro isolation, gas diversion, paving over layers with clay and the development of parks.

4.1.8. Environmental and Hygiene Problems of Urban and Rural Populations

The external macro-environment of cities and villages and also the internal *micro-environment* are both important and specific to individuals, inhabitants of a particular house or building block, kindergarten or school. In other words, living in a city, a residential area, in a house or an apartment has its own ecological environment and particular sanitary-hygienic parameters. Adverse human health impacts often happen at the micro-environment level.

The environmental and hygienic approaches to characterizing the micro-environment presupposes examination of characteristics of living conditions from the points of view of the environment (pollution of the biotopes) and hygiene (impact of the pollution on health).

One example is of the sedimentation of heavy metals in the ground, usually accumulating irregularly and concentrated in certain territories. Soil pollution may be localized in plots of land under the roofs of buildings: exceedingly high levels of concentration of heavy metals may accumulate along these lines in industrial cities. Increased levels of pollution are observed in the areas of petrol-filling stations, car parks, motor-transport depots, factories, cement works, road crossings and garbage dumps – consequently their negative effects are on the population living in the immediate neighborhood.

It is particularly important to examine the micro-environment which is formed in dwelling premises and inside institutions of continuous sojourn: e.g. in kindergartens and schools. The composition of dust in a house may sometimes contain considerably higher concentrations of dangerous substances than on the ground in the streets (carpets can accumulate dusts for a long time)

Different factors influence the quality of the domestic environment, such as the external environment (the air outdoors) and internal sources of pollution (cooking meals on coals, firewood, using polishes and paints for furniture, floors and walls, paints for wallpaper and wall panels, etc.). Dangerous substances present in domestic detergents, utensils, toys, make-up, etc., also contribute to the formation of the micro-environment. Often the micro-environments of housing premises are polluted by objects from the external environment, for example by clothes, footwear, domestic utensils, packaging, etc.

The environmental and hygiene approach may be exemplified by an analysis of lead pollution in the environment. The problem of lead pollution is particularly relevant for Kazakhstan, where lead-ore deposits are located and the lead-zinc plant "YuzhPolyMetall" and others operate in Ust-Kamenogorsk and elsewhere. The use over decades of millions of tons of leaded gasoline, industrial emissions, incorrect disposal of used storage batteries, use of lead paints, white lead, impregnating agents, and screens have all led to a 100% pollution of housing estates and residential areas with lead. In the territory of kindergartens in Shymkent concentrations of lead reaching up to 14000 mg/kg have been discovered in the soil, whereas the maximum permissible concentration is only 32 mg/kg.

Lead and its compounds are polytrophic poisons and cause, among other disorders, changes in the nervous and cardio-vascular systems and also disturb the normal course of such processes as enzymatic reactions and the metabolism of vitamins. Lead also lowers human immune biological activity and can cause 'lead' anemia.

The majority of children who have been exposed to lead pollution show sub-clinical effects. Research has confirmed a connection between poisoning with low levels of lead and children's perception disorders, derangement of movement coordination, hearing and sleeping disorders, inhibited physical growth and development and lowered IQ. Therapeutic medications to bring lead out of the organism are not effective: despite temporary reduction in the level of lead in the blood, it is retained in the bone tissue.

Kazakhstan's scientists studied 10 settlements, examined more than 1100 children, 27 infant schools and pre-school child institutions, made over 5000 analyses of the quality of paints, toys, and utensils and took 800 express measurement tests of pollution of the surface soil.

At present, the concentration of lead in blood is about 10 mcg/deciliter and this figure has been established

as a threshold level for lead poisoning in children of pre-school age. According to the research data, the average lead concentration level in the blood of pre-school aged children is 8.82 mcg/deciliter and in children who live in the Shymkent zone this level reaches 28 mcg/ deciliter. On average, 20% of children in Kazakhstan have a concentration of lead in the blood that exceeds the threshold level.

Table 4.1.8.1.

Lead evidence in blood of Kazakhstan's children, 1996-2001

Zone under Research	Average concentration of lead in children's blood (mcg/deciliter)	Proportion of children whose concentration of lead in the blood exceeds the threshold (%)
Shymkent (polluted area)	28.07	91.9
Shymkent (conditionally clean area)	8.43	25
Ust-Kamenogorsk (polluted area)	7.67	20.2
Ust-Kamenogorsk (conditionally clean area)	4.38	1.3
Taldykorgan	8.81	19.7
Tekeli	8.66	16
Pavlodar (before prophylactic program)	9.19	37
Pavlodar (after prophylactic program)	4.10	0.6
Kyzylorda	6.12	6.9

Source: Materials of the Health and Ecoprojection Centre, 2002

The average amount by which the level of lead in the blood exceeded the threshold was 2.4 mcg/deciliter in each examined child. Generally, ways to reduce the risk of negative impact of lead on children's health is to manage the quality of the micro-environment: removal of polluted objects, control over and observance of hygienic principles of children, the training of parents and of personnel at child institutions. It is necessary to regulate the macro-environment as well: prohibit the use of leaded gasoline and reduce industrial emissions.

This type of concept analysis and problem solving is a model to be used for addressing other similar environmental and hygiene problems prevalent in Kazakhstan.

4.2. Risks for Economic Development

4.2.1. Air Pollution

The "Concept of the Environmental Security of the Republic of Kazakhstan" highlighted the unfavorable environmental situation in the country and a critical ecological situation in a number of regions that make it necessary to introduce limiting systems and regulations on natural resource use to serve as a basis of ecological safety. Atmospheric pollution is a threatening to cause an ecological crisis.

Measurement of pollutant emissions in the air aims to determine maximum permissible norms of different pollutants' effect on air. These norms should guarantee protection of people's health and be appropriate for the renewal and rational utilization of natural resources.

The maximum permissible concentration of hazardous agents is among the main air quality standards. According to Article 38 of the Law of the RK "On Environmental Conservation", standards of maximum permissible emissions of hazardous substances (MPE) should be determined for each source of pollution as a measure to prevent air pollution.

Excessive pollution by dust and decreasing dust emissions to the MPE level at the borders with the sanitary protection zones of factories still remain prominent issues on the air protection agenda for industrial centres of Kazakhstan. As stated in Chapter 2, emissions of solid pollutants by mining factories total approximately 200,000 tons annually (not including emissions by gold-mining factories), for which they pay around 300 million tenge per year.

It should be noted that a factory with deficient purifying equipment or insufficiently equipped with gas-cleaning units has a negative environmental effect. In addition, the factory's expenses on nature conservation and overall production costs turn out to be less than just.

Air protection techniques are based on traditionally used principles of detecting cause-and-effect relations of pollutant emissions and identifying the best technical and economic solutions to remove or reduce them.

In terms of economic activity of a society, air is used as a means of transport communication, a source of oxygen and also as a medium for removal of gaseous and dust-like wastes of human activities. At the same time, it proves more difficult to avoid breathing polluted air than drinking polluted water.

Air pollution is one of the most disturbing problems of the modern world. Issues of air pollution are no longer confined within the boundaries of individual countries but are becoming shared problems for almost all countries across the world.

Another factor contributing to air pollution is the prevalence of mining and processing industries that are significant waste producers. The topicality of this issue necessitated Kazakhstan joining conventions and agreements determining interstate relations in natural resource use and environmental management.

Having joined the "Convention on Transboundary Long-Range Air Pollution", Kazakhstan gained an opportunity to get involved in action planning to reduce emissions of hazardous substances, address air protection issues at the international level and share information on a number of scientific and technical issues. According to the Convention's protocols, it is vital to have an idea about assessing levels of air pollution by sulfur and nitric oxides and heavy metals, as well actions to take in order to reduce pollution.

The existing nature management system has lead to the formation of zones and regions of high human impact, which eventually causes high morbidity of the population. There is no doubt that this situation is a major barrier to further traditional development of power engineering, metallurgy and chemical industries, transport communications and agriculture.

Atmospheric air is a natural resource and a component of the environment. Therefore, there should be standard limitations to pollutant discharges to ensure that air quality is safe for people's health, with consideration given to environmental and climatic conditions of a region.

According to Paragraph 3 "Development of Standards and Methodology" of the governmental Decree "On Approving Action Plan to Implement "Conception of Environmental Safety of the RK" dated 3.02.97, a document entitled "Methodology for identifying region-sensitive environmental norms and standards of air pollutant emissions when zoning" was developed and approved in 2002.

This regulatory and methodological document determines the quality and quantity standards of emissions into atmospheric air with consideration given to natural and climatic conditions. The methodology allows management of emissions and limits these, considering a given environmental potential, which will eventually lead to better air quality in many settlements.

Ecological and geographical mapping

Cities and industrial centers in Kazakhstan are located in the forest-steppe, steppe, desert, and mountain climatic zones of the country. Air quality in populated areas is estimated not only by mass of exhausts, but also by natural climatic conditions. The most important of these are wind, availability of green tracts (vegetation) and the quantity of precipitation. For example, in spite of high volumes of air pollutants in Pavlodar and Ekibastuz, a satisfactory air quality can be observed – API (air pollution index) is 2.3 and 1.7, respectively (2000).

An ecological evaluation was performed to assess the conditions of cities, taking into account emissions (volumes, content, level of impact on health and nature) and natural climatic potentials of the environment for self-cleaning and waste dispersal. The evaluation has established a preliminary ranking to be used in populated areas (atmospheric air quality and possibilities for industrial sector development). Recommendations were given - ecological safety guidance, (please see Table 4.2.1.1) - to be used in the following enterprise areas: existing and new industrial business enterprises, development of transport and power engineering in populated areas.

Table 4.2.1.1.

Summary of recommendations on environment management for various settlements

Ranking of IA groups	Inhabited areas	Recommendations for industrial development
Group I, IA is located in ecologically-clean area	Issyk Chilik Kokshetau Zaisan Ucharal Karkaralinsk	- organization of municipal infrastructure based on modern technologies (alternative power sources and others) - production of ecologically pure products - production of devices and apparatus - development of recreational and medical institutions - development of ecological and eco tourism
Group II, IA environmental conditions are favorable	Shu Zhangistobe Turkestan Taldykorgan Uralsk-1.4 Ekibastuz-1.7 Astana-2.7	Creation of new industrial enterprises, power engineering enterprises, increase of transport quantity that uses environmentally safe technologies. Re-equipment of the existing enterprises is required.
Group III, Technologically intense IAs; environmental systems are overpopulated. Threats to health exist.	Aktau 4.6 Zheskazgan 7.5 Petropavlovsk 6.8 Temirtau 6.9	Creation of new industrial enterprises, power engineering enterprises, increase of the transport quantity is not desirable.
Group IV Technologically intense IAs; environmental systems are highly overpopulated. Existence of overall threats to human health.	Aktobe – 10.0 Almaty – 9.9 Ridder – 10.0 Ust-Kamenogorsk – 17.8 Taraz – 7.8	Relocate the polluting enterprises from the PA zone Stop and re-equip the polluting enterprises. Limit/forbid usage of old transport means, ethylated benzine, Relocate the children's and patient care facilities from the IA zone.

4.2.2. Water Resources

Development of Kazakhstan's economy largely depends on the availability of water in the country. On average, the annual volume of water resources of the Republic of Kazakhstan is evaluated to be 100.5 km^3. However, water resources available for economic use comprise only 46 km^3, as significant volumes of water are consumed for environmental, fishery, transportation and energy needs, sanitary discharge into the downstream of the hydropower stations, as well as filtration and other losses.

The general indicators of water provision of the region are considered to be specific annual flow volumes per territorial unit and one inhabitant. The specific water provision of the Republic of Kazakhstan is 37,000 km^3 per 1 km^2 and 6,000 m^3 per one person per year. It is one of the lowest indicators among the CIS countries. The provision of water throughout the Republic varies significantly: there are well-provided regions, for example the basin of the Irtysh River (East Kazakhstan Oblast), and there are regions where water is lacking, for example Mangistau Oblast.

The results of comparison of water resources over the years with different water provision to the needs of the economy show extreme water deficit in separate regions and in the whole Republic. Water resource deficit in the Republic of Kazakhstan during the average water year reaches 6.6 km^3 and can be observed in all basins. During arid years the level of water provision comprises just 60%, and in some regions (e.g. Central Kazakhstan) it comprises only 5-10%, with the deficit related mainly to irrigated farming.

The reasons for water resource deficit are natural factors (uneven distribution of surface waters within the territory of the Republic, significant temporal fluctuations of the river flow by years and seasons), significant consumption of the flow of cross-border rivers by adjacent countries and extensive use and extreme unrecoverable consumption of water for irrigation, as well as water losses in the Republic.[33]

[33] Reports of the Water Resources Committee of the Ministry of Agriculture of RK, 2002

Consumption of water resources by main sectors of the economy

Recently, the average annual consumption of water by industries of the Republic of Kazakhstan has decreased from 35 to 20 km³ due to unfavorable periods of inundation and structural changes in the country. 85% of water is supplied from surface water sources. The remaining part is supplied from ground, marine and sewage waters. The main volume of water resources (over 75%) is consumed by agriculture.

Table 4.2.2.1.

Average water use indicators, %

Republic of Kazakhstan	Water consumption, %				
	Total	Utilities	Industry	Agriculture	Other
	100	5.0	16.0	78.0	1.0

Source: Water Resources Committee of MoA RK, 2002

The major groups of water consumers in the Republic of Kazakhstan are: agriculture, industry and utility and housing facilities. The general tendency for all the above groups is decreased water consumption in comparison with the beginning of 1990's, when the total water intake in the Republic amounted to 30-35 km³ per year. Recently the volume of water intake in the Republic comprised on average 20 km³ per year and is likely to increase.

The results of analysis of the data provided by the Committee for Water Resources of the Republic of Kazakhstan for 1997-2002 in respect to water resource consumption by the major groups of water consumers show the following. The volume of water intake from natural water objects in 2002 comprised 20.07 km³, which is more than in 2001 by 0.11 km³. The increase of water consumption is related to increased water intake for domestic and industrial purposes. In comparison to 2001 water intake decreased in Almaty, Pavlodar and South Kazakhstan oblasts respectively by 296, 104 and 218 million m³, due to decreased water consumption for irrigation and consumption of technical water at TETs-1 and TETs-2 in Pavlodar, and the Ekibastuz TETs.

The total water intake of 20.07 km³ includes: fresh water from natural water objects – 19.3 km³ (surface water 18.08 km³ and ground water 1.18 km³), seawater – 0.64 km³. In addition, the figures include 0.15 km³ of recycled sewage water and 0.03 km³ of collected drainage water.

Water intake according to purpose comprises, in km³:

- Production needs – 3.97;
- Domestic needs – 0.87;
- Agricultural needs – 14.67;
- Fishery and other needs – 0.55.

Water consumption by agriculture

Agriculture is the biggest consumer of water in the country: it uses 75% of the total volume of water used.

In recent years consumption of water for agricultural purposes equaled the following: in 1990-21.72 km³; in 1998-12.22 km³; and in 2000-10.43 km³. Within agriculture, the biggest proportion of water is used for irrigation farming; considerable amounts are used for estuary irrigation for production of forage, irrigation of pastures and supply of water to rural populations and livestock.

Regular irrigation is mainly based on drainage of surface water sources and is most widespread in the south and southeast of the country (Rivers Syrdaria, Ili, Shu, Talas, Irtysh and others). Estuary irrigation commonly prevails in the north and west of Kazakhstan, on the basis of spring drainage of the Ishim, Turgai and Tobol rivers.

Despite the fact that the area of irrigated land has declined (from 2.3 to 1.4 million ha), significant amounts of water are still wasted. This happens due to the poor technical state of the irrigation network and the lack of funds for repairs/ maintenance of canals/ waterworks. Water loss can be decreased by 15-20% if repairs to canals and distribution networks are undertaken.

Water use for industrial purposes

The industrial complex of the county consumes on average around 4.0 km³ (15.4% of the total volume of water consumed in the country) of water per annum, with water off-take amounting to 5.8-7.8 km³. Over the analyzed period the following volumes of water were consumed to cover production needs: in 1990-7.21 km³; in

1998- 3.77 km^3; in 2000-3.59 km^3, in 2002 – 3,97 km^3. Losses during transportation and use of water for purposes other than the ones it was provided for, amount to 2-3 km^3. Enterprises of thermoelectric power engineering, non-ferrous metallurgy and oil industry take the biggest share in water consumption.

In 2002, water consumption for industrial purposes comprised 3.69 km^3, or 18% of the total water consumption. In addition, the intake from surface and other sources amounted to 3.97 km^3. In general, water consumption for industrial purposes increased by 0.8% from 2001 to 2002.

Future industrial development is connected with the reduction of specific water consumption per production unit due to the implementation of systems of recycled and repeated-consecutive water supply.

Consumption of water by municipal utilities

Satisfaction of the population's needs for potable and domestic water is a water consumption priority, though potable water in the general water consumption structure is less than 5% by volume.

In 2002, water consumption for domestic purposes of cities, workers' camps and industrial enterprises increased as compared with 2001 by 3% and comprised 0.61 km^3. It is expected that average water consumption for domestic purposes will increase in the Republic by 4% per year. Together with a general increase of water consumption in the domestic sector, there is therefore a tendency of growth of specific water consumption per capita.

Public utilities discharge about 0.14 km^3 of sewage water into natural water bodies, of which only 0.05 km^3 are treated to comply with normative values. This situation is aggravated by the fact that a significant volume of industrial waste water (in some cities up to 24%) is discharged into the treatment facilities, which are not designed to treat industrial wastewater.

Water scarcity as a limiting factor for economic development

A complicated water management situation has arisen almost everywhere in the country. This is caused by lack of water resources and the pollution of water sources, which worsened during the period of extensive industrial development. A growth in the population and the inadequate capacity of water ecosystems to regenerate has resulted in environmental deterioration in all the country's main river basins. Some regions of the country are located in zones of ecological disaster.

The Aral-Syrdarya basin is characterized by a complex water management situation, especially in the lower parts of the River Syrdarya. This has caused an increase in the irreversible removal of water in the main course of the river in connection with the expansion of irrigated land. The river delta has lost its water regulating capability both for the natural complex downstream and for the Aral Sea as a whole. Desertification has encroached over 2 million hectares. The complexity of resolving water problems in the region is due to the fact that the water resources across the basin are completely exhausted. Such a deficit cannot be minimized only by efficient water use based on existing management structures. Fundamental changes in the main sectors of the economy—especially in irrigation and interstate cooperation—need to take place.

The basin of the Ural River is a severely water deficient basin. The development of industry in the region due to the availability of raw materials as well as regional and national economic demands took place without the required consideration of the water factor. As a result, the situation in this region is that water demand significantly exceeds the practical supply capability, especially in dry years. This deficit of fresh water is intensified by the constant and growing demand by the rapidly developing oil-extraction industry and also intensive pollution of waters of the Ural basin.

River basins of the central and northern Kazakhstan are characterized by a comparatively small drainage volume and its immobility during the year: 90% of drainage takes place during 1-2 spring months. The water resource deficit is an obstacle to the development of the mining industry, which is of prime importance for the country: 76% of electricity is produced here, as is 98% of coal, 99% of iron ore and a large share of copper. Besides coal, copper and iron ore this region possesses large reserves of manganese and lead-zinc ore, wolfram, molybdenum, bauxite and asbestos raw materials for the development of the chemical industry and others. The potential for developing the raw materials sector intensifies the need to attract water resources to the area from neighboring river basins. The River Irtysh is the only such source for this region and as a result an increase in the flow capacity of the Irtysh-Karaganda Canal is being planned.

The Irtysh River Basin includes the following countries: People's Republic of China, Republic of Kazakhstan and the Russian Federation, and each country has its own interests in using water resources of this basin. The Bukhtarma HPS was constructed during Soviet times; in 1971 the construction of the Irtysh-Karaganda Canal was completed, providing fresh water to the cities Karaganda, Ekibastuz and Temirtau. Eleven control structures, 2 reservoirs and 22 pumping stations were constructed on the canal. As a result, the total load for the water ecosystem in the region exceeds available water resources by 21%. Nowadays, 5.0 km^3 of water comes to

Kazakhstan from China by the Black Irtysh; in 1989 this figure amounted to 7.8 km^3. It is expected that because of the construction of an irrigation canal on the Irtysh River in Xianjang Kazakhstan will lose another 20% of the annual flow of this river. When examining the various possible solutions for resolving Kazakhstan's water problems in the Irtysh river basin it is necessary to remember the significance of signing bilateral and then trilateral long-term inter-state agreements with the two neighboring countries on joint usage of waters across state borders. These agreements should reflect various solutions for resolving and preventing pollution, and measures to maintain the quality of transferred drainage from the river at state borders, and maximum volumes of water that may be extracted without causing mutual harm.

The Balkhash-Alakol basin. The Lake Balkhash basin, with an area of 500,000 km^2, may become yet another environmental catastrophe for the region in the very near future. This is mainly linked to the 'swallowing' of the lake, leading to negative changes in the environment and deterioration of living conditions for the region's population. The reasons for these changes are a reduction in the flow of water into the lake caused by the building of the Kapshagai Hydroelectric Station on the River Ili and uncontrolled use of water from other rivers coming into it: Karatal, Aksu, Lepsy and others. The River Ayagoz, for example, until the middle of the 1950s fed water into the lake – now it practically does not reach it at all.

As a result of these changes, the shore reed area has become exposed and the variety of fauna inhabiting it has decreased sharply. Wildlife is depleted, having been deprived of the downstream of the River Ili as a result of the encroachment of sand from arable and haymaking land. Water pollution from industrial waste and the ill-conceived 1950s policy of acclimatization of alien species of fish and uncontrolled fishing has led to the depletion of the lake's fish reserves.

Envisaged measures to reduce these negative consequences - construction downstream of a hydro-plant to control water flow into Balkhash, and a receiver for fish - over the course of a number of years have not been completed.

Maintaining Lake Balkhash and the ecosystems of the basin as a whole depends on the implementation of measures to save water and to prevent the discharge of untreated industrial and agricultural sewage into the river. Water balance in the basin will mainly be determined by control of water relations along the River Ili from the Chinese side.

Impact of water shortage and pollution on the population and the economy

It must be noted that the main sectors of the economy – power engineering, mining, oil and gas, coal mining and the metallurgical industry – do not suffer from the shortage of water and deterioration of its quality. Placing their enterprises and industrial objects on river banks and shores of reservoirs, these facilities use water in unlimited quantities, discharge polluted water and carry out emergency discharge / evacuation of water. This is based on the practice of payments for pollution, as well as fines and lawsuits for emergency discharges. Such funds are paid into the national budget and are accounted for as measures of environmental protection. The enterprises include such extra 'environmental protection' expenses in the price of goods and services bought by customers. In this way the pollution of the environment is paid for by the population, which in no way stimulates the enterprises to reduce pollution and introduce ecologically sound technology. Pollution therefore grows with increased production, deterioration of equipment, reduced efficiency of treatment works and disposal plants. The quality of water in rivers and reservoirs keeps deteriorating as a result of the accumulation of polluting substances.

Biological resources used for food and agricultural production are immediately affected by of water shortage and pollution and suffer the most from it. Being located in river basins or in the vicinity of water reservoirs, agricultural economies use polluted water, which was subjected to industrial and municipal cycles. On one hand these water volumes are constantly decreasing, and on the other – the level of accumulated pollutants increases. Agricultural produce grown on polluted land has limited use and does not return the invested sums and expended efforts. Ultimately, in many regions of the country agricultural activity turns out to be unviable from an economic point of view.

Over the period of 1991-2000 in Almaty Oblast crop and rice capacity dropped from 40.9 to 22.8 centners/ha, and of sugar beet - from 312 to 178 centners/ha. Fish farms and farms growing waterfowl have practically stopped working and hunting trade activity has become unprofitable. Fish stocks have decreased, the quantity of wild fowl (game), fish catch and plant raw materials are reduced, areas of meadows, hayfields, littoral pastures and density of vegetation of trees and shrubs are diminished. Meadow vegetation has been transformed into steppe vegetation, perennial plants are replaced by annual weeds which are rarely consumed by cattle. The quantity of livestock able to subsist in dehydrated territories drops sharply. It becomes problematic for local residents and agriculture users to stock up on forage for winter. The quantity of livestock in local economies decreases, indicating reduced level of provision for rural populations. Over the past ten years the area in the vicinity of Lake

Balkhash has seen more than 3 times a reduction of sheep and goat populations and consumption of meat per capita drop from 77 to 45 kg per year.

The regulated run-off from Syrdaria, Ili, Shu, Irtysh and other rivers has caused a reduction of hayfield areas by 3 million ha and a shortage of 4.5 million tons of hay annually. The area of tugai forests has been decimated (down by 70%) which has caused a reduction in biodiversity and of hunting grounds and therefore of economic detriment. Excessive use of pastures (over-pasturing, grass removed from 20 million ha of pastures, cutting down of saksaul and shrubs) has led to a reduction of their capacity from 0.7 to 0.3 centners/ha on average on an area of 49 million ha, which means a loss of 11.3 million tons of natural forage per year. The forage capacity of pastures has dropped. Data from 1998 shows that 2.3 million ha - or 50% of all soil on irrigated land in southern Kazakhstan - needs to be improved because of salination, fertility loss and pollution with toxic waste.

Regulated run-off of minor rivers in order to accumulate water in manmade reservoirs causes changes in the water regime of land located above and below the reservoirs. Land located above the reservoir suffers from flooding and salination processes, while land on the level of the reservoir may suffer flood, swamping and salination. Trees and shrubs die on salinated land, and plants and grass edible by cattle stop growing. Swamping of meadows is expressed by the fact that they become bushy and overgrown with weeds. Land below the dam suffers from drainage of the territory adjoining the riverbed, disappearance of springs and seasonal brooks accompanied by loss of meadows, hayfields, arborous and shrubby vegetation. 8-10 years after a river is dammed, the area is transformed and loses its natural agricultural value. Construction of the Kapchagai Hydro-Electric Power Station on the River Ili over the past 30 years caused very significant degradation of the delta of the river: its area shrank 3 times, and out of 16 major freshwater delta lakes, only five have survived. The situation is aggravated by construction of water reservoirs on rivers, which lead to both the loss of land and decrease in the level of a river.

Economic evaluation of deteriorating quality of people's life resulting from environmental pollution has not yet been carried out. However, migration of population from disadvantaged areas indicates that people come to realise the long-term nature of environmental pollution and leave their traditional homes fearing for their children's future.

4.2.3. Desertification

Economic consequences

The spread and development of desertification[34] has led to a reduction in the area of agricultural lands from 220.7 million hectares to 90.9 million hectares over the period 1991-2001. Consequently, the area planted with main crops fell from 35.21 million hectares in 1990 to 15.3 million hectares in 1999. Areas under grain-crops reduced from 23.4 million hectares to 11.4 million hectares. Around 83.0 million hectares have been transferred to reserve lands, 10.2 million hectares to woodland, 16 million hectares have been are now in the category of settlement lands allotted for use as pasture, and up to 10 million hectares of arable land have been transferred to fallow lands due to their low productivity: the process of natural restoration of these lands without soil development will require no less than 20-30 years.

The size and category of lands in Kazakhstan as of November 2001 were as follows:

- agricultural lands – 222.5 million hectares, of which:
  - 187.9 million hectares of pasture;
  - 22.3 million hectares of arable lands;
  - 7.1 million hectares of fallow lands

According to qualitative data the characteristics of agricultural lands are as follows: fully suitable lands comprise of 23.3 million hectares; salinated and saline lands 94.4 million hectares and 30.5 million hectares of land are stricken with erosion.

The following are the main ***economic problems*** as a result of the desertification process:

- loss of agricultural land;
- reduction of crop capacity, fall of production of plant growing industry and decrease of export potential;
- decrease in the yield of cattle and livestock;
- drop in production of agricultural production and light industry output;
- sharp reduction of budget revenue from the production, processing and sale of agricultural produce.

[34] More detailed information on causes and scale of desertification please see Chapter 2.2. Agriculture

During the development of 'virgin' and fallow lands (1954-1960) considerable areas of saline lands (8 million hectares) and light-textured soils (12 million hectares) were brought into arable use. In addition 11 million hectares of low-production lands were recreated between 1970 and 1980. By 1990 the total amount of ploughed fields in Kazakhstan equaled 47 million hectares (36 million hectares of arable land and 11 million hectares of fundamental improvement lands). However, the absence of soil protection technologies led to the loss of humus by 18-25% and the reduction of land fertility as a result of wind erosion of soil - in Pavlodar Oblast this alone put 600,000 hectares of tillage out of use, and 300,000 ha in Aktobe oblast.

Crop capacity has dropped by 20%. For example, in 1957-60 yield per ha of arable land on black soil (with 12 million ha of arable land) reached 24 centners per ha, whereas in 1998 this had fallen to around 17 centners per ha, thus the loss of crop equals 40,000 tons of wheat grain per year in the black soil zone alone. The reduction of harvest of durum varieties of wheat has led to decreased export potential for the country. Data from 1998 shows 2.3 million ha (50% of all soil on the irrigated lands in the south of Kazakhstan) that needs to be developed and improved due to salination, loss of fertility and pollution with toxic waste. Irrigation erosion was observed and affects an area of 1.8 million hectares. As a result of salination and continuous swamping in the basin of the Syrdarya River, every year 10-15% of irrigated land falls out of agricultural turnover. Pasture productivity has dropped by 2-3 times and croppage of agricultural produce was reduced.

Ploughing of low-productivity lands of the steppe zone (saline lands, sandy soil and salinated land) has led to the *destruction of natural pastures*. These pastures used to produce 5-10 centners per ha, and could feed, on average, up to 10 million cattle. Today these lands have become fallow land and are overgrown with weed and even toxic plants, and their crop capacity has dropped by 2-3 times. As a result, the average annual loss is more than 85 million tons of natural fodder.

Decreases in land fertility cause a decrease in the level of harvest, which results in a lower level of income. At first, livestock farming becomes less profitable, then—due to the lack of and high cost of fodder—economically unprofitable. The number of insolvent and poor rural population grows and the young generation and qualified people move to other regions. As a result, utility and energy companies stop providing their services to such rural settlements.

Besides the low economic turnover, desertification also gives rise to a variety of serious ***social problems***, such as:

- increased unemployment, particularly among the rural population;
- reduced rural incomes from agricultural production;
- sharp deterioration in the health of the population;
- decreased quality and level of consumption of produce;
- migration of inhabitants from those regions severely affected by desertification.

The post-soviet adapted socio-economic policies (including the environmental situation) have worsened the living standards of the population to lower levels. These have particularly affected ecologically disturbed areas. Exhaustion of water resources has caused a drop in production, which in turn has brought about a reduction of work places, depriving many families of their basic source of income and thus putting them on the edge of survival.

Examples are many, and include:

- In the Aral Sea area in the 1980s, 13 fish farms were operating, a dockyard was operating in Aralsk, and a ship repair workshop functioned in the Uch-Sai port. Due to the shrinking of the Aral Sea, over 10,000 workers became unemployed, which means that, if an average family consists of 5 persons, 50,000 people were deprived of a livelihood.
- In 1995, 16,000 people lost their jobs in Kyzylorda oblast: more than 12,000 were rural dwellers, and 11,300 people were forced to go on leave due to the stoppage or partial cessation of work in their organizations. Every fifth family was affected by unemployment, i.e. more than 100,000 people.

People migrated looking for jobs. Therefore a new type of migrant appeared – environmental refugees. Tens of thousands of people leave desertified zones every year. For instance, in 1994, 298,000 people left oblasts in the desert zone. The level of outflow of people from ecological disaster areas is particularly high. In 1994, 20,080 people migrated from Kyzylorda oblast. The majority of migrants from this region settle in major cities, and fishermen often move to lakes such as Balkhash, Alakol and Zaisan. A significant number of family members remain unemployed. This causes social tension, increased poverty and promotes the growth of criminal behavior.

Low standards of living, malnutrition, insufficient healthcare and medical services, unfit drinking water, dust and saline storms, are the result of an upset in the ecological balance and deterioration of the human biotope. These have all led to a sharp deterioration in public health, reduced life expectancy, and reduced birth rates,

leading to demographic problems. "Today, the negative environmental situation causes 20% of deaths, and in some regions the situation is even worse". (Nursultan A. Nazarbayev, "Kazakhstan 2030").

Conclusions to Chapter 4

1. *It is estimated that about 5 million of Kazakhstan's population live in conditions of polluted air. About 2 million live with extremely high pollution levels that result in serious pathological effects for human health. Lack of and low quality of consumed water causes infectious diseases and seasonal epidemics.*

2. *Health risks increase in arid and desert regions and ecologically hazardous zones, near mineral mining and processing facilities, thermal power stations, industrial and domestic landfills and major industrial centers.*

3. *The majority of cities and towns were established as residential zones for workers of industrial enterprises, exposing inhabitants to a hazardous environment due to emissions and discharges from industrial enterprises.*

4. *Due to industrial and agricultural emissions and discharges, the atmosphere and water basins of the country are contaminated with different types of chemical and toxic wastes in many regions of the country. Therefore, these regions have become zones of ecological disaster not favorable for economic activity.*

5. *Despite water scarcity, especially drinking water, the existing practice of its use for economic activities does not provide complete treatment of the polluted water. Existing treatment facilities are not designed for treatment of industrial discharges. This results in the shortage of potable water in a number of regions and significant pollution of surface and ground waters. However, it does not limit consumption of water by industrial, agricultural and municipal enterprises.*

6. *Because over 60% of land in the country is exposed to 'natural' desertification, soils lose their fertility, which leads to a loss of potential farmland. In addition, desertification causes migration of the population from zones of ecological disaster to economically advanced regions, resulting in serious social and economic consequences for the entire country.*

7. *Post-soviet socio-economic policies (including the environmental situation) have worsened the living standards of the population. These have particularly affected ecologically disturbed areas. Depletion of water resources, loss of land due to salinization, inundation and the effects of testing grounds and launches have caused decreases in production in a number of regions of the country, thus depriving many families of a source of income and putting them on the edge of survival.*

CHAPTER 5.
ENVIRONMENTAL PROTECTION IN KAZAKHSTAN

5.1. Environmental Programs and Strategies

Rational environmental management is considered to be one of the main factors of the country's program for sustainable development. The State Program 2030 identifies the following priority goals of state policy in the area of environmental protection and sustainable management: stabilization in the quality of the environment, ensuring a favorable environment for people and the conservation of natural resources for future generations.

In accordance with the Plan of Activities for implementation of the Governmental Program of Actions, the Ministry has initiated environmental zoning of the country's territory through the mapping of polluted territories and the identification of natural resource potential, conducting organizational work for environmental zoning of the regions.

The Ministry of Environmental Protection has also drafted proposals on interstate (Russia-Kazakhstan) environmental monitoring and the organization of the Ural River Monitoring Center, with the purpose of submitting these proposals to the Ministry of Foreign Affairs of Kazakhstan. The procedure of exchange of results of monitoring of the Irtysh River within Pavlodar and Omsk regions has been developed and agreed upon with the administration of the Omsk region. In accordance with the Plan o*n Measures for Support and Development of the Aral Region* (Resolution of the Government No. 1121 of the 29.08.01), a draft resolution *On Kzyl-Orda Center for Monitoring of Environment and Population Health* has been prepared.

Kazakhstan is also involved in the implementation of sectoral documents, such as Programs of *Ecological Awareness/Education*, *Containment of Environmental Threat at the Mergalimsai Drainage* and *Liquidation of Mines of Mergalimsai* F*ield Above the 13th horizon*. Acceleration of works of Kazakhstan under the project on *Completion of construction of Vorobiovsk-Koty Republic of Kazakhstan all sewage collectors* were included in the list of priority ecological activities for 2002, as defined by Government Resolution No. 318 of March 18, 2002.

Financing of environmental protection measures

According to data of the Ministry of Environmental Protection (MEP) in 2001, 1200 projects aimed at the reduction of manmade influences upon environmental components (air, water, soil, flora and fauna) were financed and in the course of implementation. Out of these initiatives, 349 were measures aimed at atmospheric air protection, 302 at protection of water resources, 186 at protection of land resources, 67 on forest recreation and planting, 49 on protection of biological diversity, 59 on ecological education and awareness projects and 250 were activities related to other purposes. In total, 40 billion tenge was spent on implementation of these activities.

The following sources of financing were used for the implementation of environmental protection activities in 2001:

- Funds of enterprises- 36.6 million tenge \ 253.3 thousand USD (91.5%);
- National budget- 1.1 million tenge \ 7.7 thousand USD (2.7%);
- Local budget- 2.1 million tenge \ 14. 4 thousand USD (5.2%);
- Other sources- 0.21 million tenge \ 1.5 thousand USD (0.5%)

In 2001, seven regions received funds from the national budget for environmental protection activities, which amounted to 1,101,791 million tenge (7,624 USD) or 2.7% of the total financing for environmental activities. The allocated funds went to cover the following environmental protection activities:

- Prevention of water resource pollution – 251,051,000 tenge (1,737,000 USD);
- Protection of air – 10,000,000 tenge (69,000 thousand USD);
- Forest recreation and replanting – 3,338,000 tenge (23,000 USD);
- Other purposes – 837,402,000 tenge (5,795,000 USD)

Local budget funds allocated for implementation of environmental protection measures reached 2,075,467,000 tenge (14,363,000 USD) which added up to 5.2 percent of the total amount of financing.

The allocated local funds went to cover the following environmental protection activities:

- Protection of atmospheric air – 856,524,000 tenge (5,927,000 USD);
- Protection of water recourses – 542,333,000 tenge (3,753,000 USD)

Of which:

- 403,139,000 tenge (2,790,000 USD) –commissioning and reconstruction of treatment facilities;
- 53,655,000 tenge (371,000 USD) – development of water-saving systems;
- 85,539,000 tenge (592,000 USD)– improvement of surface water conditions

- Protection of land resources – 172,201,000 tenge (1,192,000 USD);

Of which:

- 110,393,000 tenge (764,000 USD) – land reclamation;
- 35,672,000 tenge (247,000 USD) – utilization of industrial and domestic waste;
- 25,185,000 tenge (174,000 USD) – increasing land productivity;

- Forest recreation and replanting – 106,532,000 tenge (737,000 USD);
- Protection of biological diversity – 39,919,000 tenge (276,000 USD);
- Environmental education and awareness – 26,106,000 tenge (181,000 USD);
- Other types of environmental protection activity – 331,851,000 tenge (2,296,000 USD)

State environmental programs

For the first six months in 2002, the Government allocated 796,798,000 tenge (5,514,000 USD) or 79 percent of the planned amount of 993,939,000 tenge (6,878,000 USD) for the funding of environmental protection initiatives.

In accordance with the working plan of MEP, the following environmental protection activities were financed and implemented:

- Hydro-meteorological monitoring and technical upgrade of monitoring services – 187,992,000 tenge (1,300,000 USD);
- Liquidation and prevention of environmental pollution – 157,240,000 tenge (1,088,000 USD);
- Ecological monitoring of the environment – 18,000,000 tenge (125,000 USD)
- Applied scientific research in the sphere of environmental protection – 2,140,000 tenge (15,000 USD)
- Improvement of environmental status of Balkhash Lake – 3,000,000 tenge (21,000 USD).

Table 5.1.1.

Financing for environmental activities by regions, 2001

	Country/Region/City	Total Allocations		Percent of Total
		Tenge	USD	
1	Kazakhstan	39,982,669	276,697	100
2	Atyrau region	17,269,0640	119097	43.2
3	Mangistau region	5,054,544.9	34859	12.6
4	Karaganda region	4,386,074.2	33539	10.9
5	East-Kazakhstan region	3,028,358.3	20,957	7.6
6.	West-Kazakhstan region	2,467,609.1	17077	6.2
7	Pavlodar region	2,059,380	14251	5.2
8	Aktubinsk region	1,116,024	7723	2.8
9	South-Kazakhstan region	9,490,19.6	6567	2.4
10	Almaty City	703,767.5	4870	1.7
11	Zhambyl region	541,028.6	3744	1.3
12	Almaty region	323,976.3	2242	0.8
13	Kostanai region	306,729.8	2122	0.8
14	Kyzyl-Orda region	307,585.5	2128	0.7
15	Akmola region	220,350.7	1524	0.6
16	North-Kazakhstan region	147,240.6	1019	0.4
17	Astana City	116,029.8	803	0.3

Source: Ministry of Environmental Protection, 2001

State water projects and programs

Presidential Decree No. 344 "Further Actions to Implement Kazakhstan's Development Strategy until 2030" and the Resolution No.30 of the Government of Republic of Kazakhstan of 21.01.02 approved a ***Concept of Development of Water Sector and Hydro-economic Policy until 2010***. The sectoral Program on ***Portable Water*** was approved on 23.01.02. Implementation of this Program will follow a detailed plan of action, which will allow the executive agencies to focus on priority issues of potable water supply, and will prompt them to be more flexible and efficient in employing measures and obtaining real results.

The implementation actions of the Program up to 2005 stipulate the **prevention of further deterioration of potable water supply and water quality**, ensuring access to water resources and encouraging a system-based approach to water management. The Program will cover 3,700 rural settlements with a population of around 4 million and a three million urban population.

In 2002, the state allocated 2,320 million tenge (16.05 million USD) for the building and reconstruction of 36 rural and advanced water supply systems in 11 regions and commissioning of a total of 452 km of water pipes. Implementation of this project will significantly increase the potable water supply for the rural population. The allocated budget for 2003 is 7951.47 million tenge (55.03 million USD) for the above purposes.

The main objectives of the Water Sector are:

- To speed up the process of preparation and agreement on the Covenant between Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan on joint use of waterpower resources of the Naryn-Sydariya basin;
- Continue searching for alternative ways to increase water supply in the southern regions, including the creation of a waterpower consortium;
- Continue the project on regulation of the Syrdariya River and the preservation of the northern part of the Aral Sea by means of building the Kokaral dam;
- Adopt a complex of protective measures throughout the flow of the Syrdariya River and to address the issue of protection of small rivers of the basin from pollution and reduction;
- To develop specific design components of a project of engineering protection of Astana from flooding of the River Esil. The project to be commenced in 2003;
- Determine repair/upgrade needs of the major hydro-economical facilities and implement the proposed activities from national and local budgets;
- Implement planned measures under the *Potable Water* Program;
- Develop a draft Law *On Amendments and Additions to the Water Code of the Republic of Kazakhstan* for submission to parliament;
- Continue transfer of regional, district and inter-economic facilities to the jurisdiction of municipal bodies;
- Take measures on resolving the critical situation of *Kuna's Satpayev Channel*.

State activities on conservation and reproduction of forest resources and wildlife

Forestry

In 2003, the Government increased financing for reforestation**,** fire prevention and air-patrolling by 70% in comparison to 2002.

The Forestry and Hunting Committee has issued a ban on cutting conifers in Almaty Oblast to preserve the mountain coniferous forest of Zailisk and Zhungar Alatau. The saksaul cutting fund has been decreased by 50% of the approved estimated cutting area. Reforestation activities cover an area of 8,536.1 ha of the forest fund, including planting on 4,255.5 ha, enabling natural reforestation on 716 ha and protective plantings on 541.1 ha.

In accordance with the proposed Sectoral Program for the period 2002-2010, the creation of a green zone around Astana is in progress; tree planting activities covered the area of 2678 ha, and 2411 ha of old growth forests were planted with additional trees. In Chaldai and Beskaragai forests (Pavlodar Oblast), treatment of the active spots of the pine noctuid covered an area of 2000 hectares.

Fire-prevention measures

Since the beginning of 2002, 221 forest fires have been registered (470 cases in 2001). Burned woodland for the first six months of 2002 totaled 5,270 hectares. Damage caused by forest fires amounts to around 77.78 million tenge.

In 2003, MEP purchased fire-prevention equipment, communications facilities, arms and uniform worth 111 million tenge. Practical preparations and demonstrations on mitigating fire risk were accomplished with participation of akims.

The issue of preservation of the unique coniferous forests in Pavlodar and East Kazakhstan oblasts is an urgent matter. The total woodland is 870,500 hectares; fires destroyed 102,000 hectares during the period 1997 to 2001. During the first five months of 2002, 148 cases of forest fires were registered, affecting a total area of 4,236 hectares and destroying 1,494 hectares.

The World Bank supported a 30 million tenge investment project on the *Restoration of Pine Strip line Forests,* and allocated 410,000 USD to prepare a feasibility study for the project.

Forest conservation

Commercial timber of coniferous trees is in demand in neighboring countries, which leads to an increased level of logging in Kazakhstan. Resolution of the Government as of December 5, 2001 banned the export of timber. This measure has had any effect but led to illegal export of timber by local commercial structures. On July 16, 2002, the Government adopted Resolution No. 785 with regards to the unlimited ban of exports of specific types of wood from Kazakhstan.

In addition, Resolution No. 431 adopted on April 15, 2002 affirmed payment rates for timber. This measure is compulsory and aims to prevent instances of arson of timber aiming to obtain permission for logging of wood damaged by fire, for a reduced price. For the first five months of 2003, state forest service officials intercepted 86 cargo shipments of timber and confiscated 1,952 cubic meters of wood filed for damage restitution amounting to 2,433,000 tenge (16,800 USD) and pressed criminal charges against 21 individuals.

Wildlife conservation

Combating poaching

Analysis reveals continuing reduction in the population of several species, with poaching one of the major causes.

For the first six months of 2002, state agencies revealed 9,291 infringements and imposed penalties totaling 7,929,000 tenge (55,000 USD). 93.3% of these fines were enforced – to the amount of 7,404,000 tenge (51,000 USD). Damage claims of 43,857,000 tenge (303,500 USD) were brought and 67.5 percent were satisfied i.e. 29,637,000 tenge (205,100 USD). 861 cases were submitted to the Prosecutor's office and to the Ministry of Interior, and 19 public officials were prosecuted for fraud.

Operational groups revealed 8 cases of poaching, 53 violations of hunting rules and imposed administrative sanctions such as penalties of 144,400 tenge. 100,400 tenge (700 USD) of these were paid – or 72 percent. 132 persons were found guilty of administrative offences relating to the illegal use of nature, and 25 resulted in criminal charges.

Territorial agencies of CFFH conducted 3,652 raids and 695 spot checks, identifying 2,661 violations of environmental legislation; almost all of the imposed penalties totaling 3,002,000 tenge (20,800 USD), were paid – in the amount of 2,098,300 tenge (14,500 USD). Penalties on the basis of judicial review raised 5,268,400 tenge (36,400 USD) and satisfied lawsuits amounted to 1,441,800 tenge (9,970 USD).

On 5-10 of May 2002, an international conference on the preservation of the saiga was held in Elista (Kalmykia), where participants approved a draft treaty between the governments of Kazakhstan, Russia, Uzbekistan and Turkmenistan on the protection of the saiga.

The Government in Kazakhstan has adopted a number of resolutions aimed at ensuring better conditions for wild animals: *On Approval of the List of Rare and Endangered Species*; *On Approval of the List of Valuable Species- Hunting and Fishing Objects; On Payment Rates for Use of the Animal World* and *On Withdrawal of Red Book Birds from Nature*.

Aquatic fauna and fishery

The Government has developed and approved the following resolutions: *On Approval Of Limits and Quotas Of Fishing and Prey Of Seal For 2002; On Approval Of The List Of Valuable Species – Hunting and Fishing Objects; On Payment Rates For Use Of the Animal World* and *On Approval Of The List Of Rare And Endangered Species*.

For the last three years, the volumes of fish catch have stabilized and constitute 35-37,000 tons in an average year. For the first six months in 2002, actual fish catches totaled 25% of the total limit (63,493 tons) and payment for the utilization of fish resources amounted to 50,440,000 tenge.

A tender for arrangement of fishing plots and distribution of fish catch limits and other water species by natural resource managers in the Ural-Caspian basin, Balkhash lake and Alakol lake system was announced. However, during the tender violations in East Kazakhstan region were revealed and local prosecutors decided to freeze the process.

During the spring fishing period advance payment for fauna use—introduced by the new Tax Code—again became an issue. In order to mitigate public discontent with prepayments for the use of fauna, CFFH changed the standard form of permit for wildlife use and allowed nature users to make prepayments based on a monthly limit of fish catch.

During the period of spring and the spawning of sturgeon, police and state inspectors conducted a fish-protective action *Bekire-2002* in the Ural-Caspian basin with total costs of 4,700,000 tenge (32,500 USD). During the action, 541 police officers and state inspectors detected 1,550 violations, and confiscated 76,926 kilograms of fish. Collected penalties amounted to 486,900 tenge (3,300 USD); suits amounted 263,800 tenge (1,800 USD) or 4.02 %.

In order to enhance the inventory of sturgeon, Kazakhstan allocated 32,500 USD to Caspian expeditions for establishment of the actual number of sturgeon fish, which started on March 15, 2002.

In 2002, for the first time in several years, Kazakhstan had developed a national budget program for fish melioration in the deltas of Ural and Kigach, which provided 111.8 million tenge (771,000 USD) of funding.

In 2002, aquaculture organizations conducted a spring spawning campaign for preparations of providers of sturgeons, carp and herbivorous fishes for the receiving and incubation of caviar.

Kazakhstan actively participates in the Caspian Sea Water Bio-resources Commission. A feasibility study of the fishery development program for 2003 –2007 is now being prepared.

Despite the state's efforts, the following urgent challenges have yet to be addressed:

- Poor quality of scientific research in the formulation of established norms (quotas for fish/other water animals catches) in basic fishing reservoirs of the country;
- Absence of reliable information about fish resources in reservoirs;
- Absence of ichthyologic services in the Ministry of Agriculture;
- State initiatives on regulation of fishery and efficient use of fishing resources are isolated from the system of security and control of fishing resources;
- Absence of basin principles of fish supply of reservoirs of Ural - Caspian, Ili – Balkhash, Alakol and Zaisan-Irtysh basins;
- Fish-producing and fish-processing organizations are private property.

Specially protected areas

To enhance the material and technical base of SPNT, the government has allocated 23.1 million tenge (158,600 USD), for the purchase of computer equipment, patrol and engines, checkpoints, maintenance of administrative buildings and organization of tourist routes. 11.1 million tenge (76,600 USD) have been allocated in order to purchase uniforms and equipment.

According to the Concept of SPNT development and arrangement, as approved by the Resolution of the Government No. 1692 of 10.11.00 (based on a feasibility study), Kazakhstan intends to set up national reserve parks at *Kolsai lakes* and *Charyn canyon* in Almaty Oblast. 3,500,000 tenge were allocated for a feasibility study of expanding the Barsakelmes State Park, and for the preservation and creation of a national park within the pine forests of the Irtysh basin.

Control and inspection activities

In the first six months of 2002, specialists of the inspection services of the agencies of environmental protection continued their work to reinforce state control of observance of environmental legislation by legal entities, individuals and enterprises.

On March 16, 2002, a workshop was held on improvement of coordination in the sphere of combating poaching. Based on the workshop's proposals a set of measures on combating poaching were developed and approved by the Customs Committee and the Ministry of Interior.

On June 27-28, 2002, a national seminar on *Problems and ways to address the environmental issues of oil-and-gas sector* was held in Aktobe with participation of law enforcement agencies and major oil and gas companies.

In the first six months of 2002 inspection agencies carried out 23,112 examinations for observance of environmental legislation; 35,432 violations were revealed and 29,941 written orders on remedying these violations were issued; 17,645 administrative penalties amounting to 48,848,300 thousand tenge (338,000 USD) were imposed and in 14,218 cases the fines were paid directly. Payments from administrative sanctions amounted to 40,875,900 tenge (283,000 USD) or about 84 percent of the total sum of levied fines.

Some 1,625 claims to totaling 448,442,300 tenge (3,381,000 USD) were filed, requesting compensation for violation of environmental legislation by organizations and individuals. In 1104 of these cases, the claims were satisfied and 412,010,900 tenge (2,851,000 USD) were paid in damages i.e. 92 percent of the requested amount.

A further 1,084 cases have been submitted to law enforcement agencies. The monetary value of confiscated goods totaled 894,000 tenge (6,100 USD).

The toughening of practice of application for environmental protection legislation has led to a considerable increase in sums imposed by fines and requested by claims – 1.8 and 3.5 times respectively. The level of penalties has increased by 1.9 times and those claimed by 4.8 times.

In the first six months of 2002, 233 cases were submitted for consideration of courts and law enforcement agencies. Analysis demonstrates that the majority (82%) of these cases were already reviewed. However, there were cases in which the court was either protracting the judicial review or was biased - these cases originated in South Kazakhstan, Atyrau, East Kazakhstan and Kyzyl-Orda oblasts.

Water protection

The most commonly encountered violations are: dumping of polluted runoff into water reservoirs; water diversion without permission for special water use; pollution of water reservoirs by oil products and abuse of the regime of the water protection zones and belts.

Mass violations occur due to the over-exploitation of sewage treatment plants with drainage from the regional centers, with the majority of collecting facilities being filled to their maximum capacity and threatening to breakthrough the dams. Another challenge is presented by the high concentration of harmful substances in water discharges, exceeding permitted norms several times. The quality of the majority of water bodies remains low.

During the first half of 2002, Basin Water Management Units (BVOs) of the Water Resources Committee conducted 1114 audits to check on water consumers' compliance with water and environmental legislation. As a result, 1121 failures to comply were identified, 1180 instructions to eliminate non-compliance were issued, administrative fines of 1,795,000 tenge (12,400 USD) were imposed, 120 fines totaling 839,000 tenge (5,800 USD) were collected. Forty lawsuits worth a total of 3,768,100 tenge (26,100 USD) were filed and 2,589,000 tenge (17,900 USD) were collected as a result.

The court imposed a 164,600 tenge (1,100 USD) penalty on OJSC *Atyraubalyk* for pollution of the Ural River by oil products that result from flooding of the caviar-producing facility. Another case initiated against *Tengizchevroil* for dumping of sewage waters to a subterranean water-bearing stratum resulted in a 102,300,000 tenge (708,000 USD) payment. Seven lawsuits totaling 3,317,400 tenge (22,900 USD) were filed against *Vostok Kazmed* (a branch of *Kazakhmys* Corporation) for polluting the water resources of Irtysh River tributaries through the illegal storage of toxic substances and industrial waste.

Air pollution

Two cases were pressed against *Karachaganak Petroleum Operating (*West Kazakhstan) for air pollution without permission and the company had to pay 3,468,400 tenge and 221,600,000 tenge respectively - a total of 1,557,500 USD - in fines.

In Mangystau region OJSC *Mangystaumunaigas* and a branch company *Texako Nord Buzachi Inc* faced 2 lawsuits for abusing a quota for associated gas flaring. The fines amounted to 1,620,000 tenge (11,200 USD) and 994,300 tenge (8,800 USD) respectively.

Land protection

Analysis of state control of land use and waste reclamation reveals that 31% of infringements occur in relation to land pollution and 45% are related to the abuse of environmental requirements for waste disposal.

A case against CJSC *Maikuben West* (Pavlodar oblast) was filed and the company was charged with unauthorized waste disposal, resulting in a fine of 111,563,200 tenge (772,000 USD).

Two cases were pressed against CJSC *Intergas Central Asia* for the pollution of 3.7 hectares of land (a result of two accidents) at the Atyrau gas pipeline. The total fine was 670,400 tenge (4,600 USD). JSC *Matin* (Atyrau region) had a lawsuit filed against it for 7,000 tenge (8,200 USD) for polluting the area around drilling well No.20.

Proceedings were also brought against *Rauan* Ltd. (East Kazakhstan) for unsanctioned waste disposal. The company faces a fine of 224,000 tenge (1,500 USD).

CJSC *Yuzhpolimetal* (South Kazakhstan) had to pay 521,200 tenge (3,600 USD) on a lawsuit for land pollution and improper waste.

Vityaz-1 (Kyzylorda region) might have to pay a fine of 123,000 tenge (850 USD) for polluting land with sulphuric acid.

A claim was made against OJSC *Karazhanbasmunai* (Mangystau region) amounting to 1,302,900 tenge (9,000 USD) for an infringement of waste disposal norms.

Table 5.1.2.

Financing of priority environmental activities, 2001

Priority areas	Sub-area, $USD		Financial investment, $USD
Protection of air	Reduction of greenhouse gases	192,200	942,800
	Introducing of energy-saving technologies	750,600	
Protection of water resources	Introducing of water-saving systems	12,879	38,062
	Commissioning and reconstruction of treatment facilities	13,722	
	Improvement of surface water conditions	11,460	
Protection of land resources	Utilization of industrial and domestic waste	23,565	35,652
	Land reclamation	10,530	
	Increasing land productivity	1,556	
Forest recreation and replanting			1,237
Protection of biodiversity			465,000
Ecological education and awareness			199,400
Other measures of environmental protection			47,105

Source: Ministry of Environmental Protection, 2001

Implementation of the Environment and Natural Resources Strategic Plan for 2001-2010

The government project on the Program of Implementation of the Environment and Natural Resources Strategic Plan for the years 1998-2000 is being realized in order to meet the priority goals of the long-term strategy. The Program has been approved by the Decree of the President No.3834 of Measures on Implementation of the Strategy of Development of Kazakhstan until 2030, adopted on January 28, 1998. One of its main targets is the early creation of a viable system of environmental management. The project provides for a synergy of actions and efforts between ministries/departments, authorities/public, scientific and business groups and international organizations for the purpose of development and technical assistance in addressing environmental issues.

The Strategic Plan for Kazakhstan's Development up to 2010, approved by the government in its section on environmental protection and natural resources, emphasizes the strategic goal of stabilization of environmental quality through the following objectives:

- 'Ecologization' of current legislation.
- Optimization of the nature use system.
- Increasing the level of waste utilization
- Environmental education
- Reduction of deficit of water resources

1. 'Ecologization' of current legislation

Main objectives are:

- To develop normative legal acts of environmental protection while concurrently amending and changing sectoral and civil legislation;
- To ensure that Kazakhstan ratifies international conventions in the area of environmental protection and develops and implements programs on the implementation of the provisions of these conventions

The system of subsidiary laws/by-laws in the area of environmental protection and nature use needs to be updated: over 100 documents need to be revised and 30 new documents should be added. During the period from 2001 to 2010, Kazakhstan plans to join 10 subsequent conventions, regulating the issues of waste disposal and conservation of biodiversity.

2. Optimization of the nature use system.

Main objectives are:

- Introduce environmental zoning of the territory of the country;
- Improve environmental management planning;

- Optimize environmental management and protection;
- Reduce environment pollution

Environmental zoning will be implemented by determining environmentally acceptable levels of environmental pollution and the use of natural resources, by creating a base of state cadastres and databases.

Planned activities include making cadastres, creating maps and automated databases of water resources, forests, wildlife and fishery resources, inventory-taking of specially protected natural territories and sources of environmental pollution.

Improvement of environmental management planning will be conducted through the introduction of instruments of economic assessment and determination of payment amounts for the use of natural resources, taking into account world market conditions and needs and the interests of future generations. Emphasis on the use of resource-saving and environmentally friendly technologies should be enforced.

Optimization of environmental management and protection should include the development of a system of specially protected natural territories and support for eco-tourism. A feasibility study on the possibility of expanding the network of specially protected natural territories will focus on the Yermentau reserve, Kolsai Lake, Dzhungar Alatau and Zharyn state national reserve parks. For the development of eco-tourism new facilities will be added e.g. sanitary-protective green zone to be planted around the city of Astana.

Reduction of environmental pollution intends to introduce a system of mandatory environmental audits and insurance of environmentally hazardous activity. Territories that are already contaminated and continue to pollute should be addressed by projects on pollution research and elimination. This mainly concerns the air basins of urban territories, pollution of rivers and lakes, damaged lands of military test sites, the mining industry and areas of intensive agricultural development.

The government resolutions on power-saving programs, greenhouse gas reduction, preserving biodiversity of the Caspian Sea and other measures under the International Caspian Environmental Program are in their final stages.

Government resolution has defined a register of nature conservation initiatives of national importance that received funding in 2001 and 2002:

- Containment of environmental threat at the Mirgalimsay pumping station;
- Construction of Vorobyevscko-Kotyrkol sewage collector (Akmola region);
- Facilities for the treatment of kerosene-containing ground waters in Semipalatinsk;
- Commissioning sewage treatment facilities in Ust-Kamengorsk and Semipalatinsk;
- Environmental sanitation of the Borovoye health resort, and others.

3. Increasing the level of waste utilization

Main objectives are:

- To develop normative legal documents and programs on management of industrial and domestic waste;
- To monitor industrial/domestic wastes and to assess environmental impact of hazardous waste storage;
- To introduce new technologies and to create a system of incentives for waste processing

In order to effectively address the issue of reduction of industrial and domestic waste, Kazakhstan needs a state program on waste management, which will allow it to put in place a legal framework for waste management and to define the main challenges. It is necessary to assess the environmental impact of waste, provide measures of harm reduction and a system of monitoring waste accumulation. Rates of payment for industrial and domestic waste disposal should be revised to cover the costs to the state budget and to stimulate companies to reduce the amount of waste they produce. It is important to develop and introduce economic instruments which promote projects on waste processing and the introduction of non-waste technologies.

4. Environmental education

Main objectives are:

- To ensure access to environmental information by creating environmental information centers, publishing a periodical and popular scientific literature, through TV and radio;
- To form a system of environmental education,
- To set up a system of training and advanced training of professional ecologists;
- To create a normative-legal base for environmental education and instruction.

There is a need to develop and adopt normative regulations, including collection procedures, registration and distribution of information, to create and to develop a network of information and analytical centers, to support the activity of the republican newspaper Atamaken and Ecologicheskiy Kurier, magazines ZherAna and «Ecology and Sustainable Development», develop websites on the environment and produce a TV series.

5. Reduction of water resource deficits

Main objectives are:

- To ensure rational use of water resources;
- To optimize the water management and protection system;
- To implement the State Program on Potable Water.

To ensure rational use of water resources Kazakhstan needs to enhance current legislation by introducing more rigid provisions on sewage discharge into natural water reservoirs; promote the use of water-saving technologies, recycling and closed-loop systems of water use - fully precluding discharge into natural water reservoirs. Payment rates should be revised and should include an increase of rate payments for use of potable water for technical purposes. The water-resource balance should include all available water resources, comprising both surface and groundwater, and listing all water users.

Emphasis should be put on the development of instruments to stimulate rational use of transboundary waters through joining international agreements and creating intergovernmental bodies on joint use of water resources.

Optimizing water management and protection systems requires development and implementation of programs on water supply and protection of water resources that should include economic instruments, monitoring of potable water quality and assignment of water supply objects to the property of public and municipal bodies.

Implementation of the State Program on Potable Water requires development of a framework of norms for water use and instruments for multipurpose utilization and the protection of water resources, improvement of the condition of potable water sources and taking measures to increase groundwater use.

The implementation of the State Program on Potable Water will start with arrangement of water protection zones from Viacheslavskoie reservoir to Astana.

In 2001-2002, measures were taken to improve the technical condition of the following hydro system facilities: Seletin, Aktubinsk, Kargalinsk, Sazdinsk, Shokaisk, Federovsk, Ishimsk, Zhezdinks, Aschysuisk, Intumaksk, Verhne-Tobolsk, Karatomarsk, Ters-Ashybulak, Tasotkel, Sarychaganak, Dunguluk, Kirovsk, Bitiksk, Pyatimarsk, Char, Yegensuisk, Uyedinensk, Badamsk, Bugunsk and Bartogayisk water reservoirs, Vuyacheslav, Yeraliev, Furmanov, Assin and Georgiev hydro systems.

Reconstruction of the water-supply system (improvement of potable water supply), will be implemented in: Nurinskiy, Kokshetau, Bulaevsk, Ishim, Sergeevskoy, Irgiz, Inder-Miyalinskiy water-pipe system; water-supply of East Kazakhstan, Karaganda region and South Kazakhstan. The construction of water pipe systems is planned in Likhachevsk, Uzungol (Kostanai region), Zhedelinsk and Oktyabrsk (Kyzylorda region).

The planned activities include development of a draft for governmental resolutions on:

- Multi-purpose use and protection of water-resources for the period up to 2005;
- A strategy of development of the water industry and policy in this sector;
- Terms and rates for the restitution of damages resulting from water-management activities (cessation or changes in conditions of water use);
- A target program on water saving.

Projects and Programmes supported by the International Donor Community

The necessity of realizing the range and scale of environmental issues, to identify their origins, and determine ways to remove environmental threats have added to impetus behind the development of national reports, programs and strategies in the area of environmental protection, ecology and nature use (1997-2001). UNDP, GEF and Secretariats of conventions have played a vital role in initiating this process and providing methodological and financial support. The documents - aimed at a step-by-step stabilization and improvement of environmental conditions in the country – have been developed and submitted to government. These documents include:

- National Action Plan to Combat Desertification;
- National Environmental Action Plan for Sustainable Development – NEAP/SP;
- National Strategy and Action Plan on the Conservation and Sustainable Use of Bio-diversity;
- National Program for the phasing out of ozone-depleting substances;
- National Environnemental Hygien Acnion Plan

The process of development, drafting and discussion of the program documents demonstrated to law-makers and the public that the state structures at all levels have to consolidate their efforts to address the economic, social and environmental issues that the country faces. The principle of sustainable development is the core for integration of programs and projects, for consolidation of efforts of the government, community and business groups. The partnership of government and civil society on one side and international donors on the other constitute one of the essential aspects of ensuring the sustainable development of Kazakhstan.

The Concept of Sustainable Development and Kazkahstan's Agenda for the 21st century, developed with support from UNDP Kazkahstan, aim to demonstrate a comprehensive approach to addressing the issues of environmental protection. With the purpose of activization of efforts in this area, in 2002 the Government of Kazakhstan, together with UNDP, adopted a long-term Program on Institutional Strengthening for Sustainable Development for the years 2001-2004. The Program aims to remove barriers between the departments and sectors and the building-up of the intellectual, informational and expert potential.

Among its components, Kazakhstan's Agenda for the 21st Century contains Local Agendas - developed and approved plans of economic and social development of administrative units (oblasts, cities, regions) - based on the principles of sustainable development.

In addition to strategic programs, Kazakhstan implements some environmental projects that can be classified according to **five thematic areas:**

Water sector projects

The partial rehabilitation of the Small Aral (or Northern Aral) will lead to improvement of social, economic and environmental conditions throughout the region. To address these issues Kazakhstan has agreed on a 64.5 million USD loan from the World Bank on the Project for regulating the riverbed of the Syrdarya River and preserving the northern part of Aral Sea. The loan covers the period from 2001 to 2006. At the preliminary stage, the project envisions defining the technical possibilities and feasibility of an increase of Syrdarya water input to the Aral Sea, rehabilitation of waterworks, ditches and dams.

Construction works aimed at modernization of the water supply and sanitation systems will be conducted in Aral and Kazalinskiy rayons of Kzylorda Oblast. Both rayons are experiencing acute shortage of potable water. Project for Water-supply of Kazalinsk/Novokazalinsk will be financed from a KFW grant under an official financial assistance program totaling 5 million USD. This project aims to decrease the risks of the population's morbidity caused by a shortage of potable water. The project on Water-supply of Aralsk schedules the following activities: reconstruction of the 110 kilometer main pipeline for water-supply from the Kosaman water-course to the town of Aralsk; renovation of a 50 kilometer water-distribution system in Aralsk; the construction of three experimental water-desalinization plants in three settlements near Aralsk.

The development of the full-scale joint project on "Development of rural water-supply and sewage systems in Kazakhstan" is in progress. This project aims to provide exploitation and maintenance of water-supply/sewage utilities in Akmolinsk, Karaganda, North Kazakhstan and South Kazakhstan regions. The total cost of the project amounts to 60 million USD. Of this amount 40 million comes from an Asian Development Bank loan, 9.5 million from the Islamic Bank of Development and 10.5 million USD are allocated by central government. The on-going implementation of the full-scale GEF regional project on "Management of water resources and the environment of the Aral Sea basin" should address the root causes of excessive use of basin waters.

The project on water supply and sanitation of cities of Karaganda, Temirtau and Kokshetau aims to reduce water loss by means of improvement of exploitation, upgrade of water-supply utilities and control of water use. A feasibility study is being conducted by the BWS Company (Austria) from World Bank loan funds of 482,200 USD). The study focuses on the conditions and arrangement of the city water supply system, the quantity and properties of water loss and the conditions and efficiency of water-treatment facilities.

In order to address the issue of decontamination of the Nura River from mercury pollution, a project on "Rehabilitation and management of the environment of the Nura-Ishim river basin" plans to restore the water reservoirs of Nura and Ishim river basins. The feasibility study is funded by a grant from the Japanese Government (administered by the World Bank) and amounts to 696,000 USD.

Within the framework of activities under the Caspian environmental program, Kazakhstan has set up Caspian regional centers on water level fluctuations and conservation of biodiversity. The activity of these centers focuses on 10 thematic directions.

Combating desertification

State policy to combat desertification sets forth strategic goals, such as: prevention of further degradation of natural ecosystems; gradual recovery of the natural potential of affected territories; ensuring an environment

favorable for human life on the basis of optimal development of production, rational use and the protection of natural resources. Agenda 21 also emphasizes the importance of rational use of land resources and combating desertification. To comply with its obligations under the UN Convention to Combat Desertification, Kazakhstan implements a number of projects and programs for combating desertification, which are also aimed at the development of economy and agriculture.

Today, the low profitability and productivity of virgin lands presents a serious problem, in particular in Central Kazakhstan. For example, in southern areas of Karaganda region the productivity of grain amounts only to 6-8 centners per hectare with profitability of 10 centner per hectare. To address these issues, from 2001 in Shetskiy region a special working group has started developing a Project on Management of Arid Lands, supported by GEF and World Bank. This project provides for restoration of 75% of deserted grain lands through cultivating sown pastures and helping farmers to improve the market structure and increase livestock production. Kazakhstan also implements several programs on combating desertification with the support of UNDP/UNSO. A global office to combat desertification - UN Convention to Combat Desertification – involves the Asian Development Bank, governments of Germany, Switzerland, Finland and other international donor organizations. The received funds were in the form of grants.

Conservation of biodiversity

Kazakhstan plays a special role in the area of preservation of biodiversity in Central Asia because it has territories/ecosystems of global importance and of significant research capacity. Kazakhstan obtains funds for development and implementation of projects and programs mainly from GEF, UNDP and from the World Bank. From 1997 to 2002, Kazakhstan prepared its first and second National reports, Strategy and Action Plans on Preserving Biodiversity, trans-boundary projects on biodiversity of West Tien-Shan and Altay-Saian regions, projects on conservation of water and swamp resources and mountain agrobiodiversity. A number of projects on preserving individual species are financed by WWF and other international organizations.

Protection of the air basin and conservation of the ozone layer

For the most part, the high level of air pollution is caused by the use of out-dated production technologies and inefficient treatment facilities; mismatch of coal fuel and boiler units; insufficient use of renewable and alternative energy sources and high level of power consumption by utility users. With the support of UNDP and GEF, Kazakhstan has prepared projects on "Removing Barriers to Increased Energy Efficiency of Hot Water & Heat Supply in Kazakhstan" (1998-2000). These projects are aimed at the development of wind-power engineering, reduction of greenhouse gas emissions, addressing the issue of power-supply to remote settlements; reduction of general costs of heat supply to domestic consumers through promotion of power saving and environmentally-friendly technologies.

When Kazakhstan signed the Montreal Protocol, it assumed the obligation of gradually reducing use of ozone-depleting substances. The program has been developed by national experts with support from UNEP and UNDP and endorsed by the Government. The Program includes the following elements: recovery and processing of Freons, exclusion of HFU-11 from processes of production of soft foams and solid polyurethane, exclusion of solvent HFU-113 and setting up a scheme for Halon control.

Chemical safety

After signing the Stockholm Convention on Persistent Organic Pollutants on May 22, 2001, Kazakhstan received a grant from GEF/UNDP for the project on "Sustaining measures: assistance to the Republic of Kazakhstan with purpose of meeting its obligations under the Stockholm Convention on Persistent Organic Pollutants". The aim of the project is to develop an Action Plan to discontinue production by sources of persistent organic pollution, as well as the recovery of contaminated territories.

5.2. State Inventory and Cadastre of Natural Resources

The state inventory and cadastres are maintained for the purposes of identification of the quality and quantity of natural resources, and used for the needs of the population and industry.

The state environmental inventory is taken within the framework of:

- National statistical reports;
- Departmental statistical reports;
- Specialized research, stock-taking and surveys

Ministry of Environmental Protection (MEP) in Kazakhstan registers information on environmental conditions on the basis of monitoring conducted by the *Center of Monitoring of Environmental Pollution of the Kazgidromet republican state enterprise*. This system registers all information about the conditions of surface

water, soil and atmosphere (including nuclear monitoring data). The MEP is also responsible for registering data relevant to sources of pollution and capacity of production, volumes of emission and discharge of pollutants and disposed waste, as well as taking stock of the industries subject to environmental expertise. The state register in the sphere of air protection is maintained jointly by the MEP and Statistics Agency. The statistical data covers all the variables of stationary sources of air pollutants, emission of specific hazardous pollutants, and the utilization of hazardous substances within treatment works.

The state inventory of commissioned environmental protection facilities, of the availability, formation and removal of toxic waste, of current costs of nature protection, environmental payments and natural resources payments, are maintained by the national Statistics Agency.

The state inventory of protection and rational use of forests is maintained by the Forestry and Hunting Committee (CFH) of the Ministry of Agriculture (MoA) and the Statistics Agency. This inventory should include data on preparation of forest plants seeds, cultivation of planting stock, planting/sowing of forest species, natural restoration of forests, forest fires and affected areas, felling for the purpose of forest health and forest use. The state inventory of wildlife area protection is also kept by the CFH of the MoA. This body registers the conditions of game reserves, biotechnological and hunting activities and information relating to observance of the SPNT regime.

The Committee on Water Resources of the Ministry of Agriculture maintains a state inventory in the area of protection and rational use of water resources. It registers the indices of runoff from natural sources/water planes, the use of clear water and use of water for agricultural purposes, saving clear water resources through increased use of circulating/sequential reuse of water and the discharge of waste waters into surface reservoirs or underground.

The Committee on Atomic Energy registers information about the sources of ionizing radiation, their movement, and of companies that implement licensed activities relating to use of atomic energy, including handling radioactive waste.

Another department of the Ministry of Energy and Mineral Resources - the Committee on Geology and Subsoil Protection - is in charge of the subsoil conditions inventory, including groundwater data, information on extraction/mining, underground discharge of sewage and other types of water/ hazardous waste burial/disposal.

The Ministry of Interior of Kazakhstan maintains a specialized inventory of air pollution by vehicles. The Ministry of Health maintains an inventory of observance of sanitary and hygienic environmental norms. The Agency on Emergency Situations registers information about emergencies, including their impact on the environment and on public health.

Natural resource cadastres integrate the data that describes the qualitative and quantitative characteristics of specific natural resource types, including their status, use, reproduction and protection.

Kazakhstan has also completed compilation of a water cadastre (of surface and ground waters) and a land-survey. Forest and wildlife cadastres are in the process of development.

The Committee on Geology and Subsoil Protection of the Ministry of Energy and Natural Resources collects and processes data for water cadastre. This information is stored in an electronic database of the Kazgeoinform Republican Center of Geological Information and on paper as hardcopy. The Center of Monitoring of Environmental Pollution of the Kazgidromet republican state enterprise maintains a cadastre of surface waters. The Center uses this information for data processing, development and publication of reference guides and updating of electronic databases. Decisions on the use and protection of water resources are taken on the basis of data from the water cadastre.

The state land cadastre is maintained by the Cadastre Department of the Center for Land Resources and Land Use of the Agency for Management of Land Resources, in accordance with the Law of the Republic of Kazakhstan on Land, the Procedure of Keeping the Land Cadastre and the Guidelines for Keeping a Land-Survey Book. The land cadastre data consists of the following information: area of land territory; categories of land; qualitative composition of land; categories of land use, ownership and usage of land etc. The data of cadastre assessment of land is used in the process of planning the land usage, land distribution according to types of use, allocating/ejecting land plots, determining rates of payments and assessing land use conditions.

CFH of the MoA keeps forest and wildlife cadastres, which contain data received from standard forestry/ hunting arrangements and on the results of the state forest inventory that is taken once every five years.

5.3. Environmental Impact Assessment and Ecological Expertise

Kazakhstan embarked upon launching its health and environmental impact assessment system (EIA) in the 1980s. The main regulatory document governing these relations is the temporary regulation on EIA procedures in the Republic of Kazakhstan, approved by the former Ministry of Environment and Bio-resources in December 1993.

At present EIA is a mandatory and integral part of any project documentation. EIA is part of the decision-making process with regards to economic activities. Item 4.1 of the current regulation stipulates that this procedure shall be applied to all planned economic activities without exception. However, for economic reasons, EIA is conducted for large projects only, when the parties can afford to cover these costs.

Kazakhstan's legislation has no provisions to fully ensure public participation and community interests under EIA procedures. It does not contain specific requirements concerning the timeframe of public awareness activities at the initial stage and tools to inform the population; nor does it have provisions regarding EIA timeframe and its stages (stages of community participation in the above procedure). The general principle of *"providing access to information to the public at all stages of project design (the client's obligation to maintain contact with the communities)*[35] does not provide a functioning mechanism for community involvement. Clarification on communities' access to information remains unresolved, lacking clarity as to whether the government or the initiator of economic activity should be responsible.

On the whole, the role of EIA as part of the economic decision-making process still remains unclear. So far, it is only a section of the project documentation submitted for Ecological Expertise[36].

Ecological Expertise in its turn is a type of environmental control exercised prior to any activity that may have a hazardous impact on the environment. Its objective is to determine compliance of economic and other activities with environmental quality standards, to approve project implementation and to prevent possible adverse environmental impacts. Ecological expertise seeks to avoid serious mistakes in the area of environmental management and rational use of natural resources at an early stage of decision-making.

In Kazakhstan, there is a distinction between governmental and public types of Ecological Expertise. *Governmental EE* is conducted by the MEP and its regional branches. This is a mandatory exercise, which should precede any legal, organizational and economic decisions regarding environmental management and environmental/health impacts. EE findings are reflected in a final report with conclusions on the feasibility and approval of a project. No project can be implemented without approval of the governmental EE, nor can they receive financing from the state, commercial banks or other financial institutions.

Chapter 4 of the Law "On Environmental Expertise" provides for public participation and this procedure is called *Public EE.* This expertise is considered to be an alternative to state EE and can be initiated by a group of citizens, public foundations, scientific institutions or independent expert commissions. However, such legal public participation is not widely practiced. In particular, being of an informative and consultative nature, the Public EE initiative requires state registration and needs to be published by the mass media. Procedures for Public EE are complicated and require considerable financial resources, but under Kazakhstan legislation its conclusions are not of high importance.

Both state and non-state (financed) economic entities can apply for and initiate EE. The customer prepares and submits all required materials, including a comprehensive environmental, social and economic impact assessment of project activities throughout its implementation cycle, a statement on environmental impacts/approvals of the relevant government entities, and other materials requested by the government entity conducting EE.

5.4. Environmental Monitoring

According to the Law on Environmental Protection,[37] monitoring of the environment is defined as: observation of man's natural environment and prevention of crisis situations (harmful or dangerous to the health of people and other living organisms). Monitoring of the environment emphasizes the following procedures:

- Identification of the object of monitoring;
- Development of an information model for the object to be monitored;
- Planning the measurement;

[35] Article 61. Temporary Instructions on EIA Procedures
[36] N.S. Baimbetova, Legal aspects of EE in the Republic of Kazakhstan. Textbook, Almaty, Kazakh University, 2001, p. 43.
[37] Article 1

- Taking the measurement;
- Management of measurement data;
- Assessment of the conditions of the object of monitoring;
- Prediction of changes of the object's condition;
- Organizing the information in a user-friendly format, and reporting.

Kazakhstan legislation defines two types of environmental monitoring – state and industrial monitoring. *State Environmental Monitoring* is carried out by state agencies authorized to exercise environmental protection functions and to manage use of nature, and includes:

- Monitoring the condition of the environment and natural resources, as well as sources of human impact upon them;
- Assessment of conditions of indicated objects of observation;
- Predicting future changes

At present, Kazakhstan has several autonomous agencies and bodies that monitor the environment and natural resources and process and analyze the subsequent data. These bodies include:

- Kazgidromet, subordinate to MEP;
- The Committee for Forestry, Fishing and Hunting areas and the Committee for Water Resources of the Ministry of Agriculture;
- The Agency for Management of Land resources;
- The State Sanitary-Epidemiological Service of the Ministry of Health;
- The Committee on Geology and Subsoil Protection of the Ministry of Energy and Mineral Resources;
- The Agency for Emergency Situations.

Information on the environment and nature use is divided into sub-categories of information relating to: air, surface water, groundwater, land resources, plants, forests, fishing, and wildlife hunting resources.

In accordance with amendments to the Law on Environmental Protection of 2001, the Ministry of Environmental Protection now coordinates the above activities. The amendments also oblige all state agencies to provide the requested information free of charge and within the stipulated timeframe.[38] More recently, a special government resolution has enhanced the competence of the environmental authority, which now is responsible for methodological guidance, functional ability and coordination of a unified state environmental monitoring system at the national level. In the meantime, the system has not yet been established and has not reached the required level of effectiveness.

In recent years, more resolutions have been introduced in an attempt to change the situation. Government Resolution № 885 of 27 of June 2001 introduced regulations to organize and implement a uniform system of monitoring of environment and nature use. However, a reorganization of ministries in August 2002 and the resulting transfer of the Committee on Water Resources and the Committee for Forests, Fisheries and Hunting from under the national environmental authorities has impeded creation of a centralized environmental monitoring system. Public access to information on environmental conditions and their impact on public health remains limited.

Industrial environmental monitoring is carried out by legal entities. The purpose of industrial monitoring is to provide reliable information about the enterprise's impact on the environment, possible changes and adverse or hazardous situations. The companies should submit the data collected and compile an environmental impact report to the authorized state agency. The information should be collected and reported on a regular basis, defined by environmental monitoring plans developed by the company. These plans are subject to mandatory examination by the territorial divisions of the MEP. Industrial environmental monitoring plans should include the following sections:

- Monitoring of air;
- Monitoring of water resources;
- Monitoring of soils, land resources and industrial/domestic wastes;
- Monitoring of biological resources;
- A database of environmental conditions and sources of pollution;
- Timing, format and addressees of environmental information;
- Analysis of current environmental impact, measures to rehabilitate the environment, perspective status of environment.

The technical equipment used for the purpose of industrial monitoring should be attested by the agencies in charge of ensuring national standards.[39]

[38] Paragraph 6 of the Article 24 of the Law on environmental protection»
[39] Paragraph 2 of Article 25 of Law on Environmental Protection

5.5. Environmental Education and Raising Public Awareness

Environmental Education (EE) and public awareness should help to address environmental issues, based on the concept of sustainable development.

The Resolution of the eleventh session of the Intergovernmental Environmental Council of CIS countries emphasizes that environmental education is meant to develop and strengthen human behaviour, aiming to:

- Save natural resources;
- Prevent environmental pollution;
- Conserve natural ecosystems;
- Respect norms of behaviour and principles of co-existence accepted by the international community;
- Encourage willingness to take an active part in environmental protection activities and provide the required financial assistance;
- Support joint action for environmental protection and implementation of common ecological politics of the states.

The fact that the government is paying attention to this problem is demonstrated by the development of an Environmental Education Program, approved by the former Ministry of Education, Public Health and Sport on 4 January 1999, and by resolution № 207/p of the Ministry of Natural Resources and Environmental Protection on 30 December, 1998. This program represents a basic document for implementation of a Government Action Plan in relation to the Concept of Environmental Safety of RK (Resolution of the Government of RK of March 3, 1998, № 137 p.8). The 2030 strategy in its section *Environment and Natural Resources* states that environmental education is among the priority directions of the country's development. Articles 73 and 74 of the Law of RK *On environmental protection*, provides for universality and continuity of ecological education and training, taking into account vocational environmental training of experts in the course of their employment, attestation and examination.

Preschool environmental education

Preschool environmental education is the fist stage of continual environmental education and lays the foundation for an 'ecological mindset'. Children need to realize their connection with the world around them, their own place and their interdependence with the environment. To ensure this, three preconditions are required:

- Teachers trained in environmental protection and capable of teaching children the basics of environmentally-conscious behavior;
- Visual aids and printed materials that would be easy to understand (e.g. the ABC book on environmental movies);
- Contacts with real nature, especially for urban children, plus excursions to recreation centers outside urban areas.

Analysis of the available data demonstrates that the situation in this area is very complicated. There are almost no environment-oriented programs or study-guides for the environmental education of children that would be based on the local context. Order № 42 of the Ministry of Education defines a standard curriculum for preschool institutions, including a lesson called "*Getting to know the world around us"*. All of the education programs for infant schools partially contain "Environmental education". However, this age group is often overlooked and it appears that the government's efforts in this direction could be much more methodical and consistent.

Environmental education in secondary schools

Environmental education in secondary schools is the second stage of continuous ecological education. The elementary school curriculum comprises a course of *Natural History*, which provides for basic knowledge of environmental characteristics. Courses in *Botany* and *Zoology* taught at middle schools are more focused on flora/fauna and are insufficient for any environmental training.

Specialized schools, advanced schools and lyceums, often offer courses in ecological education, but these constitute only 5 % of all schools. These schools use educational courses developed by Russian specialists (educational program on *Ecology and Natural Dialectics*) and by local scholars. For example, the methodological department of the NGO *EcoImage* has developed a program *"The House Where We Live"* consisting of a study guide for both teachers and students of 5th and 6th grades.

Environmental education in higher education institutions

Environmental courses were first introduced into the higher education curriculum in 1986, when the

Ministry of Higher Education of the USSR issued directive №56 on November 28, 1986. It proscribed to all corresponding ministries of the Soviet Republics «...to provide for introduction of an integrated plan of continuous education in the sphere of ecology, efficient nature use and environmental protection within every educational institution».

At present, higher education establishments in Kazakhstan offer a variety courses for the training of ecology specialists, including training of teachers and scientific researchers. For example, *Al-Farabi Kazakh National University* has developed a well-rounded program of ecological education of students of all faculties, which has been made part of the general curriculum of mandatory courses. The Institute of Advanced Training along with various public educational institutions provides training, retraining and advanced training courses in the area of environmental development (Independent University of Ecology under the National Academy of Sciences, *Ecology* school in Kyzyl-Orda and the Yassaui International University in Turkestan).

However, job placement of such trained specialists remains poor. In 1996, the Biology Department of Karaganda State University opened a chair of ecology to train specialists for State institutions in the sphere of environmental protection and education. Staff of the chair developed educational programs using their own resources and adding NGO experience in the sphere of principles of ecology teaching. According to alumni statistics, job placement averaged only 5 per cent.

Informal programs of environmental education

After over ten years of work in the area of environmental education and training, Kazakhstan's NGOs have acquired extensive experience in the field. In many cases, these initiatives started on the basis of environmental societies and clubs, which, in turn, originated from optional classes taught at schools. One of the oldest environmental organizations of Kazakhstan - the Karaganda *Edelweiss* - has been active for over 11 years and was created by the initiative of a biology teacher L.N. Bushman and now is affiliated with *EcoImage (EcoObraz)* NGO. The club has published a number of manuals on the environment.

Due to the specifics of their activities, NGOs tend to have better access to international experience in this sphere than representatives of the public education system. The growth of NGOs has been facilitated by financial aid in the form of grants from international agencies and technical assistance, such as training courses and study visits abroad. In 1998 a working visit of environmental education experts from Kazakhstan and Kyrgyzstan NGOs visited the Netherlands and were sponsored by the Dutch *MilieuKontakt Oost-Europe*. There are plans for more seminars and trainings aimed at sharing experiences, for example a joint British-Kazakhstan project *Ecological Education and Sustainable Development)*. NGOs have published a methodology manual for education on the issue of sustainable development called "*Choosing the Future"* and a web site has been created to disseminate information. NGOs actively share their experience of informal education activities by publishing manuals on the organization of the educational process, for example EcoImage devised a series of five manuals on the work of Children's Ecological Associations.

A Forum of Non-Governmental Environmental Organizations, set up in 1998, now has a section on environmental education with over 20 active organizations, which have developed a program for the development of environmental education in Kazakhstan.

International programs for environmental education

The United Nations (UN) declared the decade 1989-1999 to be the years of general environmental education and therefore international organizations working in Central Asia have contributed to its development. About 100 schools in Kazakhstan and Kyrgyzstan participated in the *GLOBE* Program, coordinated by the US Peace Corps. One of direction of Peace Corps' activity in Kazakhstan includes bringing volunteer ecologists and involving them in NGO initiatives and teaching at schools.

On March 27 and 28 of 2001 the Central Asia office of UNESCO held a Consultative Meeting on "*Problems of Ecological Education in the Countries of Central Asia"* and dedicated a discussion to the possibility of providing scientific, technical and ecological education within the framework of the Academy of Science. These efforts demonstrate that the world community, represented by the UN, is interested in these developments.

In 2001, the Norwegian Society for Nature Conservancy offered a number of Kazakhstan NGOs the opportunity to take part in a program of energy and resource-saving technology and the economy through the eyes of children. Within the framework of the SPARE program (international school project) a methodological manual on resource saving in everyday life was issued for students and teachers. In 2002, children's "power-saving" conference "*Ecology and Children"* took place in Karaganda.

Typical problems of environmental education in Kazakhstan

Analysis of Kazakhstan's environmental education identifies a range of challenges:

- Development of a modern model of continuous environmental education has not yet been completed, resulting in a shortage of methodological instruments, demonstration materials and specialists/resources for development of EE in elementary and pre-schools.
- No transparent school program has been created for EE which would embrace all age groups of middle school. School courses such as natural history, botany, zoology and biology do not reflect the specifics of nature complexes and the ecological situation in Kazakhstan.
- The training and retraining of competent personnel for systematic work in EE remains problematic. The experience of EE innovations made by schoolteachers is being insufficiently used. The inclusion of an *Ecology* course in the school curriculum is being delayed everywhere, and the level of integration of ecological elements in other parts of the secondary education curriculum is insufficient.

The challenges for ecology study processes at all educational institutions are highlighted below:

- Shortage of text-books and study-guides in official language; insufficient programs of environmental learning;
- Poor technical and laboratory equipment of departments responsible for ecology training;
- Poor connection between colleges and schools;
- Tenuous relationship with foreign institutes of higher education, including the area of student and faculty exchange.

In order to ensure Kazakhstan's participation in the international process of ecological education, it is essential to:

- Develop and implement a State program of *Environmental Education* providing a transparent system of environmental education and a proper legislative and economic framework;
- Develop regional programs for EE and upbringing;
- Set up joint methodological councils (commissions, boards) at the national and regional level;
- Set up a united ecological and methodological center for the accumulation of methodology, programs, study guides for all levels, and creation of a specialized website to disseminate information;
- Create centers of environmental education in the regions;
- Participate in international projects in the sphere of ecology and environmental protection (UNESCO, UNEP) in the sphere of content and methods of EE and to extend ecological information.

5.6. Public Participation in Resolving Environmental Problems

Public participation in decision-making is crucial for a country where civil society is being developed and a jural state is being established. This is true for Kazakhstan today. Ratification of the Aarhus Convention (the Convention of UN European Economic Commission on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters) has made public participation in the area of environmental protection essential and has given additional impetus to cooperation between the state and the NGO sector.

At present, there are over 170 environmental NGOs in Kazakhstan, working in different environmental protection fields, including environmental education and awareness, legislation on environmental protection, cooperation with SPNT aimed at preserving biodiversity, activities in the area of combating desertification and addressing climate change etc. The number of NGOs in rural areas of the country is growing, in particular in the Caspian and Aral regions, and in the Altai and West Tien Shan. The Aral region, Almaty city and Eastern Kazakhstan have more NGOs than other regions of the country.

The current stage of development of the environmental NGO sector is defined by the involvement of a greater number of organizations, which aspire to participate in environmental decision-making at different levels and who seek cooperation with state bodies and international organizations.

A vital stage of public involvement in environmental protection is the preliminarily raising of awareness of public/civil society associations on existing environmental issues, current measures taken by state organizations and informing communities of the planned decisions/actions that have a considerable impact on the environment. The Ecological Press-Center and the "Greenwomen" Agency of Environmental News are actively working in this direction, as well as the NGO EcoForum which in 2002 opened a Resource Center in Almaty.

NGOs publish a range of printed and electronic environmental periodicals, such as "Ecovesti" - an NGO forum - and the "Kazakhstanskkaya EcoPravda" by Ecological Press-Center, which is published 2-3 times a week. It contains the most important news on environmental protection, information about MEP projects and legislation. During 3 years of operation the Ecological Press-Center has published over 350 issues of the newspaper, which is

received by 600 organizations. Other topics that Ecological Press-Center is dealing with include the development of legislation. In this area, there has been extensive experience of public meetings and proposals relating to draft laws. One example is public discussion of government amendments to the Law on Specially Protected Natural Territories, the draft Forest Code as well as legislation and approval on the import of nuclear waste. Active participation of the public in discussions on environmental issues has led to the removal of provisions in the legislation that would have resulted in negative environmental effects and potential health hazards.

Among NGOs taking part in legislative activities are the National Environmental Society, the Public Foundation for Asian-American Partnership, and the Environmental Society 'Green Salvation'. The number of NGOs, which have the expertise and know-how on environmental legislation requirements, remains limited. However, their input often leads to an improvement in the quality of laws adopted by parliament and in some cases results in the blocking of provisions that would have negative results on the environment.

However, examples of the impact of public opinion on important state documents are few. The reasons for this are that many officials treat public opinion as a pure formality and draft laws are only discussed at the final stages when it is difficult to influence changes.

When it comes to public involvement in environmental impact assessment (EIA) it should be noted that Kazakhstan does not have precedents in this area. Public involvement in environmental impact assessment exists only in the course of major projects e.g. oil-production projects in the Caspian. Local NGOs in the Caspian region are increasingly aware of the need to monitor the environmental aspects of oil industry activities and the companies in charge, such as TengizChevrOil, Agip KCO and KazmunaiGas. In Pavlodar region, public actively participated in discussions of the project on construction of an electrolysis factory. In 2001, within a Dutch project on implementation of the Aarhus Convention, a local NGO "ECOM" held public hearings to discuss the above mentioned project.

Still, participation of the public in EIA remains insufficient in Kazakhstan due to lack of practical experience in this area. The few examples of public involvement in this sphere are rather acts of goodwill to proceed with initiators of economic activity rather than concentrating on environmental impacts. Present legislation does not indicate clearly the involvement of civil society initiatives in relation to norms of public participation.

Kazkahstani NGOs increasingly using judicial mechanisms to gain the rights of environmental protection. Examples include the NGOs Biosphere, Belovodie-2, Asian-American Partnership and Green Salvation which already have experience of protecting the community's interests in court, having filed petitions requesting bans on construction of potentially hazardous objects and protested the refusal of state agencies to give out information, etc. The success of NGOs in this area has influenced both the specific decisions of companies and organizations, and the general system of decision-making. Nevertheless, the access of NGOs to legal procedures for protection of environmental rights remains limited, partially due to lack of funds and partly because such trials are complicated and cumbersome. Often litigation on an environmental case can last several years and in these conditions the community has little possibility to prove its case. Furthermore, wining the case in Court provides no material incentives for the NGOs.

Initiation of and participation in parliamentary hearings on typical environmental issues has become a popular form of public participation. One example is the hearing on the environmental impact of Baykonur Space Center activities, initiated by the Karaganda NGO EcoMuseum. Such initiatives help to attract the attention of Members of Parliament and the Government to specific environmental problems, ensuring that the legislators confront a diversity of opinions and give thought to the practical implementation of legislative acts.

NGOs increasingly conduct joint actions to protest against environmentally hazardous activities. Recent examples include a successful campaign against the draft law on imports and storage of radioactive waste and a campaign against large-scale deforestation in East Kazakhstan. Both initiatives united a number of NGOs in a single protest action against projects that may have an adverse effect on the environment and the health of the people. Other forms of protest actions by local environmental NGOs include jointly addressing the decision-makers, conducting signature campaigns, press conferences and public hearings.

Environmental NGOs are also active in the area of SPNT protection, uniting the Koryk Association of staff of national reserves and national parks, the Almaty Tau NGO, Karaganda "EcoCenter", Naurzum NGO, 'Wild Nature' NGO from South Kazakhstan and 'Bars' NGO from Ridder (Leninogorsk). Recently the NGOs have been attempting to restore the institute of public inspectors and to develop the practice of public participation in the examination and control of protected territories by the state environmental protection agencies. The Koryk Association has for years been lobbying for the restoration of rights and social privileges of National Reserve staff and improving the working and living conditions of inspectors and research officers.

The majority of NGOs working in this area are very small in terms of numbers of staff and membership and often the work burden rests on the shoulder of just one or two individuals. Besides, they also experience a serious shortage of funds that limits their performance. It should be noted that the grassroots frequently lack knowledge of how state agencies adopt decisions and how decision-making by central and local governments operates.

Gaps in legislation and improper practice often restrict and even **preclude** the public from participation in environmental protection activities. For example, the legislation that regulates the procedure of issuing permits for special nature use (surface/groundwater, land, forest, hunting) does not allow public participation. Often civil society is only informed once a decision has been made and the documents have been approved. As a result permits are issued for hunting Red Book species, restricted logging and pasturing in the reserves' buffer zones, pasture/fishing in national reserves and the construction of houses in the buffer water control areas.

The Ministry of Environmental Protection (MEP) is among the ministries trying to give due attention to public awareness. The ministry has taken a number of initiatives to promote public participation in environmental decision-making, such as:

- Workshop on "Environmental education: NGOs and State in implementation of the Aarhus Convention in Kazakhstan" 7-8 of June 2001;
- A regional seminar on the "Role of NGOs in implementation of the Aarhus Convention in Pavlodar Region", 11-12 of June 2001;
- Development and discussion of the project of Regulations of access to information and public participation in environmental decision-making (although was not adopted);
- Adoption of Regulations on the cooperation of specially authorized state bodies with public organizations in the area of control of environmental protection, approved by MNREP, August 20, 2001;
- The Government has adopted a "Concept" of state support for NGOs;
- The guidelines for co-operation envisage:
  - Organization of joint inspections;
  - More attention to be given by state environmental control agencies to the violation of environmental legislation discovered by public control initiatives;
  - Encouragement of public activists and organizations to form a reserve of state environmental protection inspectors from the most active and competent community members.

Some other ministries and akimats also attempt to encourage feedback from the public: the Ministry of Culture, Information and Public Accord; National Commission on Women; some local administrations (e.g. Pavlodar region and Kostanai region) have held public hearings on official decisions. However, in absence of a clear definition of the procedures for such consultations between authorities and public organizations, public participation is restricted and its role is undermined. Changing this situation requires a well-defined cooperation mechanism from both government and public institutions' in the process of decision-making.

Conclusions to Chapter 5

1. *Kazakhstan has developed national strategies and action plans on protection of key elements of the environment and biological resources. A number of programs and projects are being implemented to assist in resolving specific problems and tasks in specific regions of the country.*

2. *Environmental agencies make every effort to stabilize the quality of the environment: sustainable use of resources and mitigation of adverse effects of man-caused pollution. State Environmental Agencies need adequate and stable funds for comprehensive long-term activities.*

3. *Available economic and legal instruments for environmental quality management (monitoring, expertise, environmental impact assessment, state audit and control) are not used to their full extent and are generally not applied when developing projects, programs related to economic development.*

4. *To ensure sustainable development, there is a need for state programs on conservation and rational use of natural and biological resources, on environmental education.*

5. *In most cases, civil society does not have access to reliable and updated information on quality of the environment, social and economic consequences of environmental degradation. Participation in decision-making is not practiced and needs greater attention. Existing practice does not provide for participation of the public and NGOs in environment quality issues, in decision-making on use of natural resources.*

CHAPTER 6.
INTERNATIONAL AND REGIONAL COOPERATION

Kazakhstan's efforts to be integrated into the process of sustainable development at global, regional, and national levels are a peculiarity of the current development of the country. Kazakhstan's active involvement in international programs, projects and international environmental conventions, enable the country to be included in world environmental activities and to gain access to modern technologies, information networks and financial resources. These allow Kazakhstan to upgrade production and decrease non-production losses.

Kazakhstan participated in the UN World Conference on Environment and Development in Rio de Janeiro (1992) and adopted its basic documents, such as the Rio Declaration and the Program of Actions to Move the World Community to Sustainable Development – Agenda for the 21st Century (Agenda 21). The delegation of Kazakhstan headed by N.A. Nazarbayev, President of Kazakhstan, participated in the work of the Special Session of the UN General Assembly Rio+5 (1997), where the first global evaluation of Agenda 21 performance progress was presented.

From August 26 to September 4, 2002, the World Summit for Sustainable Development (WSSD) took place in Johannesburg (Rio+10). The results of the world community's activities were discussed 10 years after the Rio summit, including implementation of Agenda 21. The WSSD outcomes were presented by the Political Declaration of the Summit and the Plan for Implementation of WSSD Resolutions, with specific obligations and timeframes, as well as with implementation mechanisms including globalization processes, improved resource management, public participation and institutional development.

A statement on the establishment of a new international institute for Partnership Initiatives was an important outcome of the Summit, which was put forward by regions, groups of countries and organizations from Africa, Europe, and Central Asia. The initiative of the Central Asian countries was aimed at the development and implementation of a sub-regional Strategy for Sustainable Development (Central Asia Agenda 21), and was also included in the Implementation Plan. Participation of the Central Asian countries in the Summit's work was considered successful and fruitful.

Kazakhstan has ratified a significant number of conventions in the area of preserving the basic components of the biosphere (water, air and ozone layer) in order to restrain environmental deterioration through the harmonization of national laws with international conventions.

6.1 Multilateral Environmental Agreements and Conventions

Activities in relation to Kazakhstan's involvement in international environmental conventions (IECs) and agreements started in 1993 when Kazakhstan became a member of the Convention of the World Meteorological Organization. In 1998, within the framework of a UNDP program, MEP has extended its activities in this area. As a result, by 2003, 19 IECs were ratified and 2 International Agreements were signed (Annex 5, Table 1).

Activities on joining international agreements are constantly in progress: submitted to the Expert Council of MoFA of RK proposals on cooperation with foreign partners on joining the Cartahena protocol, the Ramsar Convention, the Bonn Convention on protection of migratory birds, the Rotterdam Convention; prepared and submitted to the ministries and agencies of Kazakhstan Draft Action Plans on the implementation of ratified conventions (Annex 5, Tables 2 and 3). In 2003, Kazakhstan adopted a law on ratification of the Basle Convention.

Currently Kazakhstan is an active participant at different international conventions: Rio-92 within the UN Conference for Environment and Development "Environment for Europe", "Agenda 21", and "Millennium Development Goals in Kazakhstan". Kazakhstan's active participation in international environmental processes is

an integral part of a new environmental policy and of structural changes related to area management. Government activities in the area of environmental protection, based on agreements for international environmental cooperation are a positive indicator. Future plans for Kazakhstan as an active participant in IECs include:

- Expansion of international cooperation by further involvement in the process of global environmental activity processes;
- Promoting the country's sovereignty;
- Gaining international technical and information experience in the field of environmental protection;
- Obtaining financial and technical assistance;
- Implementing new legal and economic mechanisms in natural resource utilization practices.

Financial aspects of the country's participation in conventions

Obtaining technical and financial assistance from secretariats is an important factor for developing countries and countries with transitional economies.

Generally, conventions require entrance and annual fees. Depending on a convention, the entrance fee varies from 3,000 to 40,000 USD and annual fees might reach up to 60,000 USD. These figures vary from country to country and depend on the country's GDP. Several conventions, however, do not require fees.

On the other hand, financial assistance received by developing countries and countries in transition exceed the annual fees by several times. Kazakhstan's joining of the "London Amendment to the Montreal Protocol on Substances Damaging the Ozone Layer" allowed it to obtain 4 million USD. (Annex 5, Table 4)

Fulfillment of the country's obligations on implementation of international environmental conventions

The convention covers a broad range of environmental issues and rational management of resources. An increase in the number of ratified conventions and the availability of certain commitments require considerable efforts from government bodies related to the convention's jurisdiction and further participation in the process of implementation.

These activities require inter-agency cooperation as well as development of a sector interaction strategy. This relates to internal country measures and interaction of CAR countries, as well as consolidation of actions/programs among the Convention Secretariats.

Improving coordination of the conventions on biodiversity preservation, combating desertification and preventing greenhouse gas emissions are topics that have been discussed at world forums for many years, though without noticeable progress. Detachment of the Secretariats on Convention results in duplication of activities and establishment of numerous national structures for convention management, executing agencies and coordinators. A number of provisions of the Conventions (e.g. the Convention to Combat Desertification, the Convention on Biodiversity, Bonn, Bern, Ramsar conventions) overlap, thus requiring implementation of similar measures for landscape and biodiversity preservation.

The Convention on Persistent Organic Pollutants and the Rotterdam and Basel Conventions regulate pollution prevention, which is a key component of the Convention to Combat Desertification. Trade flows of bio-objects and hazardous substances are regulated by several conventions and UN-EU transboundary conventions regulate pollutant transfer by natural agents such as atmosphere and rivers.

Uncoordinated activities lead to the overlapping of different convention objectives. Often, such conventions are within the competence of different ministries and sub-regional organizations, which, acting as Convention secretariats, do not coordinate their activities well.

At the stage of project implementation, part of the activities may fail to follow the methodological and monitoring guidelines of relevant conventions. This leads to the loss of information, which finally reduces the effectiveness of environmental management.

Consolidation of activities for environmental management is urgent for Kazakhstan; therefore it should be conducted in the area of environmental conventions and interrelated areas with plans and programs at local, national, regional and global levels.

The principal constraints to fulfilling commitments under the conventions in Kazakhstan are as follows:

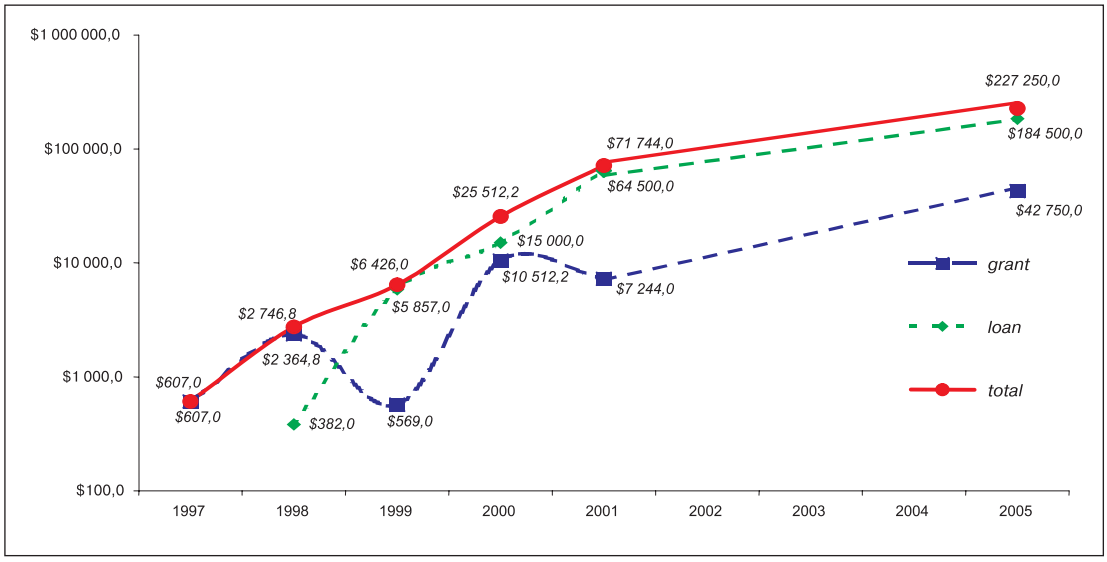
- Difference in priorities established by economic and environmental protection agencies;
- The low 'rating' of the environmental protection sector (Ministry of Environment Protection, Committee for Forestry, Fishery, and Hunting, Ministry of Agriculture, environmental NGOs, and scientific societies);
- Lack of interest by certain economic sectors in establishing high or international environmental standards;

- Lack of legal and economic mechanisms to ensure fulfillment of conventions (ratified conventions, not having the force of law, require amendments to be introduced to the existing national legislation);
- Low level of interaction among convention secretariats, accountability of convention executing agencies to different agencies and uncoordinated activities.

6.2. Participation of International Organizations in Resolving Environmental Issues in Kazakhstan

International donor organizations currently support programs and projects that cover various environment components: subsoil, energy resources, soil, air, water resources, biodiversity, and others. During 1997-2001, Kazakhstan, within the framework of environmental conventions, obtained financial assistance from international environmental organizations and donor countries in the amount of 107 million USD, of which grants amounted to 22 million USD (30 grants, 7.2 USD million in 2001), loans to 85.0 million. At present, 4 loan agreements totaling 85.0 million USD (including 64.5 USD million in 2001) have been obtained. It is intended to sign 4 future loan agreements worth 184.5 USD million.

Figure 6.2.1. International financial assistance for environmental projects, 1997 – 2001, in '000 USD



Source: Ministry of Environmental Protection, 2001

International donor organizations, funds, and environmental project groups provide assistance in preparing and implementing a considerable number of projects and programs on the territory of Kazakhstan. The thematic, geographic, temporary, and financial ranges of projects differ, thus depending on the interests and scope of donors, established goals, and resources available. According to the targeted objectives, such projects can be grouped into the following thematic categories:

- *Preventing degradation of the environment* - reduction of pollutant emissions and contaminant discharges by industrial and power generating enterprises, power savings, replacement of ozone destructing substances from production cycles, persistent organic pollutants and leaded gasoline;
- *Rehabilitation measures* - removal of mercurial and chemical pollutants of rivers and underground water, improvement of the population's health in environmentally unfavorable areas;
- *Conservation of landscape and biodiversity* - monitoring of globally significant species, support of transboundary protected territories, fighting desertification, planting of greenery and forest recovery;
- *Water resources management* - flow distribution, water supply, water economy, drinking and waste water, treatment, sanitary issues, rehabilitation and expansion of water supply systems;
- *Informative and analytical* recommendations to Government and ministries on institutional and legal issues; creation and support of special groups to enhance opportunities of the government in the

environmental area and international cooperation; preparation of reviews, analytical reports; social and environmental studies, publication of methodological and reference literature; interactions with NGOs: trainings, conferences, training programs, advisory and grant assistance, support of NGOs, mass media, publications, web-sites, and electronic issues;
- Projects supported by Convention Secretariats.

Large-scale projects that are financed by grant providers are developed in full agreement with government, executive agencies, local governments, and local representatives of executive bodies. An essential part of project development and preparation is the establishment of working groups that would include international and local experts beside officials.

Under various UNDP projects National strategies and Action Plans for bio-diversity conservation and rational use, combating desertification, as well as a draft National Programme for withdrawing ozone-destructives from use. Also, an interdepartmental centre for global climate change has been set up. Various national action plans are at different stages of development and progress. Table 7 of Annex 5 updates the reader about international donor-sponsored projects in progress in Kazakhstan.

With GEF financial assistance, Kazakhstan is implementing a number of international projects and programs in the SPAs.

The "Transboundary project on biodiversity conservation of the West Tien Shan. The project is financed by the World Bank with a planned duration of 5 years. The government contribution is 266,000 USD. In the first quarter of 2002, the *Aksu Dzhabagly national reserve* spent 29,500 USD, including consulting services-18,000 USD, operational expenses – 4,200 USD and training of the park staff – 2,300 USD.

The project on "*In-situ* conservation of Kazakhstan's mountain agro-biodiversity". Total cost of the project is 7.02 million USD. The project is aimed at the preservation of wild congeners of fruit varieties such as apple-tree and apricot at Zailiski and Djungarski Alatau.

The project "Integrated Conservation of Priority Wetlands in Kazakhstan". Total cost of the project is 38.54 million USD. The project aims to realize new approaches to the management of wetlands of Alakol- Sasykol, the Ural delta and the Tengiz-Kurgaldzhin lake systems.

In 2002, Kazakhstan started implementation of the project on *"Conservation and Sustainable Use of Biodiversity in the Kazakhstani of the Alta – Sayan Ecoregion"*. For the project's development 60,000 USD were allocated by GEF. The project was staffed and the covered territory was defined. On February 5, 2003 at the Second round of the Regional Coordination Committee (Russia, Mongolia and Kazakhstan) the concept formulated by the Kazakhstan side of the project was highlighted and approved.

Project development and preparation are mainly accomplished within fixed terms at a high methodological and technical level, thus facing no obstacles, except for a lack of specific information at a national and local level. In certain cases difficulties begin at the stage of project agreement - obtaining finance in particular - by executive agencies, governmental institutions, local executive bodies, private sector, and international organizations. The process of project agreement and partners' search can be prolonged due to uncoordinated activities, scarce budget resources of governmental institutions, and lack of economic incentives. A considerable part of the developed projects is not urgent any longer due to changes in local conditions, removal of structural units or lack of financial support.

During project implementation, obstacles can arise that hinder implementation processes, reduce performance, increase project costs and make the project less attractive for replication. The following factors often contribute to such situations:
- The environmental situation changes in the area of project activity;
- Activity priorities change, as well as donor activity areas;
- Certain local institutional changes take place e.g. executive agencies and their local branches merge, are separated, or are removed;
- Key figures of the project consortium change (donors and recipients);
- The project loses its urgency or is absorbed by a larger project;
- The legal framework changes;
- The parties do not fulfill their commitments due to various reasons and to a different extent;
- Fluctuation of project cost (or cost of separate project components) dramatically increases, which makes it unattractive for financing parties.

Ways to improve efficiency of cooperation. When developing environmental projects and measures, international organizations should take into account the following circumstances:

- In Kazakhstan, there is a largely adequate legal, institutional and scientific-methodological framework for development and implementation of the majority of projects and technologies.
- Lack of the state financial resources hinders independent implementation of strategies, programs and projects.
- Not all national environmental strategies and action plans are always included into the work plans of supervising ministries and committees.
- Activities of national executing agencies are poorly coordinated with those of the Secretariats and among themselves.
- The country's potential for environmental protection management is systematically weakened by the lack of a balanced financial agenda and labor resources required for Kazakhstan's contact units.
- International donor agencies and organizations have insufficient information on national priority areas, developed strategies, and action plans, leading to incorrect project appraisals and implementation.
- Donors' actions are not well coordinated, causing overlapping of proposed projects, conferences, research, as well as publications and recommendations. Some cases are well-known when the measures taken by different project groups overlapped (i.e. projects with similar goals, but different finance sources), which were implemented within one administrative oblast, covering the same districts, settlements, and NGOs.
- The existing practice of donors' preferential contracting of western consulting companies from developed countries, with patchy knowledge and familiarity with local legal matters, managerial and the resource specifics of the county resulting in huge cost increases for project preparation and implementation.
- A considerable part of the educational and information-analytical projects occur in the form of conferences, documents, reports, and recommendations delivered both to decision-makers and civil society, including local communities and NGOs. These practices, however, are not enough to achieve expected progress (e.g. positive mentality and behavior changes). Funds' attempts at broad public awareness campaigns do not bring tangible outputs, as they are not supported by real local actions.
- Absence of a mechanism of national co-financing of projects is a significant constraint for projects implementation, regardless of environmental and economic benefits that the project may bring, if implemented. As a result, developed strategies, programs, and projects become "dead" papers while environmental conditions in the country continue to deteriorate.

The effectiveness of international cooperation in the area of addressing national environmental issues can be significantly improved by removing the above challenges that now exist.

6.3. Environmental Challenges in Central Asia

The Central Asia (CA) Region is comprised of 5 independent states: Republic of Kazakhstan, the Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan. The total area of the region is 3,882,000 million km^2 with a total population of 53 million.

Extensive integration of the Central Asia Region (CAR) countries has been established throughout history. Within the framework of the former USSR, mining and processing industries were formed and developed in the CAR countries. Military-industrial and military-missile complexes were the most developed, with their operations causing significant environmental and human health damage in the region.

The richest mineral, feedstock, water, and land resources predetermined the specifics of the countries' economic development, with a dominant resource orientation. Processing industries with end user products were not sufficiently developed. The economic potential of the CAR countries is high. Hydrocarbon reserves (oil and gas) constitute a considerable part of world reserves and CAR is also rich in non-ferrous metal deposits. The specific weight of fuel-energy, hydro-energy and mining complexes in the total production volume exceeds the corresponding indicator for CIS countries by 10-15%. In the agricultural structure, plant cultivation (cotton and grain) and livestock breeding are well developed. The region is one of the leading cotton and grain exporters in the world. The countries export mineral and agricultural resources, semi-finished products, fuel and energy resources outside the region and import mainly machinery, equipment and consumer goods. The demand in CA countries for finished products is met: by 96% - for railroad machine building, by 95% - for light industry equipment; by 82% - equipment for chemical and petroleum industry and handling machinery; by 72% - for metallurgical equipment; by 62% - for machine tools and metal-working machines, and by 61% - for radio-electronic products.

CAR countries' industries for finished product manufacturing started to develop after independence e.g. machine building, oil refining and gas processing, power industry, and agricultural processing.

Due to historical facts established during the Soviet period, integration of the CA countries' economies and current issues of market development predetermined the act of signing the Agreement on Creating a Uniform Economic Zone, by the presidents of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan on April 30,1994. A number of agreements have been signed in the area of economic, cultural, and environmental cooperation. Appropriate bi-lateral and multi-lateral links are being developed. On the initiative of the CA countries, the Regional Environmental Center of Central Asia was established, which aims to provide assistance to the governments, NGOs, and business sectors of member countries to jointly address and resolve environmental issues.

Regional environmental issues

Resource-based economies of CA, centralized and agency management system, and declared principles of extensive nature utilization indicate the occurrence of environmentally risky zones on the territory of the region that have resulted in local, regional, and global problems. The main common environmental problems of CA countries are as follows:

Depletion and deterioration of water resource quality

The limited nature of water resources and uneven water supply to the territories are the key factors restricting population settlement and economic activities in the CA countries.

The majority of a significant part of the countries' territories (flat terrains) do not have any water resources (with a permanent drain and non underground water) fit for economic and drinking needs and the fresh water deficit is increasing. For individual consumption, at least 5,000 cubic meters per annum of fresh water are required, whereas in the majority of the CAR not more than 700 cubic meters per annum are available. A considerable part of watercourses are characterized by a high level of contamination with industrial waste, residential sewage and drainage water. Violating the norms of constructing and operating irrigation systems has caused salinization and swamping of the irrigated areas and territories adjacent to the main canals.

Land degradation

Considerable territories of CAR countries have suffered desertification and degradation of different scales, caused by wind, water, pasture erosion and secondary salinization. In recent times these processes have come to cover larger and larger territories. The status of soil contamination in agricultural lands is characterized by a high content of chlorine-organic pesticides.

Degradation of mountain ecosystems

Environmental and socio-economic wealth of the population of the densely populated and economically developed areas of the CA countries considerably depends on whether the existing mountain natural balance can be maintained. In many mountain areas degradation of the environment has exceeded natural self-regulation mechanisms. The most explicit demonstrations of such degradation is deforestation, activation of hazardous exogenous phenomena, decline of pasture productivity and its contamination, depletion of water resources and natural environment contamination from adjacent densely populated sub mountain plains with high industrial potential. Regulating the impact of recreation on the mountain ecosystem is an urgent matter.

Air pollution and depletion of the ozone layer

The principal sources of air pollution are generated by heat energy enterprises, ferrous/ non-ferrous metallurgic plants and communal utilities. While pollution from industrial sources has generally decreased, automobile emissions have increased and their share of total air pollution now reaches 80%, particularly in large cities.

Countries of the region do not produce ozone-damaging substances. The issue of ozone layer preservation is related to governmental regulation of the delivery and utilization of ozone destroying substances.

Environment pollution by space, military and industrial testing sites

Despite the fact that nuclear and space test sites are located in Kazakhstan, the issue of environmental contamination by missile and fuel emissions are of common concern for all countries of CAR and the world. In Kazakhstan, Tajikistan, and Kyrgyzstan there are sites for the production and processing of uraniferous ores. Waste utilization and removal of tailing dumps in mountain gorges and river valleys, inherited from the USSR, is an urgent matter.

Transboundary migration of pollutants

Transboundary migration of pollutants relates mainly to watercourses and air. Pollution of the AmuDarya, Syrdarya, Zaravshan, Mailisy, Chu, and Naryn rivers is caused by the development of mining and metallurgical enterprises in their basins, as well as from the agricultural sector and municipal utilities. Rivers polluted upstream entering the valley area aggravate nutrition and health problems for rural populations, thus threatening social and economic development of the entire region. Effluent water is the key cause of pollution of transboundary rivers and the high level of gastrointestinal disturbance in the populations living in the basins thereof.

Transgression of the Caspian Sea that started in 1978 is accompanied by the flooding of coastal areas where oil and gas producing complexes are located, including larger settlements, such as the towns of Aktau, Atyrau, and Turkmenbashi. Flooding of coastal areas (including oil producing areas) causes seepage of petroleum products into the water of the Caspian Sea. Meanwhile, the release of industrial and residential wastewater near coastal settlements threatens the biodiversity and preservation of the entire Caspian ecosystem.

Reduction of biodiversity

Extensive utilization, decades before, of biological resources exceeded natural reproduction potential, causing degradation of the gene pool and considerable loss of species while the number of endangered animals has increased. Many rare species are officially endangered, due to various forms of human impact on natural habitats.

Since the beginning of the last century, the Central Asian forest area has been reduced on average by 4-5 times. Saksaul and flood plain forests have been the most severely damaged by human activity, especially agriculture, and their area in the valley of the AmuDarya has fallen from 150,000 hectares in 1928 to just 22-23,000 hectares in 1993, and the decline process is still ongoing.

Uncontrolled purchase of crude drugs and food has considerably reduced the reserves of such species as licorice, elecampane, ephedra, etc.

Ecosystems that have not yet been affected by human impact maintain their ability for self-reproduction and are therefore an important factor in regional environmental stability. They continue to accomplish certain environment-creating functions, thus being a habitat for living organisms.

Increased levels of industrial and household wastes

During a long period of economic activity a huge amount of industrial and household waste has been accumulated at different locations of the territory of the CA countries. The issue of their removal, storage, and utilization has become more and more urgent as a result of increased rates of accumulation. A considerable part of industrial waste is the formation of toxic non-ferrous metallurgic wastes. A system of industrial waste utilization has yet to be developed in the CA countries. Tailing pits of mining enterprises contain certain valuable components which can be recycled. Waste piles and tailing pits are resources for industries which utilize secondary raw materials as feedstock.

Household waste still presents a problem, often containing such toxic substances as mercury, cadmium, and other elements. Household and industrial wastes are often disposed of together. However, modern systems of sorting waste and secondary waste processing have not been implemented, which could have both economic and environmental effects. Some initial steps in introducing and implementing waste sorting and re-use technologies are being taken in the major cities of the region.

Geo-chemical problems of natural habitat

Geochemical problems of natural habitat are extremely urgent for the Central Asia countries. The largest borate province in the world is located in the region (the Caspian region), as well as fluorine (in granite areas) antimony, lead, zinc, copper provinces and provinces with increased natural radioactivity. A lack of iodine and fluorine is a specific feature of the mountain ecosystem, which causes thyroid function abnormality and such mass diseases as endemic goiter. Research has shown a prevalence of abnormalities due to radon gas emission from the soil, where admissible radiation level is exceeded by 10 to100 times.

The Aral Sea crisis

A prolonged dry period, a number of low-water seasons, and an increase of irrevocable water consumption caused a situation in which the precipitation from the Aral Sea surface exceeded the amount of river run-off. Since 1964 the sea level constantly decreased at a rate of 20 to 90 centimeters per annum. In the 1980's, the AmuDarya and Syrdarya rivers discharged into the sea only a maximum of 10% of the previous norm. In 1982, the river run-off amounted to 2.28 cubic kilometers, and the sea level decreased by 97 centimeters; in 1983 the river run-off amounted to 3.23 cubic kilometers, and the sea level decreased by 80 centimeters. By 1984, the

southern and eastern parts of the sea had become shallow, and by the 1990s the southern and northern parts were separated. Thus the southern and southwestern parts became exposed, and new islands and peninsulas appeared. The 33,000 square kilometers of exposed seabed became a source of salt and dust on a huge scale of up to 150 million tons per annum. The climate of the region changed, fish and game birds disappeared and agricultural activities became unviable. This environmental crisis generated a social crisis. The morbidity rate increased, life expectancy declined, the process of population outflow started and ecological refugees appeared.

Increase of the Caspian Sea level

The Caspian Sea is the largest inland water basin, over which the state frontiers of Kazakhstan, Turkmenistan, Russia, Azerbaijan and Iran pass.

Since 1978, the present periodic cycle of Caspian Sea level increase has been observed, with its intense stage lasting until 1995. Over 18 years, the sea level increased by 14-36 centimeters per annum, with the total increase equaling 2.5 meters. By the beginning of 1996, the sea level achieved a mark of minus 26.6 meters, and in 1997-2000 the sea level stabilized at minus 27.0 meters.

Huge territories of the eastern coast were flooded as a result of flatness and a lack of banks. After the sea level increased by one meter, flooding of 10 to 17,000 square meters was recorded only on the Kazakhstan coast (depending on wind direction and strength). The flooded area covered the territories where, in addition to settlements and agricultural entities, oil and gas producing complexes of the region's countries of were located. Many abandoned and existing wells were flooded located at the coast and were destroyed by ice floes.

The situation was exacerbated by periodic water surges: a westerly wind pushes seawater to flood huge areas and remain on land for a long time and then returned to the sea, carrying all types of contaminants back into the water. The increase of the sea level and surges has led to under flooding and flooding of existing fields, oil storage pits pipelines, dikes, roads, and oil wells in the Kazakhstan part of the coastal areas. This has caused a backwash of petroleum products into the sea, as well as causing significant areas to be contaminated with petroleum products/oil residuals, accumulated industrial and utility effluent discharged by coastal enterprises and settlements.

In 1990, a hurricane-force wind (30-35 m/s) caused an increase in the sea level in the Kazakhstan coastal area by 2 meters, resulting in water advance to the mainland for 20-30 kilometers (depending of the relief) and the fields of Prorva and Terenozek.

Increased oil production, expansion of existing industrial capacity on coast, in the shelf area and in the water area of the north-eastern Caspian Sea create a real environmental threat to Caspian Sea ecosystems due to sea level fluctuations.

6.4. Regional Cooperation in the Area of Environment and Sustainable Development

Regional programs and projects

The Central Asian Region plays a major role in the world community by preparing and implementing environmental protection plans for the Aral Sea basin, demonstrated by leading international donor organizations (global, regional and bilateral) and executive agencies, such as the GEF, UNDP, UNEP, WB, EBRD, ADB, KWF German Fund, Kuwait Fund of Economic Development of the Arab Countries and, USAID and by participating in different forms of technical assistance to CA states. The total amount of expected investment in the development and implementation of regional environmental programs and projects in the Aral Sea basin is in the range of 350-400 million USD. De facto disbursement of funds for resolving the environmental problems of the region does not exceed 10% of the intended finance. This depends mainly on the programs and project compliance with the national priorities and economic interests of the countries in the region, as well as on their activity in the co-financing of regional projects. As a result, Kazakhstan and Uzbekistan have an active agenda in the area of water management systems; Kazakhstan, Kyrgyzstan, and Tajikistan in the area of mountain ecosystems; Kazakhstan and Uzbekistan have an active agenda in the area of biodiversity; and Turkmenistan and Kazakhstan in the area of combating desertification.

The principal financing for regional projects is divided according to the following priorities: environmental problem of the Aral Sea 76% of total funds; protected mountain territories 16%; combating desertification and land degradation 2%; and other targeted projects 6%. It is obvious that trans-boundary issues - air and surface water pollution, waste utilization, combating densification of soil exposed to erosion - are not sufficiently covered by the regional programs. The above components are therefore often covered by national projects.

International organizations often invest considerable funds in projects, without taking into account any actual or potential environmental changes. Such projects reflect policy aimed at research and institutional support in the countries rather than implementation of practical measures in the area of environmental issues. However, recently certain trends have been observed to achieve practical results in reform implementation (taking into consideration the vital interests of the country) but are not highly efficient, as they are primarily preconditioned by an insufficient level of analysis/expert study (at the national level) of project materials and by a lack of information provision.

Implementation of the objectives specified (programs and projects) can only be achieved with close cooperation between environmental protection agencies of the CA countries during the development stage of a uniform regional environmental strategy.

The most significant initiatives of regional cooperation in Central Asia are as follows:

- Establishment of the International Fund for the Aral Sea (IFAS);
- «Agreement on Joint Actions for Addressing Issues of the Aral Sea and Adjacent Territories, Environmental Recovery and Promoting Social and Economic Development of the Aral Sea Region» dated 1993;
- Agreement on Establishment of the Central Asian Regional Union of the Countries of Central Asia and Kazakhstan (CARA);
- Nukous and Issyk-Kul Declarations. Establishment of the Interstate Commission for Sustainable Development (ICSD);
- Tashkent Declaration on Special UN Program for Central Asia Economies - SPECA ;
- Agreement on Cooperation in the Area of Environment and Rational Nature Utilization». Almaty Declaration, 1997;
- Participation of the CAR delegation in the Conference of Ministers for Environment Protection in Kits-Kiusiu. ESCATO Meeting (Tehran); resolution on creating a Regional Environmental Action Plan (REAP), 2000;
- Establishment of a Regional Environmental Center (REC) (1997-2000);
- April, 2000 – the First Eurasian Economic Summit "Eurasia-2000» in Almaty, presentation of SPECA;
- Ratification of the Orhus Convention by Kazakhstan, Tajikistan, Turkmenistan, and Kyrgyzstan;
- A renewable database has been created, and the Regional Report on "Environmental Conditions and Development of the Central Asia Region» has been prepared;
- The beginning of preparation to Phase II of the National Environmental Action Plans (NEAPs), 2001;
- Global Mountain Summit (BGMS), November 1, 2002, Bishkek, Kyrgyzstan- Mountain Platform was adopted, and the Central-Asian Mountain Charter was signed

Regional action plans

The governments of the CAR countries have still not developed coordinated methods on integrated management that would take into account economic, social, and environmental issues on a comprehensive approach basis. This is mainly predetermined by the regional nature of ecosystems, and a necessity to take joint measures in resolving transboundary and inter-sector issues.

The process of "Environment for Europe", which started in 1991 with the adoption of the Program of Actions for Environment Protection, played a key role for the countries of the region in implementation of the negotiation process. The Region's participation was supported by resolutions of the conferences, which were held in Sofia (1995) and Aahus (1998). In particular, in Aahus, the decision was made by CAR countries to begin drafting a regional environmental action plan (REAP), which was widely supported. The process of NEAP was an important stage, which was launched in the majority of the region's countries. It allowed a shift from comprehensive and unrealistic programs to priority actions and extensive work with donors. At present, the countries of the region participate extensively in similar programs established for the NIS in 2002.

The Regional Environment Action Plan for Central Asia (REAP) has been developed with the assistance and under the guidance of the UNEP/UNDP. Its goal is to create a basis for future of regional cooperation and the integration of efforts for the region's countries, aimed at preservation of the environment and the populations' living conditions. A set of measures has been developed to resolve priority targets. The following key strategic targets related to environmental protection in the CAR countries have been identified for REAP:

- Sub regional Plan for Combating Desertification;
- Regional Plan for the Sustainable Development of Mountain Territories;
- Regional Pattern of Protected Natural Areas;

- Regional Plan of Water and Salt Management

Water resources

Water challenges (resource, freshness and scarcity) in Central Asia are the main issues that need to be addressed. Environmental, social, and economic implications in the Aral region have a major impact on watercourses and energy needs. Fluctuations in seasonal demand for water resources and their unbalanced distribution are the results of conflicting preconditions that significantly influence the economic conditions of all countries in the region.

An agreement between the countries on the status of the Aral Sea and its adjacent territories, as independent water consumers, should help resolve the water challenges of the Aral basin and address the different countries' water needs. Therefore, establishing a legal framework at the regional level should be an important factor in resolving such water-related conflicts as:

- Between the areas of water course formation and deltas;
- Between all water consumers and the environment;
- Between irrigation and hydro energy industry

The existing legal framework of water management should be determined by a set of policy documents (taking into account international water laws, as well as local traditions) which strictly regulate the parameters of cooperation in the area of water management and consumption. Establishment of a strong legal framework is a labor-intensive process, requiring involvement of highly skilled specialists, national experts and the general public.

In order to expand the issues identified for the Aral Sea basin, a number of regional programs and projects are being prepared with broad scope in the area of rational utilization of water resources and environmental protection:

- the Aral Sea Basin Programs (ASBP and ASBP-2);
- Regulation of the Syrdarya River bed and the Northern Part of the Aral Sea SYNAS, World Bank;
- Water Resource Management and Environment, GEF;
- Rational and Efficient Utilization of Water and Energy Resources in Central Asia: UN SPECA Program;
- CAR Natural Resource Management Project, USAID;
- Creation of a Forecasting System for Snowmelt Runoff for the Rivers within the Aral Sea Basin» USAID;
- Monitoring System for the Hydrological Cycle in the Aral Sea Basin; Aral-HYCOS

A detailed study of the majority of thematic components of these projects reveals a certain degree of duplication and overlap.

IFAS was established in 1993 by the Presidents of the Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan, and Republic of Uzbekistan. It plays a leading role in regional cooperation, in environmental protection and the integration of sustainable development environmental processes in the region. IFAS was built by the Interstate Commission for Sustainable Development (ICSD) - which coordinates activities in environmental protection and sustainable development of the Central Asian countries - and the Interstate Commission for Water Coordination (ICWC), its basic task is the development of a strategy of a uniform water policy in the region.

The ICSD cooperates with many international donors, such as UNDP, GEF, UNEP, the World Bank, TACIS, KFW German Fund, Kuwait Fund for Economic Development (Arab Countries), ADB, EBRD, and USAID. Total investment in the intended and implemented regional environmental programs and projects of the Aral Sea basin are estimated to be between 250-300 million USD.

Regional cooperation in the area of utilization of land and water resources

The problems of transboundary water resource utilization are still of utmost importance in resolving regional issues between Kazakhstan and neighboring countries, such as the Chinese People's Republic, Kyrgyzstan, Russia, and Uzbekistan. The existing water supply is one of the main constraints to developing the rich mineral, fuel, energy, and land resources of the country.

In order to establish closer regional cooperation in transboundary water apportioning, Kazakhstan joined the «Convention of Protection and Utilization of Transboundary Watercourses and International Lakes» on December 4, 2000.

Cooperation of CA countries in the area of transboundary watercourses

Improvement of interstate water relations should be viewed as a key issue in terms of national security,

particularly in the southern regions of Kazakhstan. In spite of the extensive activities conducted by the IFAS and its branches, the urgent nature of transboundary water resource distribution in CAR is constantly growing.

The key documents regulating the distribution of water resources in the basin of the Syrdarya River are:

- Nukus Declaration of the Central Asian countries and international organizations on sustainable development of the Aral Sea basin, signed by the five Heads of the CAR states on September 20, 1995;
- Declaration of the Heads of the Republic of Kazakhstan, Kyrgyz Republic, and the Republic of Uzbekistan on Utilization of Water and Energy Resources, signed by the heads of these countries in Bishkek on May 6, 1996;
- "Specified Pattern of Comprehensive Utilization and Protection of Water Resources in the Basin of the Syrdarya River";
- "Corrective Note to the Specified Pattern of Comprehensive Utilization and Protection of Water Resources in the Basin of the Syrdarya River". This document determines the limitations of water resource sharing by sources, water management areas and parts of the basins, and fixes the share of each republic in the total amount of water resources of the basin of the Syrdarya River.

Cooperation in the area of transboundary watercourses with the Russian Federation

Taking into consideration the significant amount of transboundary watercourses passing over the territory of Russian Federation and Kazakhstan, on August 27, 1992 an interstate Agreement on Joint Utilization and Protection of Transboundary Water Facilities was signed in Orenburg. The Agreement regulates relations in the area of transboundary water facilities' protection and utilization. Based on the Agreement, a Kazakhstan-Russia Commission was established, which approves time schedules of common use of water reservoirs and distribution of water intake limits and develops measures to conduct repair and operation of water management utilities.

Cooperation in the area of transboundary watercourses with China

To resolve the issue of managing Transboundary Rivers with China, three rounds of negotiations were conducted by experts, which resulted in the approval of the provision on a Joint Working Group of Experts for Transboundary Rivers between the two countries. At the first meeting (November 6, 2000 in Almaty) of the Joint Working Group of Experts, a preliminary list of trans-boundary rivers was agreed and a list of action measures was specified.

Mountain ecosystems

Undoubtedly, an important stage in the preservation of mountain ecosystems, is a project which proposes the strategy of «Regional Cooperation in the Area of Sustainable Development of Mountain Territories in Central Asia» (ABRD). Its key priority is facilitation and coordination of comprehensive research of mountain territories by monitoring.

The Bishkek Global Mountain Summit (BGMS) (Bishkek, October 29-November 1, 2002) became the principal outcome of the International Mountain Year, which attracted the international community's attention to the issues of mountain areas. The Bishkek Mountain Platform was adopted and a Central Asian Mountain Charter was signed. The *Central Asian Mountain Charter* was signed by the Ministers of Environmental Protection of Kazakhstan, Kyrgyzstan, and Tajikistan, containing the principles, goals and approaches on the management and utilization of mountain territories. It also contains an intention to draft a Central Asian Convention for the Preservation and Rational Utilization of Mountain Territories and the establishment of an International Negotiation Committee.

The basic provisions of these conventions are the development of provisions to the UN draft Resolution on the Sustainable Development of Mountain Territories, under which the UN and its agencies will develop policy approaches and programs in compliance with the goals and principles of the Platform. In the document, the "International Partnership for Sustainable Development of Mountain Territories" was supported and was adopted at the World Summit for Sustainable Development in Johannesburg, as well as the UN Food and Agriculture Organization's proposal to locate the Partnership Secretariat under its guidance. It is also proposed to create within the framework of the International Partnership a new *International Network of Developing Mountain Countries and Regions, as well as a Working Group for further discussions.* At a plenary discussion on this issue, the Regional Environmental Center of Central Asia noted it had established mechanisms and a procedure of cooperation with all interested countries, and expressed its interest in extensive participation in future partnership.

With support from the Asian Development Bank, the region's countries have developed a Central Asian Strategy for the Sustainable Development of Mountains. The Working Group set up, as well as the Regional Office in cooperation with the Regional Environmental Center (REC) of Central Asia, conduct activities to improve the

adaptable Strategy for all countries of the region. The necessity has been justified to create the Regional Mountain Center (RMC), its activities aimed at resolving specific issues of mountain territories.

It worth noting that the intended and implemented projects in this area - Preservation of Biodiversity of the Western Tien Shan (GEF) and Preservation and Sustainable Utilization of Biodiversity of the Altai-Sayan Mountain Ecoregion (GEF) - cover only a minor part of the existing issues of mountain ecosystem preservation.

Biodiversity conservation

A significant contribution to the well being of the natural wealth are made by implemented, ongoing and planned national/regional projects for biodiversity preservation and expansion of protected territories. Activities in this sphere include:

- Preservation of Biological Diversity of the Western Tien Shan- GEF;
- Preservation and Sustainable Development of Biodiversity of the Altai - Sayan Mountain Eco-region-GEF;
- In-situ Preservation of Mountain Agro-biodiversity in Kazakhstan-GEF;
- Comprehensive Preservation of Priority Water and Wetlands as Habitats of Migratory Birds, GEF;
- Preservation of Globally Significant Water and Wetlands and Migration Corridors Required for Cranes and Other Globally Significant Migratory Waterfowl in Asia-WWF;
- Development of an Eco-network for long-term conservation of CA ecosystems.

Cooperation of CAR countries in the area of international environmental conventions

The process of joining, ratifying and implementing the commitments under International Environmental Conventions (IECs) is accomplished by the CA and CIS countries on a bi-lateral basis with the Convention Secretariats. Each country possesses a sovereign right to determine the necessity of adopting conventions, which may result in benefits and/or expenses for the country.

Countries' joining IECs create a basis for unified methodological and regulatory approaches to the issue of the convention in the national context. International cooperation required by such activities is vital in integrating the convention commitments.

The intended preparation of the Convention for CA Sustainable Development/Mountain Convention, Framework Convention on Preserving the Ecosystem of the Caspian Sea region will be significantly based upon the provisions of many conventions.

It is obvious that certain specific roles are played by four Transboundary Conventions (UN, EEC, Basel and Rotterdam Conventions). However, the key implementation activities can be accomplished only by neighboring countries - for natural 'migration' of pollutants, as well as along transportation routes - during transportation and trade. National activities in these conventions are subordinate only as legal and organizational support of interstate activities. All conventions contain provisions on the possibility of joint representation of countries in the Conventions.

The right of joint representation is envisaged for «regional organizations for economic integration», which means not only the availability of relevant policy decisions, but also a high level of integration. An example of such joint representation was established by the EC resolution on a joint representation of the EC in the Kyoto Protocol.

It is clear that the integration level achieved within the framework of CAR, CIS Executive Committee or EAEC, is still far from delegating countries' authority to represent the countries in the conventions - particularly under conditions in which not all countries have joined the majority of conventions.

All conventions strongly recommend developing bilateral**,** multilateral and regional agreements to adjust the terms of conventions to specific geographic and environmental conditions.

Such conventions include territorial conventions of integrated approaches: the Convention on CA Sustainable Development; CA Mountain Convention, Framework Convention on Preserving the Ecosystem of the Caspian Sea Region; Convention of CIS Environmental Safety. The legal basis for these conventions will be comprised of IECs' provisions, and primarily those of UN and EEC trans-boundary conventions. (Annex 5, Table 6)

As a rule, programs and plans for an integrated approach to environmental protection and sustainable development make use of convention provisions and combine them. This in turn creates a methodological and legal basis for regional cooperation.

Issues to be addressed

The key future obstacle appears to be the fact that the countries of different sub-regions are members of different sets of conventions.

The process of joining conventions is rather prolonged and the countries have their own priorities in the sequence of joining. It is assumed that in the near future all the CAR countries will join the above conventions. Extensive joint activities and increased attention of the Convention Secretariats to the CA sub-region may accelerate the joining process.

Unwillingness to join certain conventions is a result of different government approaches to the benefits and costs of the commitments undertaken. Governments are more concerned about the financial commitments (e.g. fees to secretariats) and potentially unfavorable political and economic terms for the country.

Each country has its own set of costs and benefits due to commitments of various conventions. For example, Kazakhstan and Uzbekistan, located in the area of the Syrdarya and AmuDarya basins, benefit if all counties in the region join the "Helsinki Convention on Protection and Utilization of Transboundary Watercourses and International Lakes" than Kyrgyzstan and Tajikistan. In turn, the latter are more concerned about other countries joining the area of sustainable development of mountain ecosystems - particularly in resolving the issue of numerous mountain toxic and radioactive tailing pits, which present a threat to all countries of the region, but to a different extent.

A 'package' consideration by governments (costs and benefits) as a result of joining a convention can have a positive impact even in a narrow environmental context. It is obvious that the inclusion of economic, political, transportation and other issues into such a 'set' is expected to become an effective incentive.

Conclusions to Chapter 6

1. *Since independence, the Republic of Kazakhstan has received significant financial and technical assistance from the international donor community to assist in resolving environmental challenges. Kazakhstan's membership in the UN has facilitated joining different international conventions and agreements.*

2. *The global nature of environmental challenges existing in Kazakhstan cannot be resolved with state resources alone - it also requires continuous support from donors and international environmental organizations. This relates both to financial and technical aspects of cooperation. Kazakhstan must comply with its commitments of ratified conventions, which forms a long-term basis for gradual solution of environmental problems.*

3. *The key condition for resolving many continuing environmental problems is regional cooperation. Recently, inter-state relations have been established and regional strategies developed to manage environmental elements and joint environmental projects and programs are being developed. The importance of the current tasks related to the improvement of the environment of the region and the joint efforts of the Central Asia Region countries are met with understanding and support by international political, financial and environmental organizations.*

4. *The main challenge that minimizes solutions to environmental issues is the low efficiency of utilization of state and donor funds. There is an urgent necessity to prioritize environmental issues when developing and implementing state strategic plans in the sphere of economic development of the Central Asia countries.*

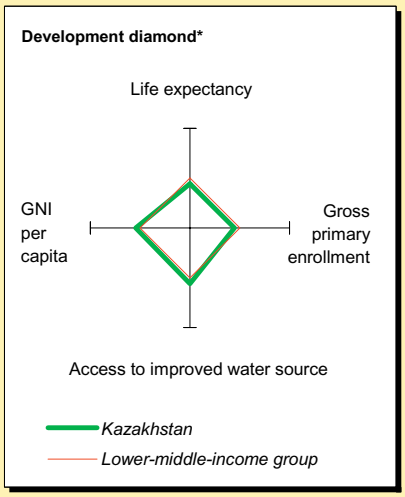
ANNEXES

ANNEX 1 Table 1

Kazakhstan at a glance

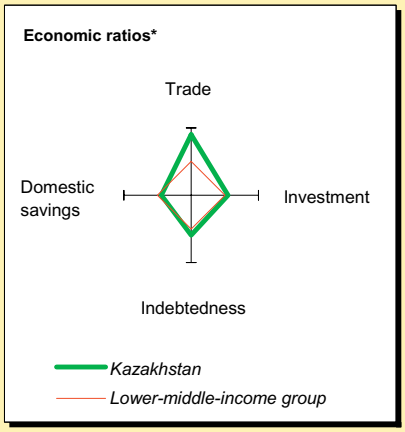
9/3/03

POVERTY and SOCIAL	Kazakhstan	Europe & Central Asia	Lower-middle-income
2002			
Population, mid-year *(millions)*	14.8	476	2,411
GNI per capita *(Atlas method, US$)*	1,510	2,160	1,390
GNI *(Atlas method, US$ billions)*	22.3	1,030	3,352
Average annual growth, 1996-02			
Population *(%)*	-1.2	0.1	1.0
Labor force *(%)*	-0.7	0.4	1.2
Most recent estimate (latest year available, 1996-02)			
Poverty *(% of population below national poverty line)*	38	..	..
Urban population *(% of total population)*	56	63	49
Life expectancy at birth *(years)*	62	69	69
Infant mortality *(per 1,000 live births)*	81	25	30
Child malnutrition *(% of children under 5)*	4	..	11
Access to an improved water source *(% of population)*	91	91	81
Illiteracy *(% of population age 15+)*	1	3	13
Gross primary enrollment *(% of school-age population)*	99	102	111
Male	99	103	111
Female	98	101	110

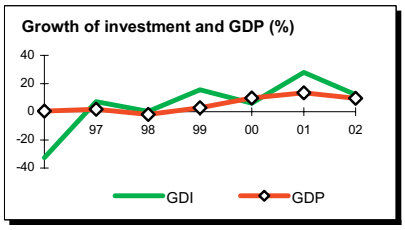


KEY ECONOMIC RATIOS and LONG-TERM TRENDS	1982	1992	2001	2002
GDP *(US$ billions)*	..	27.4	22.2	24.2
Gross domestic investment/GDP	..	31.5	26.1	26.9
Exports of goods and services/GDP	..	74.0	46.8	46.0
Gross domestic savings/GDP	..	30.2	23.7	23.5
Gross national savings/GDP	..	..	18.9	19.4
Current account balance/GDP	..	..	-5.6	-7.5
Interest payments/GDP	..	0.0	3.1	2.9
Total debt**/GDP	..	0.1	64.9	72.5
Total debt service/exports	..	0.0	31.1	36.7
Present value of debt/GDP	..	..	64.4	..
Present value of debt/exports	..	..	133.2	..

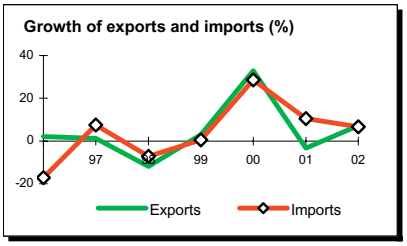
	1982-92	1992-02	2001	2002	2002-06
(average annual growth)					
GDP	..	0.4	13.5	9.5	5.9
GDP per capita	..	1.6	14.7	10.2	5.8
Exports of goods and services	..	1.5	-3.3	7.2	10.1



STRUCTURE of the ECONOMY	1982	1992	2001	2002
(% of GDP)				
Agriculture	..	26.7	9.0	8.5
Industry	..	44.6	38.8	43.4
Manufacturing	..	8.9	15.6	17.4
Services	..	28.7	52.3	48.1
Private consumption	..	51.6	59.7	63.9
General government consumption	..	18.2	16.6	12.6
Imports of goods and services	..	75.3	49.2	49.3



	1982-92	1992-02	2001	2002
(average annual growth)				
Agriculture	..	-5.6	16.9	-6.0
Industry	..	-1.2	15.1	10.7
Manufacturing	..	..	..	..
Services	..	3.0	10.8	8.6
Private consumption	..	-0.1	18.9	9.1
General government consumption	..	-1.4	19.6	10.3
Gross domestic investment	..	-5.1	28.0	12.1
Imports of goods and services	..	-2.7	10.5	6.7



Note: 2002 data are preliminary estimates.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

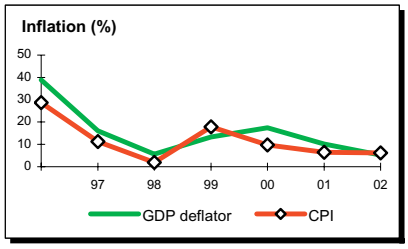
** Includes intra-company loans.

ANNEX 1 Table 1 (continue)

Kazakhstan

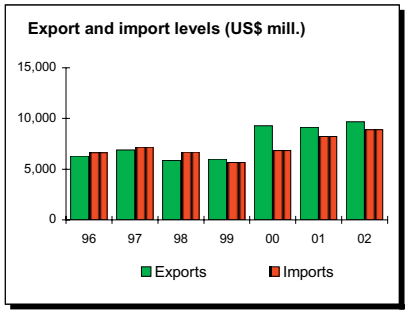
PRICES and GOVERNMENT FINANCE

	1982	1992	2001	2002
Domestic prices				
(% change)				
Consumer prices	..	2,960.8	6.4	6.2
Implicit GDP deflator	..	1,472.2	10.2	5.3
Government finance				
(% of GDP, includes current grants)				
Current revenue	..	..	21.8	22.5
Current budget balance	..	..	2.3	3.2
Overall surplus/deficit	..	..	-0.9	-0.2



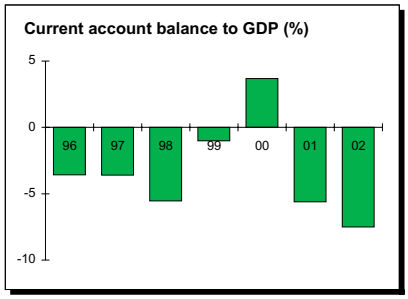
TRADE

	1982	1992	2001	2002
(US$ millions)				
Total exports (fob)	..	..	9,120	9,676
Fuel and oil products	..	..	4,733	5,038
Ferrous metals	..	..	1,009	..
Manufactures	..	..	1,508	1,618
Total imports (cif)	..	..	8,224	8,886
Food	..	..	836	..
Fuel and energy	..	..	790	..
Capital goods	..	..	2,837	3,125
Export price index *(1995=100)*	..	..	..	..
Import price index *(1995=100)*	..	..	..	..
Terms of trade *(1995=100)*	..	..	..	..



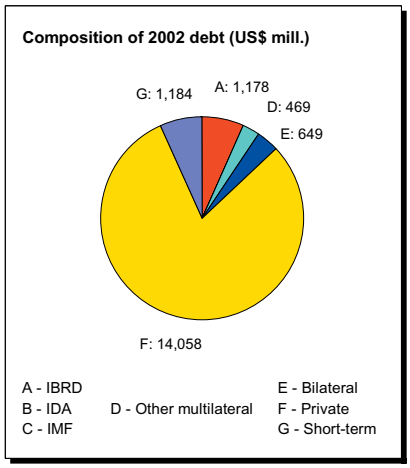
BALANCE of PAYMENTS

	1982	1992	2001	2002
(US$ millions)				
Exports of goods and services	..	5,758	10,393	11,129
Imports of goods and services	..	5,862	11,077	11,938
Resource balance	..	-104	-684	-809
Net income	..	-175	-1,215	-1,200
Net current transfers	..	168	232	190
Current account balance	..	..	-1,240	-1,818
Financing items (net)	..	..	1,625	2,089
Changes in net reserves	..	589	-384	-270
Memo:				
Reserves including gold *(US$ millions)*	..	..	2,508	3,136
Conversion rate *(DEC, local/US$)*	..	8.80E-2	146.7	154.8



EXTERNAL DEBT and RESOURCE FLOWS

	1982	1992	2001	2002
(US$ millions)				
Total debt outstanding and disbursed	..	35	14,372	17,538
IBRD	..	0	1,070	1,178
IDA	..	0	0	0
Total debt service	..	0	3,331	4,115
IBRD	..	0	101	107
IDA	..	0	0	0
Composition of net resource flows				
Official grants	..	3	28	..
Official creditors	..	10	34	20
Private creditors	..	17	2,128	1,809
Foreign direct investment	..	100	2,763	..
Portfolio equity	..	0	55	..
World Bank program				
Commitments	..	0	65	0
Disbursements	..	0	114	92
Principal repayments	..	0	47	56
Net flows	..	0	67	36
Interest payments	..	0	53	51
Net transfers	..	0	13	-15



The World Bank Group: This table was prepared by country unit staff; figures may differ from other World Bank published data. 9/3/03

Table 2. Republic of Kazakhstan — Key Economic Indicators, 1997-2002

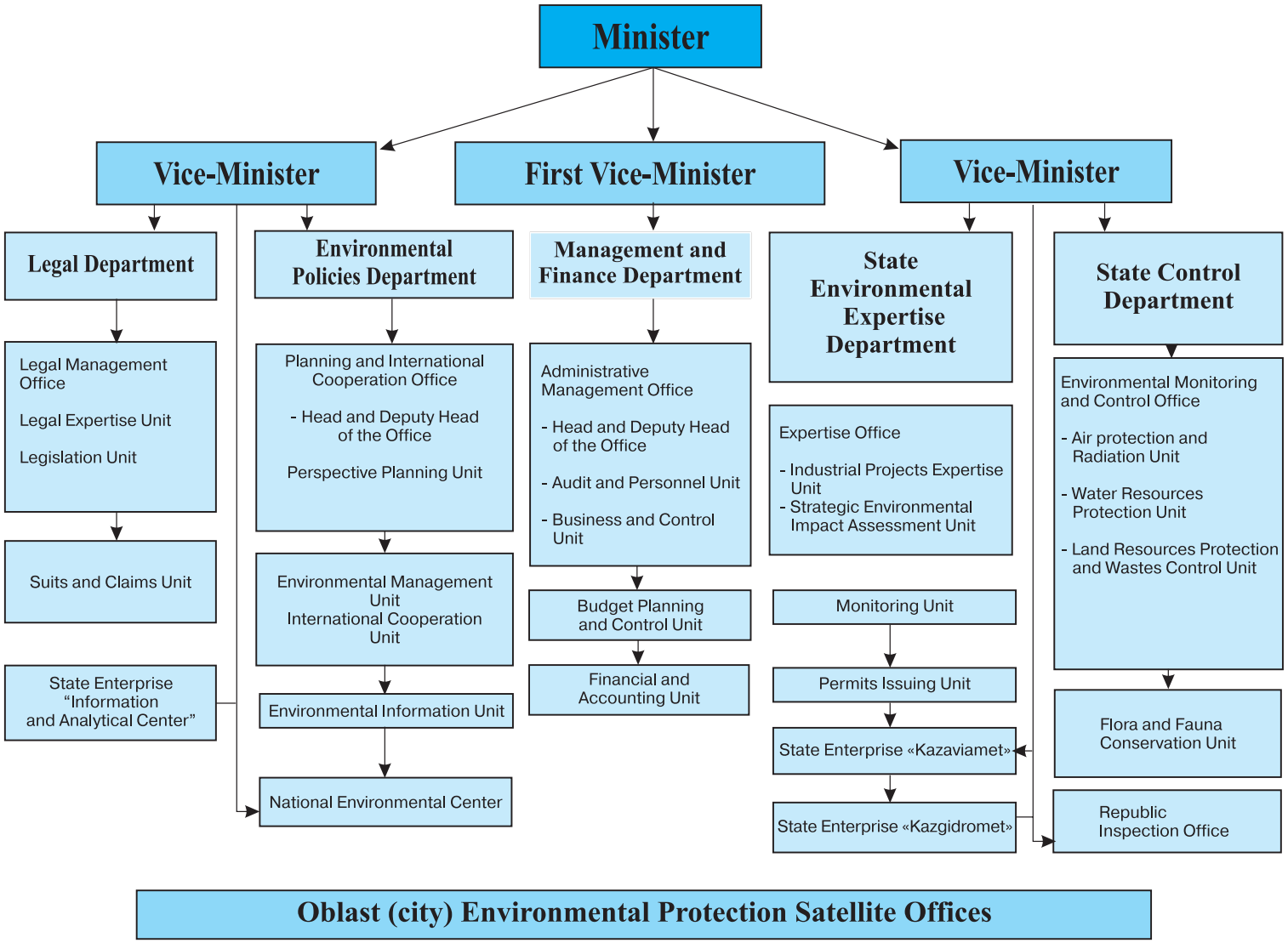
	1997	1998	1999	2000	2001	2002
						Preliminary
National accounts (as % of GDP)						
Gross domestic product'[1]	100	100	100	100	100	100
Agriculture	11	9	10	8	9	8
Industry	21	24	28	33	31	29
o.w. Oil sector'	5	6	10	13	13	16
Services	67	67	62	59	61	63
Total consumption	87	89	89	79	76	71
Gross domestic fixed investment	17	17	17	18	25	24
Government investment	2	3	2	1	2	3
Other investment	15	14	16	17	24	21
Exports (GNFS)[c]	37	32	45	61	51	52
Imports (GNFS)	39	37	43	52	52	51
Gross domestic savings	14	12	21	28	28	29
Gross national savings'[1]	13	11	19	22	23	25
Memorandum items:						
Gross domestic product (US$ billion)	22.2	22.1	16.9	18.2	21.1	24.2
GNI per capita (US$, Atlas method)	1270	1350	1260	1250	1350	1520
GDP at market prices, real growth rate (%)	1.7	-1.9	2.7	9.8	13.5	9.5
o.w. Oil sector[1']			18.9	26.3	23.5	19.4
o.w. Non-oil sector			1.6	8.0	12.0	8.1
Unemployment rate, %	13	13	14	13	10	9
Average monthly wage, USS	113	124	99	101	US	133
Avg monthly pension, USS	47	54	36	31	34	38
Balance of payments (USS billion)						
Exports (GNFS)[0]	7.7	6.8	6.9	10.4	10.2	11.7
Merchandise FOB	6.9	5.9	6.0	9.3	8.9	10.1
Fuel and oil products	2.2	2.1	2.3	4.8	4.8	5.6
Ferrous metals	1.0	0.8	0.9	1.2	1.0	1.1
Grain and cotton	0.6	0.4	0.4	0.6	0.4	0.5
Imports (GNFS)	8.3	7.8	6.7	8.9	10.4	11.4
Merchandise FOB	7.2	6.7	5.6	6.8	7.6	7.6
Resource balance	-0.6	-1.1	0.2	1.6	-0.2	0.3
Net current transfers	0.1	0.1	0.2	0.2	0.2	0.1
Current account balance	-0.8	-1.2	-0.2	0.7	-1.1	-0.6
Net private foreign direct investment	1.3	1.1	1.5	1.3	2.8	2Л
Long-term loans (net)	0.8	0.7	0.2	-0.1	0.5	0.8
Other capital (net, incl. errors & omissions)	-0.8	-0.8	-1.4	-1.4	-0.3	-0.5
Change in reserves[6]	-0.5	0.3	-0.1	-0.1	-0.4	-0.5
Memorandum items:						
Resource balance (% of GDP)	-2.5	-4.8	1.0	8.6	-0.9	1.1
Current account balance (% of GDP)	-3.6	-5.6	-1.4	3.7	-4.9	-2.4
Net foreign direct investment (% of GDP)	6.0	5.2	8.7	7.0	12.6	s.s
Public finance (as % of GDP at market prices)'						
Current revenues	20.7	17.9	17.7	21.6	24.3	22.3
Current expenditures	25.0	22.8	20.3	20.3	19.5	17.7
Capital expenditure	1.8	2.2	1.6	1.8	2.8	3.4
Current account surplus (+) or deficit (-)	-4.3	-4.9	-2.6	1.3	4.8	4.6
Overall account surplus (+) or deficit (-)	-7.1	-8.0	-5.2	-1.0	1.8	1.4
Memorandum items:						
Education expenditures (% of GDP)	4.4	4.1	3.9	3.3	3.3	3.2
Health expenditures (% of GDP)	2.8	2.1	2.2	2.1	1.9	1.9
Social expenditures (% of GDP)	10.1	9.6	7.9	6.6	5.7	5.4
Financial indicators						
M3/GDP	10.3	8.6	13.6	15.3	17.7	20.4
Pension Funds (accumulations), % GDP		1.4	3.2	4.3	5.6	7.2
Price indices						
Real exchange rate (USS/LCU)[8]	90.1	88.7	126.8	137.5	134.7	135.0
Consumer price index (% change)	11.2	1.9	17.8	9.8	6.4	6.6
GDP deflator (% change)		1.0	1.1	1.3	1.5	1.5

a. GDP at factor cost
b. Includes an estimate of oil activities in mining, manufacturing, construction, and transport.
c. «GNFS» denotes «goods and non-factor services».
d. Includes net unrequited transfers excluding official capital grants.
e. Includes use of IMF resources.
f. General government, including the National Fund.
g. «LCU» denotes «local currency units». An increase in USS/LCU denotes appreciation.

ANNEX 1

Figure 1.

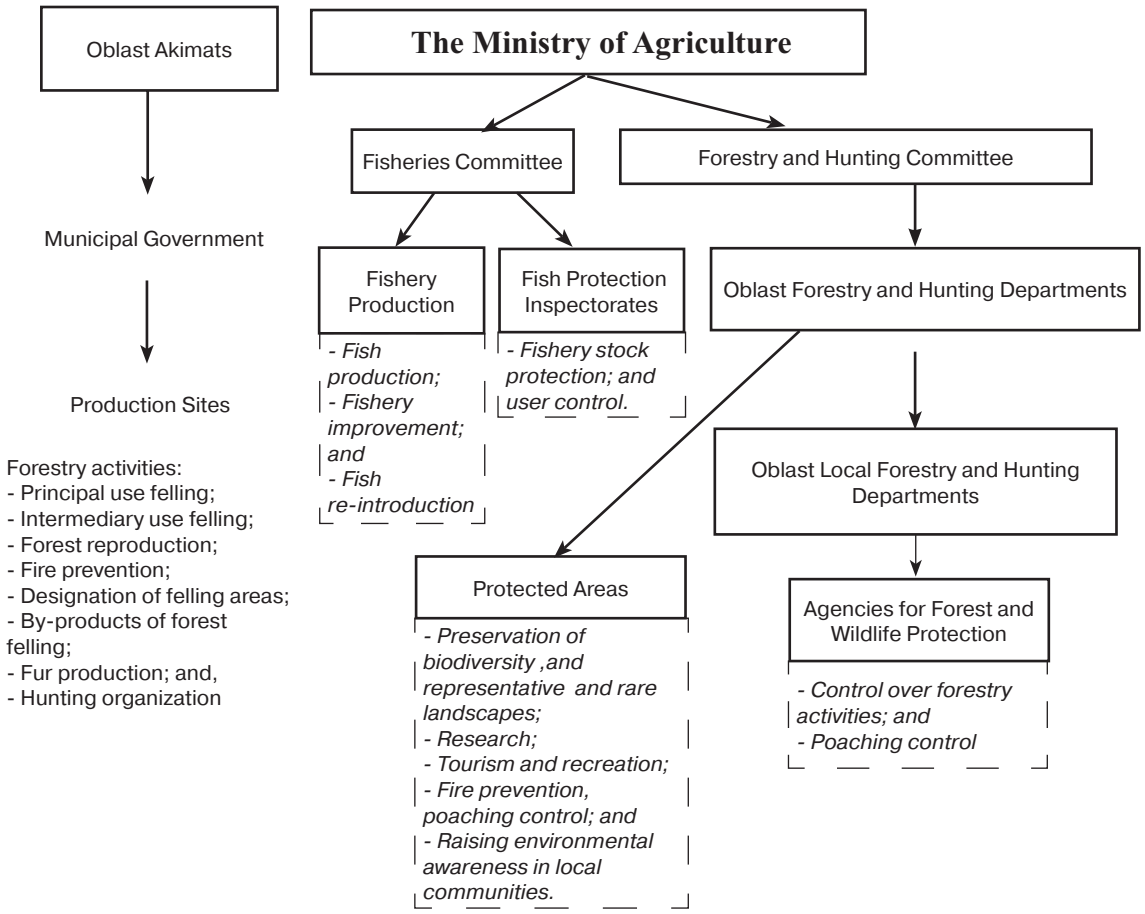
Structure of the Ministry of Environmental Protection



ANNEX 1

Figure 2.

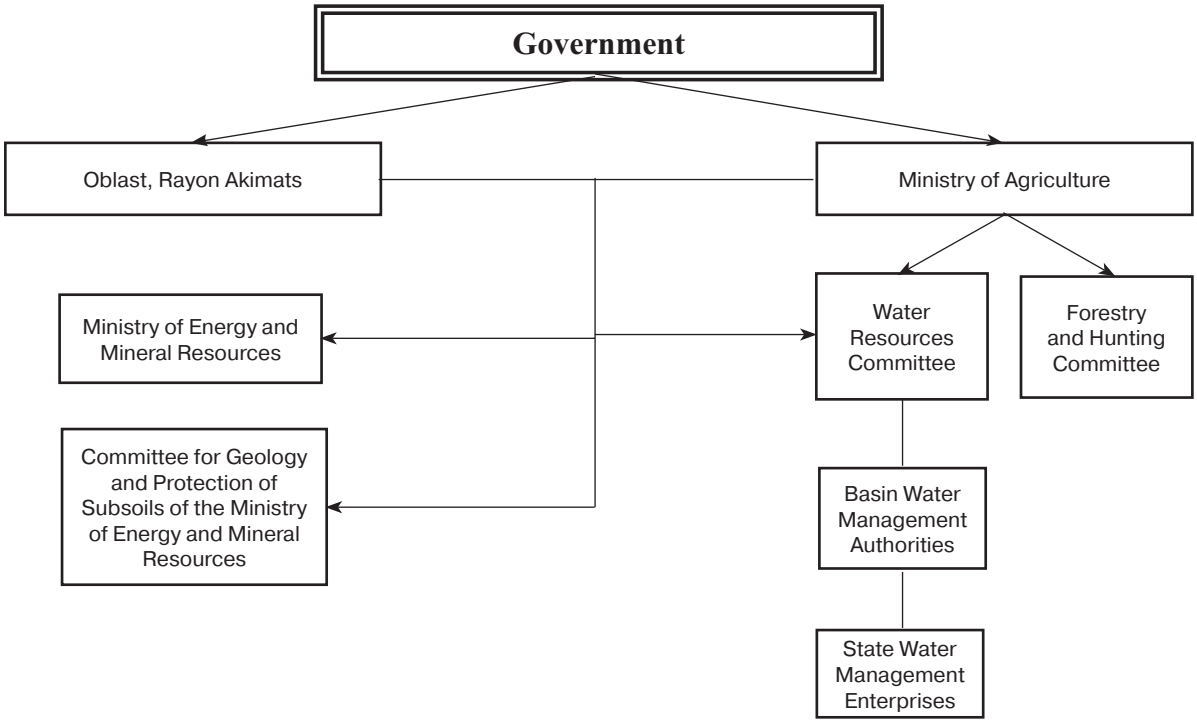
Biological Resources and SPA Management Structure



ANNEX 1

Figure 3.

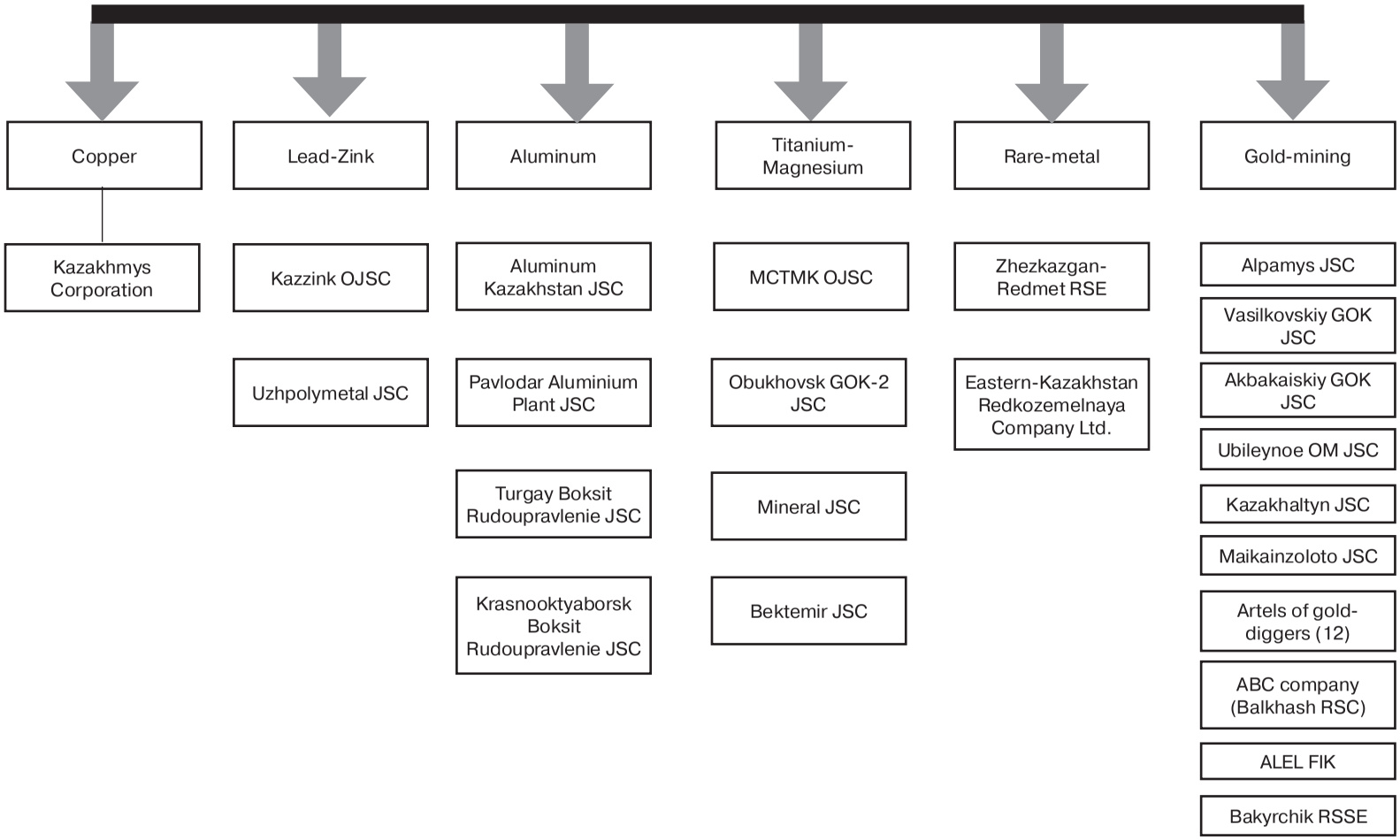
Water Resources Management Structure



ANNEX 2

Figure 1

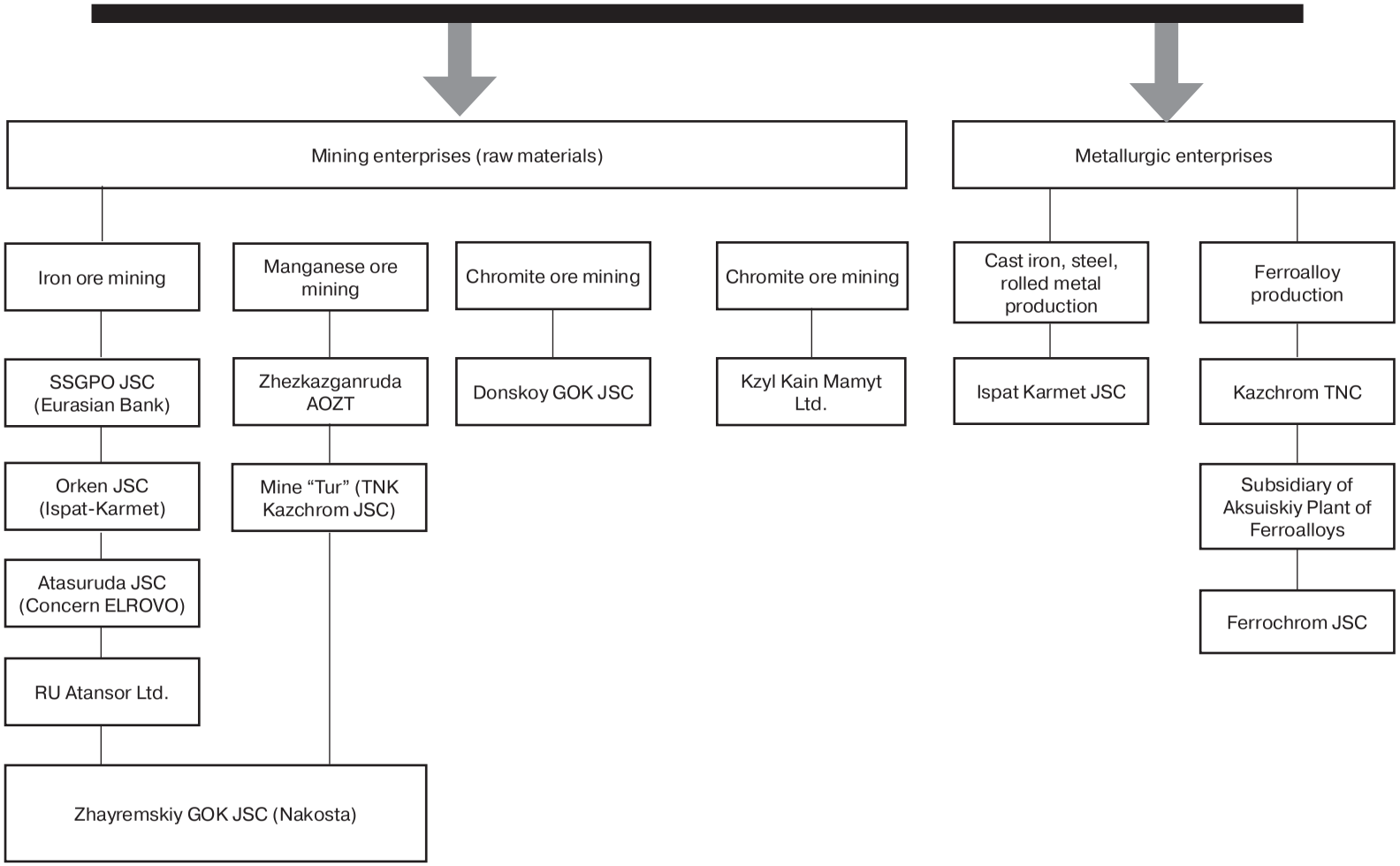
ENTERPRISES OF THE NON-FERROUS METALLURGY OF KAZAKHSTAN



ANNEX 2

Figure 2

ENTERPRISES OF THE FERROUS METALLURGY OF KAZAKHSTAN



ANNEX 2

Table 1.

Location of Industrial Wastes in Kazakhstan, 2001

Type	Class of hazard	Limited volume (tons)	**Actual for 10 months of 2001**
Waste products I class, total	1	77,744	0,255
including:			
Aldacide-G	1	2,304	-
Hydrate of potassium	1	3,186	-
Hydrochloric acid (ИСТ)	1	62,820	-
Fluorescent tubes	1	0,340	0,03
Other waste products of class 1	1	9,095	0,225
Waste products of class 2, total	2	45,377	1,4114
including:			
Lead batteries	2	4,980	0,8027
Medical waste products	2	0,532	-
Chilly warhead batteries	2	2,490	
Lithium batteries	2	0,373	0,0007
Utilized fuel cans	2	3,327	0,208
Puncheons from under chemicals	2	6,790	0,4
Other 2nd class waste	2	26,884	-
Waste products of 3rd class, total	3	26195,964	5881,4
including:			
Solid wastes, total	3	*4587,211*	*1415,43*
Including:			
Waste contaminated by oil products	3	22,09	2,9
Remains of the varnish-and-paint materials	3	3,40	0,117
Steel drums after cleaning from chemicals of class 3 hazard	3	36,25	0,06
Remains of packages from chemicals of class 3 hazard	3	29,08	-
Ashes from the waste incineration units	3	130,95	20,051
Remains of class 3 hazardous chemicals	3	12,00	-
Cleaned saline drilling sludge	3	4372,00	1392,3
Liquid waste, total	3	*21554,2*	*4466*
Including:			
Water containing fuel oil	3	9588,00	3617
Restored oil for preparation of the drilling mud	3	3138,90	849
Sludge waters	3	8763,29	-
Waste oil	3	65,30	-
Other wastes of the 3rd class	3	54,57	-
Wastes of the 4th class, total	4	31424,9	6050,6
Including:			
Solid wastes, total	4	*31424,89*	*6050,6*
Including:			
Scrap metal	4	1213,71	36,0
Empty oil barrels for preparation of the drilling mud and chemicals of the 4th class hazard (after cleansing) danger (after cleaning)	4	116,75	1,9
Deactivated sediment	4	207,00	-
Lumber	4	58,92	-

Source: Ministry of Environmental Protection, 2002

ANNEX 2

Table 2.

Anthropogenic Factors of Desertification

Types of desertification	Activity that causes the given type of desertification	Areas of appearance and consequences
Technological disturbance of lands	Construction of housing, industrial construction, exploration and development of subsoil reserves, drilling, laying of electric power lines and pipelines, storage of industrial and household waste, fuel oil contamination Military and missile test sites	Everywhere. In total, not less than 10% of the country's entire territory. The area of the technological land disturbance by construction work and mining operations amounted to 181.3 thousand hectares
Salinization of land	Not following the proper moisture-loving crop cultivation technology Activity of industrial and public utility enterprises that use sewage tanks	Water-meadows, river valleys. Industrial complexes, city settling tanks (sumps), places of development and processing of mineral resources
Water and wind erosion of soil, dehumification	Violation of the soil cultivation and cropping technologies. Ploughing of hill slopes. Felling of wind-breaks (shelter belts). Felling of mountain coniferous woods and fruit trees. Terracing of slopes, construction of roads and other structures at foothills.	Cultivated lands exposed to wash-out and wind-erosion (regions of mountains and foothills, steppe and semi-desert regions). 18 million hectares of agricultural land are exposed to wind erosion. The following areas are exposed to water erosion: Steppes (11.9 million hectares); Deserts (3.5 million hectares); Mountains (3.5 million hectares) Dehumification : 11.2 million hectares of non-irrigated areas and 0.7 million hectares of irrigated areas
Chemical pollution of soils, underground and surface water	Activity of the industrial enterprises and utilities that use sewage tanks; storage of industrial and household waste, test sites, dumps, residual quantities of insecticides, transport, oil-refining, ore mining and processing, metallurgic, chemical enterprises, obsolete technological processes, energy complex.	Everywhere. In a number of cases it takes a transboundary polluting character.
Unsustainable hydrological regime of rivers and lakes (stream conditions)	Construction of dams to regulate water supply for agricultural, utility, industrial and energy enterprises. Partial diverting of watercourse for economic needs Felling of mountain and flood-plain forests. Plough of lands up to the borders of lakes and natural reservoirs. Burning out (searing) and etching by animals of shore vegetation.	Rivers, lakes, natural currents, river valleys, riverside and near-water ecosystems, flooded meadows and pastures. Pastures–total 182,6 million hectares Desertified over 79 million hectares; hayfields – 3,3 million hectares lost since 1970; woods – at least 10% lost since 1990

ANNEX 2

Table 3.

Conditions of Natural Pastures, ha

Oblast	Area of pastures	Radical improvement	Conditions of Natural Pastures						
			Clean	Covered with hummocks	Covered with bushes	Covered with forests	With rocks	Extent of forests	Overgrazed
Akmola	6,875.1	1,075.6	1,559.5	111.8	227.5	18.0	1,271.1	593.3	2,018.3
Aktyubinsk	24,848.7		18,447.7	37.3	949.6	137.9	0.3	1,369.6	3,906.3
Almaty	14,472.6	94.4	7,829.4	142.9	1,901.1	695.3	468.1	327.8	3,013.6
Atyrau	9,091.6	0.5	4,506.9	2.5	281.8			93.9	4,206.0
East-Kazakhstan	19,571.1		11,710.5	140.9	4,651.8	130.1	1,566.9	912.4	458.5
Zhambyl	9,418.5	179.7	5,596.8	0.2	1,812.2	460.9	101.5		1,267.2
West-Kazakhstan	11,033.7	61.4	6,919.0	42.2	359.8	2.4		704.6	2,944.3
Karaganda	33,254.9	831.6	24,258.5	359.8	3,719.9	147.8	628.9	2,255.1	1,053.3
Kyzyl-Orda	11,868.4		6,510.1	29.9	2,272.8	894.5		9.4	2,151.7
Kostanay	12,082.1	1,094.2	8,070.9	347.5	825.1	1.2	34.9	310.2	1,398.1
Mangistau	12,696.2		9,767.8	133.5	772.9	200.4	77.3	8.4	1,735.9
Pavlodar	8,085.6	718.8	4,967.1	47.9	418.4	1.0	243.0	1,057.2	632.2
North-Kazakhstan	3,523.5	610.5	2,077.9	39.6	63.7	25.1	235.8	2.9	468.0
South-Kazakhstan	9,071.7	179.8	5,058.5	0.1	1,553.6	908.8	20.5	10.5	1,339.9
Astana city	24.3	6.5	14.8		0.2		0.1	0.3	2.4
Almaty city	0.8				0.7		0.1		
Total	185,918.8	4,853.0	117,295.4	1,436.1	19,811.1	3,623.4	4,648.6	7,655.6	26,595.7

Source: GosNPTsZEM, 2001

ANNEX 2

Table 4.

Hayfields' amelioration condition by nature zones, '000 ha

Natural zones	Area of hayfields	Radical improvement	Hayfields' amelioration condition taken by nature zones				
			With bushes	clean	with pestilent plants	forest covered-	Covered with hummocks
Plains							
Forest-steppe and steppe zones	1483.1	29.6	1354.0	44.6	2.6	3.6	48.7
Semi desert zones	971.8	9.0	931.7	0.5	17.8		12,8
Desert zones	790.2		736.0	14.5	0.1	27.3	12,3
Small hills	581.3	2.8	544.2	9.6	0.5		24,2
Foothill plains	798.0	5.5	718.1	31.8	1.7	27.2	13,7
Mountains							
Low and mid level mountains	395.9	15.4	322.0	29.1	3.4	8.0	18,0
High mountains	6.9		6.9				
Total»	5027.2	62.3	4612.9	130.1	7.8	84.4	129,7

Source: GosNPTsZEM, 2001

ANNEX 2.

Table 5.

Air Pollution in Major Cities of Kazakhstan, 2000

City	API	Name of the admixtures exceeding MPC	Average concentration		Maximum concentration	
			mg/m^3	MPC exceeding times	mg/m^3	MPC exceeding times
Aktau	4.6	Dust Nitrogen dioxide	0.4 0.05	2.7 1.2	2.2 0.12	4.4 1.4
Aktobe	10.0	Nitrogen dioxide Formaldehyde	0.05 0.014	1.2 4.7	0.12 0.024	1.4 -
Almaty	9.9	Dust Carbon oxide Nitrogen dioxide Phenol Formaldehyde	0.3 2.0 0.06 0.002 0.011	1.3 - 1.5 - 3.7	1.3 26 0.24 0.018 0.059	2.6 5.2 2.8 1.8 1.7
Astana	2.7	Nitrogen dioxide Anhydrous hydrogen fluoride	0.02 0.007	- 1.4	0.19 0.082	2.2 4.1
Atyrau	2.5	Dust Nitrogen dioxide	0.3 0.02	2.0 -	1.5 0.15	3.0 1.8
Balkhash	3.3	Dust Sulfur dioxide Nitrogen dioxide	0.02 0.056 0.04	1.3 1.1 1.0	1.0 1.658 0.81	2.0 3.3 9.5
Zhezkazgan	7.5	Dust Nitrogen dioxide Phenol	0.7 0.03 0.004	4.7 - 1.3	3.2 0.17 0.021	6.4 2.0 2.1
Karaganda	4.6	Dust Carbon oxide Nitrogen dioxide Phenol Formaldehyde	0.1 1.0 0.03 0.002 0.006	- - - - 2.0	1.1 11 0.39 0.055 0.048	2.2 2.2 4.6 5.5 1.4
Kostanay	2.9	Carbon oxide Nitrogen dioxide	2 0.05	- 1.2	9 0.13	1.8 1.5
Leninogorsk	10.0	Sulfur dioxide Nitrogen dioxide Phenol	0.091 0.07 0.01	1.8 1.8 3.3	0.215 0.22 0.02	- 2.6 2.0
Pavlodar	2.3	Dust Carbon oxide Nitrogen dioxide Hydrogen sulphide Phenol Hydrogen chloride	0.1 1.0 0.02 0.001 0.001 0.06	- - - - - -	1.6 21 0.26 0.016 0.020 0.99	3.2 4.2 3.1 2.0 2.0 5.0
Petropavlovsk	6.8	Carbon oxide Nitrogen dioxide Phenol Formaldehyde	2.0 0.05 0.004 0.006	- 1.2 1.3 2.0	28 0.27 0.018 0.024	5.6 3.2 1.8 -

Semipalatinsk	4.0	Dust Carbon oxide Nitrogen dioxide	0.3 3.0 0.04	2.0 1.0 1.0	1.2 8.0 0.19	2.4 1.6 2.2
Taraz	7.8	Carbon oxide Nitrogen dioxide Ammonia Formaldehyde	2.0 0.05 0.02 0.01	- 1.2 - 3.3	13 0.17 0.22 0.061	2.8 2.0 1.1 1.7
Temirtau	6.9	Dust Nitrogen dioxide Hydrogen sulphide Phenol Ammonia	0.2 0.02 0.002 0.008 0.08	1.2 - - 2.7 2.0	1.1 0.40 0.037 0.047 0.46	2.2 4.7 4.6 4.7 2.3
Ust-Kamenogorsk	17.8	Dust Sulfur dioxide Carbon oxide Nitrogen dioxide Phenol Chlorine Formaldehyde	0.2 0.172 2.0 0.08 0.014 0.02 0.008	1.3 3.4 - 2.0 4.6 - 2.7	2.4 3.172 19.0 0.42 0.049 0.13 0.033	4.8 6.3 3.8 4.9 4.9 1.3 -
Uralsk	1.4	Nitrogen dioxide	0.04	1.0	0.15	1.8
Shymkent	10.0	Dust Carbon oxide Nitrogen dioxide Hydrogen sulphide Ammonium Formaldehyde	0.4 4.0 0.04 0.002 0.03 0.009	2.7 1.3 1.0 - - 3.0	1.7 18.0 0.40 0.012 0.33 0.069	16.0 12.0 8.0 0.9 0.1 0.7
Ekibastuz	1.7	Carbon oxide Nitrogen dioxide	2.0 0.03	- -	9.0 0.11	1.8 1.3

Source: Center for Environment Pollution Monitoring, State Enterprise “Kazgidromet”, Almaty, 2001, 2002

ANNEX 2.

Table 6.

Kazakhstan Major Cities and Levels of Air Pollution

City	API_5			Branches of the industry, significantly impacting the atmospheric air pollution leve
	1997	2000	2001	
Ust-Kamenogorsk	14.3	17.8	14.2	Non-ferrous metallurgy, power engineering
Shymkent	6.9	10.0	11.8	Non-ferrous metallurgy, chemical, oil-refining sectors
Aktobe	12.8	10.0	8.5	Ferrous and chemical metallurgies
Leninogorsk	9.2	10.0	10.3	Non-ferrous metallurgy, power engineering
Almaty	11.6	9.9	10.2	Power engineering, motor transport
Taraz	6.6	7.8	8.5	Chemical
Zhezkazgan	4.4	7.5	7.9	Non-ferrous metallurgy, power engineering
Petropavlovks	5.7	6.8	7.8	Power engineering, instrument-making
Karaganda	1.3*	4.6	6.7	Power engineering, coal-mining, motor transport sectors
Aktau	6.6	4.6	5.1	Chemical industry
Semipalatinsk	5.5	4.0	4.6	Power engineering, building materials
Balkhash	3.0	3.3	4.4	Non-ferrous metallurgy, power engineering
Kostanai	3.8	2.9	3.3	Power engineering
Astana	1.5	2.7	3.2	Power engineering, motor transport
Atyrau	2.7	2.5	2.7	Oil-refining branch
Pavlodar	2.3	2.3	2.2	Oil-refining, power engineering
Ekibastuz	1.1	1.7	1.8	Power engineering, coal-mining
Uralsk	2.2	1.4	1.4	Power engineering
Average in the country	5.78	6.14	1.3	

*- The content of formaldehyde in the air was not examined in 1997 in Karaganda, but it renders a significant impact on API

Source: Center for Environment Pollution Monitoring, State Enterprise “Kazgidromet”, Almaty, 2001, 2002

ANNEX 2.

Table 7.

Impact of Cities and Industrial Centers on Pollution Levels of Surface Water Resources

Monitoring Unit Location	Water pollution index		Water quality characteristics
	1999	2000	
riv. Ural, Atyrau city	1.01	0.73	2 class, clean
riv. Irtysh, Ust-Kamenogorsk city	1.02	1.61	3 class, mod. polluted
riv. Buhtarma, Zyryanovsk city	0.94	1.5	3 class, mod. polluted
riv. Ulba, Tishinskiy mine	8.61	4.41	5 class, muddy
riv. Ulba, Ust-Kamenogorsk city	1.39	2.34	3 class, mod. polluted
riv. Tihaya, Leninogorsk city	8.12	6.21	6 class, very muddy
riv. Breksa, Leninogorsk city	10.1	7.13	6 class, very muddy
riv. Glubochanka, Belousovka village	2.75	4.38	5 class, muddy
riv. Glubochanka, Glubokoe village	3.79	4.88	5 class, muddy
riv. Krasnoyarka, Predgornoe village	12.2	8.25	6 class, very muddy
riv. Irtysh, Pavlodar city	-	1.04	3 class, mod. polluted
riv. Ilek, Alga	11.65	5.14	5 class, muddy
riv. Ilek, Aktyubinsk	7.42	3.75	4 class, muddy
riv. Ishim, Petropavlovsk: 0,2 km above the city 4,8 km below the city	0.67 0.69	0.81 0.81	2 class, clean 2 class, clean
riv. Ishym, Astana city: 3 km above the city within the city 8 km below the city	0.70 1.01 1.03	0.77 1.04 1.37	2 class, clean 3 class, mod. polluted 3 class, mod. polluted
riv. Nura, Temirtau	2.12	3.69	4 class, muddy
riv. Kara-Kengir, Zhezkazgan city	-	6.89	6 class, very muddy
lake Balhash, Buhta Bertis	4.64	7.21	6 class, very muddy
lake Balhash, Maliy Sary-Shagan bay	2.85	4.43	5 class, muddy
riv. Malaya Almatinka, Almaty city	2.49	1.78	3 class, mod. polluted
riv. Talas, Taraz city	0.68	1.10	3 class, mod. polluted
riv. Badam, Shimkent city	2.7	2.61	4 class, muddy
riv. Syrdaria, Shardarinskoe reservoir, Shardara city	2.44	2. 81	4 class, muddy

Source: Center for Environment Pollution Monitoring, State Enterprise “Kazgidromet”, Almaty, 2002

ANNEX 3.

Table 1.

Endangered Vegetative Groups

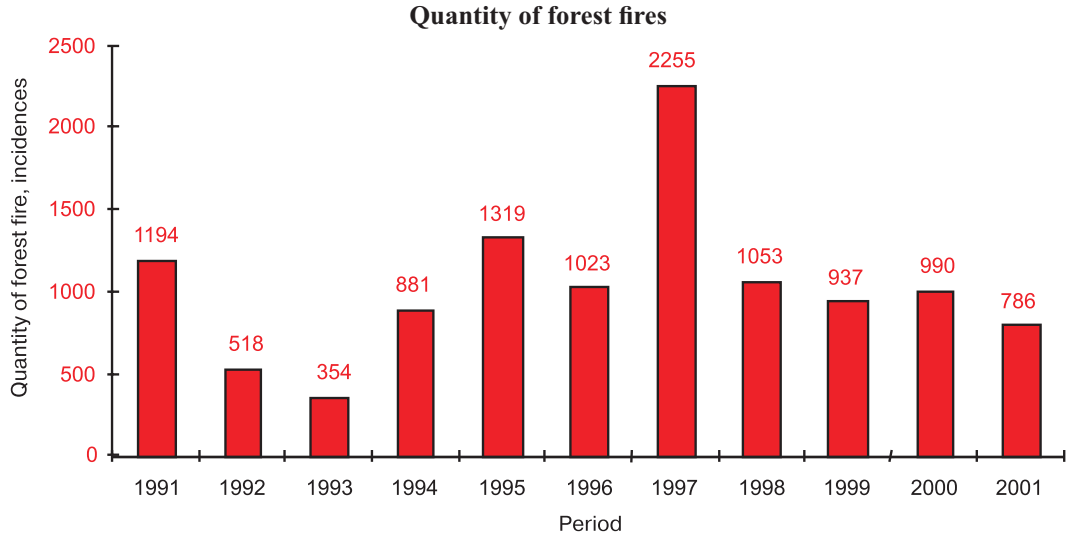
Forests			
№	**Name**	**Content**	**Areas of sprouting**
1	Apple	Malus sieversii u M.kirghisorum	Tarbagatai, Northern Dzhungar Alatau, Central part of Zailiski Alatau
2	Apricot	Armeniaca vulgaris	Zailiski Alatau, Western Tian Shan, southern slopes of Dzhungar Alatau, central part of Zailiski and Western part of Kirgiz Alatau
3	Maple	Acer semenovii	Zailiski, Dzhungar, Kirgiz Alatau, Ketmen-Tau, Western Tian Shan
4	Celtis Caucasian	Celtis caucasica	South macro slopes of Dzhungar Alatau (Chulak mountains), central and western parts of Zailiski Alatau, Kirgiz Alatau
5	Central Asian juniper	Juniperus seravschanica	Western Tian Shan, southern part of Karatau
6	Pistachios	Pistacia vera	Kirgiz Alatau, Karatau
7	Turgan	Populus diversifolia	Syr Darya, Ili
8	Oak	Quercus robur	Flood bed of Ural river
9	Poplar	Populus alba+P.nigra	Flood bed of Irtysh river, Ural river
10	Ash-tree	Fraxinus sogdiana	Flood bed of Charyn river, Boraldai
Plain Steppes			
11	Forb red feather grass	*comm. Stipa zalesskii+ Peucedanum morisonii + Salvia stepposa + Veronica spuria + Filipendula hexapetala*	Kokchetav hills, North Kazakhstan
12	Forb oats	*comm. Helictotrichon desertorum + Onosma simpicissima + Veronica incana + Astragalus kasahstanicus*	Kokchetav hills, Eastern part of Central Kazakhstan low hills
13	Forb grass and forb sedgy	*comm. Carex pediformis + Helictotrichon desertorum + Oxytropis chionobøa + Androsace ovczinnikovii(+ Amblynotus rupestris*	low mountains of Kent city, Kysil rai city
14	Forb korzhinski feather grass	*(+Galatella angustissima + Pedicularis physocalyx comm. Stipa korshinskyi*	
15	Xerophitic forb	comm. Stipa lessingiana + Festuca valesica + Galatella tatarica	Turgai plateau, Ishym area
16	Peatree cold vermouth	*comm. Stipa capillata + Artemisia frigida + Caragana pumila*),	Eastern Central Kazakhstan low hills
17	Psammophytic forb sandy feather grass	comm. Stipa pennata + Gypsophyla paniculata + Achillea gerberi + Helichryzum arenarium	Turgai hollow, Irtysh area
Mountainous Deserts			
18	Grassland dry steppe	comm. Stipa orientalis+ S. capillata, S. Lessingiana+ S. kirghisorum+ Bothriochloa ischaemum+ Poa stepposa+ Koeleria cristata	Altai, Tarbagatai, Dzhungar Alatau, Northern Tian Shan

Steppe			
19	Saxaul bushes taxon	*comm.Haloxylon aphyllum* + *Carex physodes* + *Cousinia mollis; ñomm. H. aphyllum* + *Salsola lanata* + *S. brachiata*	South Kyzylkum
20	Rich ephemeroid piedmont	Santonica (*ñomm. Artemisia cina* + *Ephemeretum*	Piedmont plumes of western Tian Shan
21	Forb ephemeroid piedmont	comm. Ephemeretum + Phlomis + Psoralea drupacea + Alhagi pseudalhagi	Piedmont plumes of western Tian Shan
22	Salsola laricifolia	comm. Salsola laricifolia	Dzhungar Gates
23	Spireantus taxon	ñomm.Spiraeanthus schrenkianus	Betpak-Dala, Karatau
24	Ephedra taxon	comm. Ephedra stobilaceae; comm. E. Przewalskii	Kyzylkums, Dzhungar Gates, Ili hollow
25	Ephedra endemic	*comm. Ephedra lomatolepis*	Taukums
26	Zaisan saxaul bushes taxon	(*Haloxylon ammodendron*) with (*Salsola laricifolia*) and Ephedra Prizhevalsky (*Ephedra przewalskii)*	Dzhungar Gates
Flood Meadows			
27	Forb grass and forb sedgy marshy	*comm.Alopecurus arundinaceus*+ *Phalaroides arundinacea*+ *Elytrigia repens*+ *Carex muricata*+ *C. vulpina Herbae mesophytica*	Flood bed of Ural River, Irtysh
28	Licorice meadows	comm. Glycyrrhiza uralensis, G. Glabra	Flood bed of Ural River, delta of Ili River, delta of Chu, Syr Darya, Lepsy, Karatal rivers
29	Halophytic forb grass	comm. Puccinellia tenuiflora+Leymus multicaulis+ Aeluropus littoralis+ Hordeum bogdanii+ Trachomitum lancifolium+ Poacinum pictum+ Sphaerophyza salsula+ Orchis salina	Delta of Emba, Irgiz, Sarusy, Chu, Ili rivers
Coastal Water Areas			
30	Cattail reeds	comm. Phragmites australis+ Typha angustifolia+ Trapa natans+ Nimphaea condida	Interstream area of Volga-Ural
31	Reeds	comm. Phragmites australis+ Scirpus kasakstanicus	Avantdelta of Syr Darya
32	Water-marsh area	comm. Phragmites australis+ Typha latifolia+ Nimphaea candida+ Aldrovanda vesiculosa	South Balkhash area
Mountainous Meadows			
33	Tall grass	*comm. Alopecurus pratensis*+ *Dactylis glomerata*+ *Brachypodium pinnatum*+ *Heracleum dissectum*+ *Ligularia heterophylla*+ *L. macrophylla*+ *Aconitum septentreonale*+ *A. leucostomum*	Altai, eastern part of northern Tian Shan, Kungei, Terskei, Ketmen.

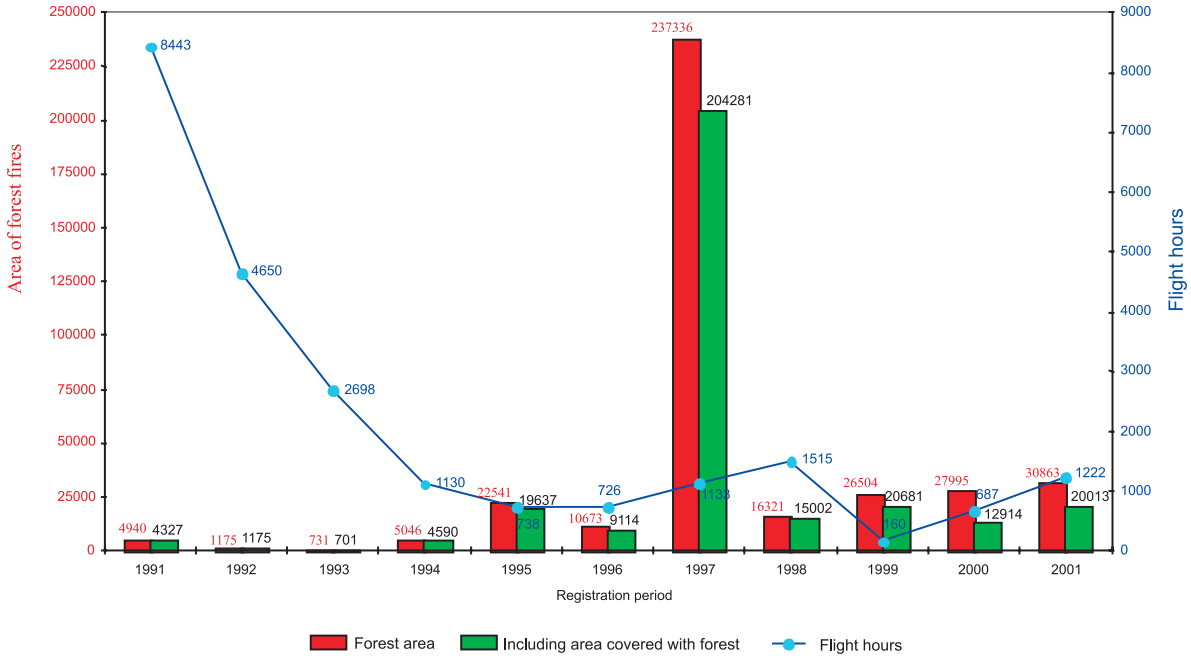
Source: Limited Partnership "Terra", 2002

ANNEX 3.

Figure 1.



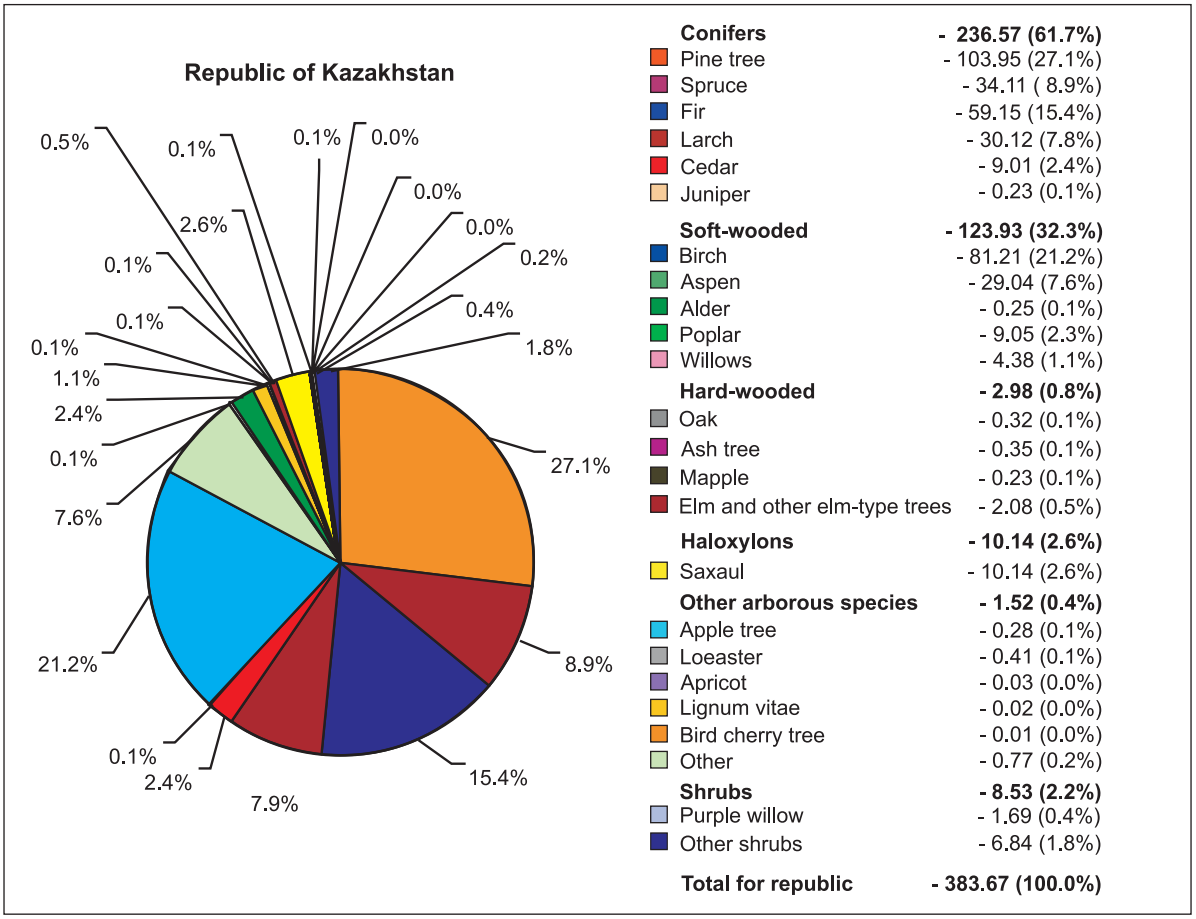
Area of forest fires and flight hours of the air forest protection group



Source: Kazakh State Forest Organization (Kazlesoproject), 2002

ANNEX 3. **Figure 2.**

Standing Timber, mln/m³

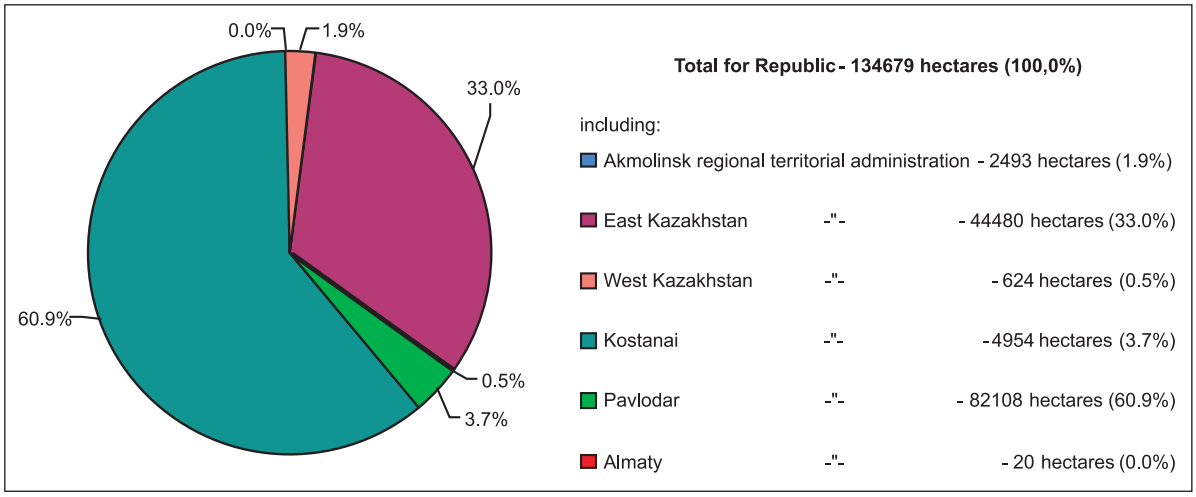


Source: Kazakh State Forest Organization (Kazlesoproject), 2002

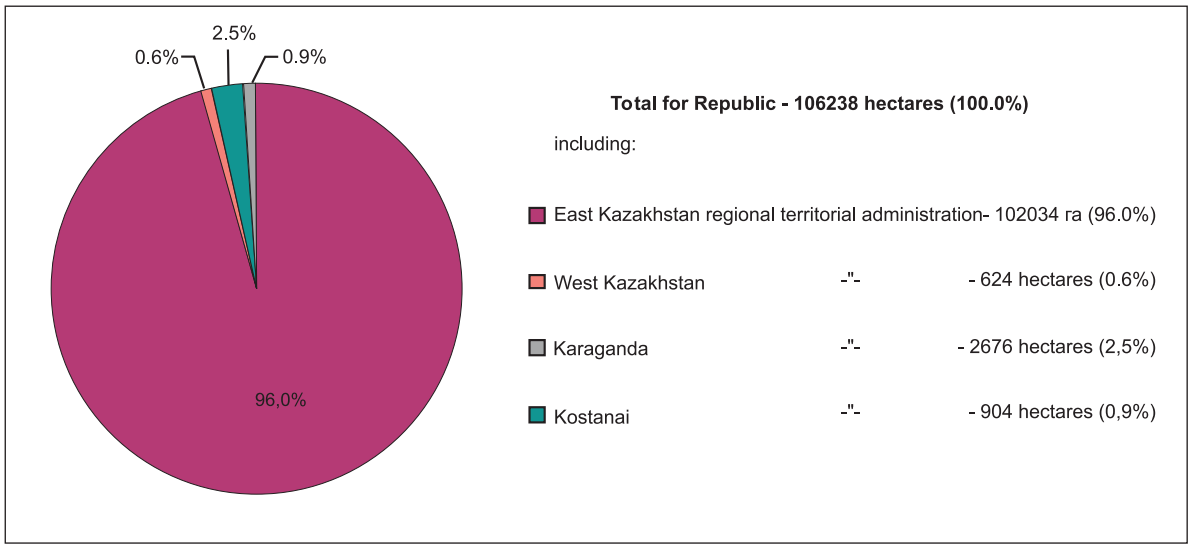
ANNEX 3. **Figure 3.**

Vermin and forest diseases pestholes dynamics in the Republic of Kazakhstan

1Conifers vermin's pestholes by the end of 2001

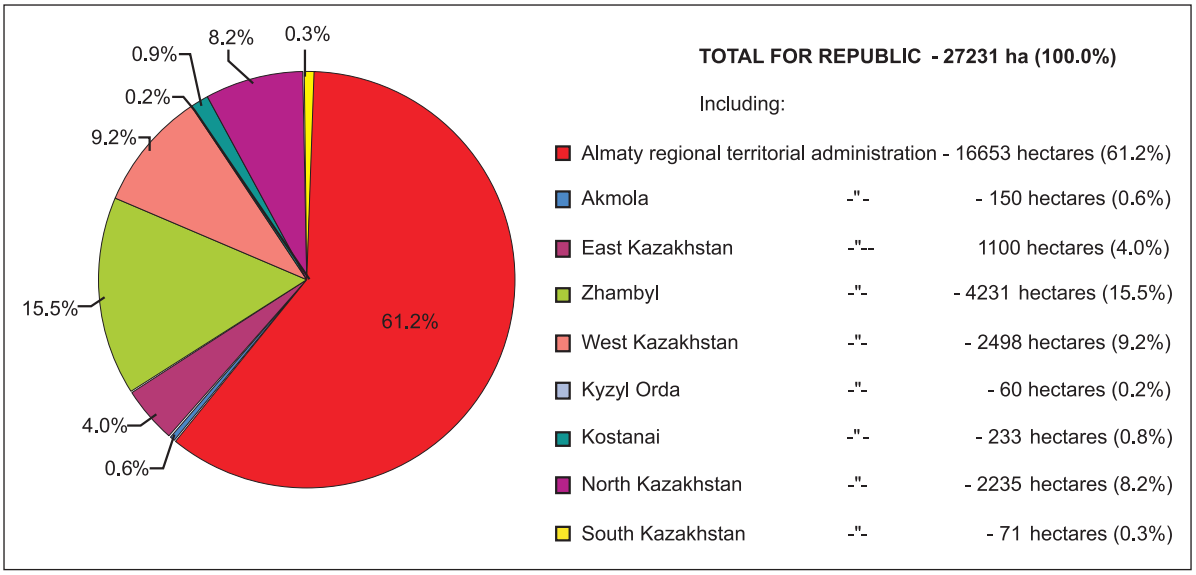


2Stem forests vermin's pestholes by the end of 2001

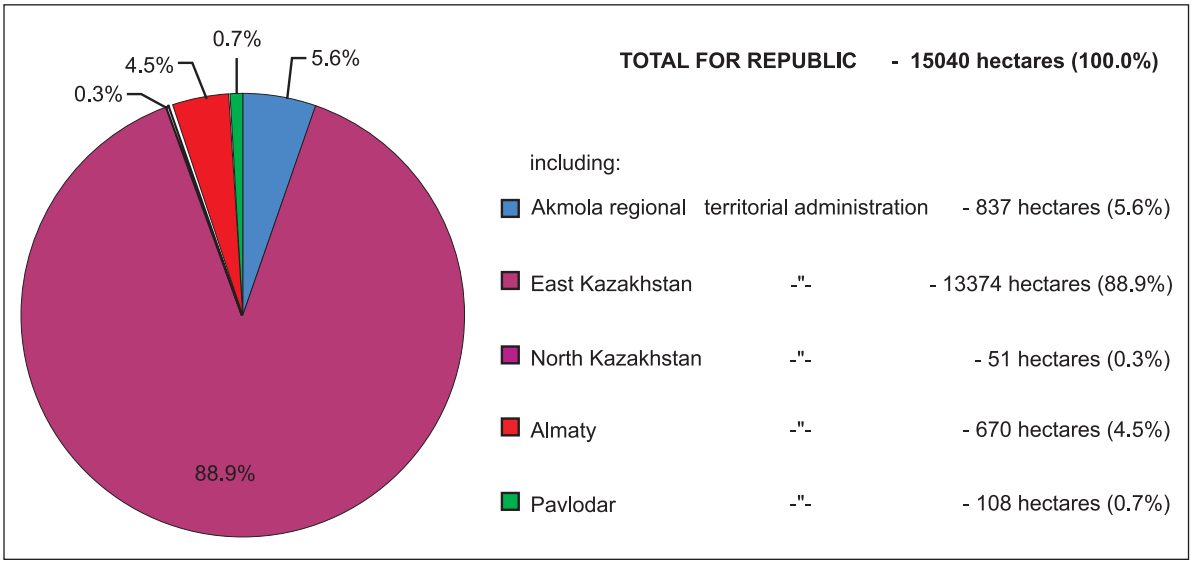


ANNEX 3. **Figure 3. (continuation)**

Hardwood vermin's pestholes by the end of 2001



Forest diseases pestholes by the end of 2001



ANNEX 4.

Table 1.

Incidence of Neoplasm in Population (per 100,000 inhabitants)

Oblasts	Adults		Teenagers		Children	
	1997	2001	1997	2001	1997	2001
RK	586.1	694.0	61.4	113.0	56.7	77.0
Akmolinskaya	690.9	476.5	90.7	79.9	64.0	22.3
Aktobe	451.2	233.4	27.1	13.2	120.9	9.4
Almaty	581.7	339.3	33.5	67.4	32.4	29.4
Atyrau	230.1	197.5	7.2	39.2	11.1	14.7
East-Kazakhstan	827.9	1,113.1	121.6	171.5	49.1	108.9
Zhambyl	674.0	347.5	30.3	27.1	50.5	33.2
West-Kazakhstan	726.3	512.7	16.9	244.5	43.5	61.0
Karaganda	465.0	885.2	107.1	251.4	100.3	105.5
Kyzylorda	538.8	583.0	19.0	56.9	17.5	32.2
Kostanai	439.6	971.6	64.1	173.9	75.2	78.0
Mangystau	200.8	538.0	22.3	5.6	64.8	155.6
Pavlodar	817.6	802.3	127.5	117.6	62.5	60.7
North-Kazakhstan	671.3	1,369.2	87.8	133.5	31.7	433.8
South-Kazakhstan	166.3	579.1	10.1	70.1	12.0	16.8

Source: Center for Health Protection, 2002

Table 2.

Incidence of Respiratory Diseases (per 100,000 inhabitants)

Oblasts	Adults		Teenagers		Children	
	1997	2001	1997	2001	1997	2001
Kazakhstan	9,919.4	10,933.5	17,670.8	25,425.3	31,330.3	41,407.7
Akmolinskaya	6,825.0	8,200.0	20,932.0	30,510.3	29,268.8	33,487.6
Aktobe	9,714.8	15,901.4	10,396.6	16,820.6	34,441.2	36,494.8
Almaty	9,505.6	11,165.0	16,590.7	21,058.2	29,574.9	35,808.6
Atyrau	5,563.9	6,255.4	6,640.3	10,729.4	20,335.2	22,035.4
East-Kazakhstan	10,702.7	14,176.2	26,340.4	48,100.4	35,393.8	63,941.2
Zhambyl	8,525.3	6,968.3	11,0045.4	14,494.6	23,887.9	25,222.0
West-Kazakhstan	8,655.5	7,841.2	18,110.2	20,620.7	36,157.0	40,338.8
Karaganda	12,742.9	10,941.1	16,295.6	24,727.5	32,705.5	42,800.5
Kyzylorda	10,363.6	12,959.1	10,657.1	17,593.5	25,187.9	38,316.2
Kostanai	6,952.9	6,844.3	18,450.6	25,551.4	27,883.5	31,970.9
Mangystau	8,579.1	12,196.0	9,748.6	22,405.6	29,868.6	42,292.3
Pavlodar	10,644.7	9,167.1	22,610.7	32,632.4	39,877.2	52,315.2
North-Kazakhstan	7,101.5	8,637.2	16,073.5	28,021.8	25,349.3	49,661.9
South-Kazakhstan	6,214.4	7,662.0	8,018.7	10,289.4	17,373.3	20,699.8

Source: Center for Health Protection, 2002

Table 3.

Incidence of idiopathic infectious and parasitical diseases in population of Kazakhstan (per 100,000 inhabitants)

Oblasts	Adults		Teenagers		Children	
	1997	2001	1997	2001	1997	2001
Kazakhstan	2,190.9	1,971.1	2,214.3	2,131.7	4,523.6	4,254.0
Akmolinsk	3,219.9	1,663.1	2,736.1	1,451.0	3,541.1	5,281.4
Aktobe	1,862.6	2,694.7	3,376.8	2,934.0	3,764.0	4,778.0
Almaty	1,409.7	658.6	1,535.6	980.6	3,220.6	2,662.0
Atyrau	5,161.4	3,057.5	1,381.3	1,105.9	5,605.4	5,166.3
East-Kazakhstan	2,124.4	1,742.3	3,016.4	2,928.8	4,764.3	4,800.8
Zhambyl	1,514.3	1,342.5	1,156.3	1,521.7	3,496.6	2,715.5
West-Kazakhstan	2,119.0	2,878.9	2,262.7	2,410.7	11,313.1	7,515.8
Karaganda	1,785.4	1,708.6	1,563.3	3,030.9	3,370.3	3,918.3
Kyzylorda	2,607.7	2,398.6	2,600.0	2,512.2	8,685.1	7,092.0
Kostanai	1,264.4	1,823.6	1,818.0	3,195.7	2,965.5	3,405.3
Mangystau	2,656.5	1,851.4	1,865.9	1,233.3	8,447.6	6,315.6
Pavlodar	2,609.3	2,785.2	3,281.9	3,992.6	3,896.3	4,233.6
North-Kazakhstan	1,476.4	2,264.5	1,810.0	2,525.9	3,059.7	5,547.8
South-Kazakhstan	1,799.2	1,956.4	1,885.3	1,343.0	2,728.3	2,196.4

Source: Center for Health Protection, 2002

ANNEX 5.

Table 1.

Multilateral Environmental Conventions/Agreements Ratified by Kazakhstan as of March 1, 2003

№ .	Convention, Agreement	Ratifying Document
1	Convention of the World Meteorological Organization	Resolution of the Supreme Council of the Republic of Kazakhstan «About Joining the WMO Convention» of 18 December1992. Resolution of the Cabinet of Ministers of 13 April 1993 «About Acceding to the WMO Convention».
2	International Convention on Civil Liability for Oil Pollution Damage	Resolution of the Cabinet of Ministers of 04 March 1994 «About Acceding to the International Conventions, Adopted under the Aegis of the International Maritime Organizations (IMO) and to the Convention about IMO». Ratified on 05 June 1994.
3	Convention on the Safety of Marine Living Resources	Resolution of the RK Cabinet of Ministers of 04 March 1994 «About Joining to the International Conventions, Adopted under the Aegis of the International Maritime Organizations (IMO) and to the Convention about IMO». Ratified on 07 June 1994.
4	Convention on Biodiversity	Resolution of the RK Cabinet of Ministers No. 918 of 19 August 1994 «About Approval by RK of the Convention on Biodiversity and Organizing Fulfillment of its Obligations». Ratified on 06 September 1994.
5	Convention on Preservation of the World Cultural and Natural Heritage	Acceding and ratification on 29 July 1994.
6	UN Framework Convention on Climate Change	President's Decree "About Ratification of the UN Framework Convention on Climate Change" of 4 May 1995. Ratified on 17 May 1995.
7	UN Convention to Combat Desertification	Resolution of the Senate of 28 June 1997.The Law of the Republic of Kazakhstan «About Ratification of the UN Convention to Combat Desertification» No. 149-13 of 7 July 1997. Ratified on 9 July 1997.
8	Vienna Convention for the Protection of the Ozone Layer	Law of the Republic of Kazakhstan «About Joining of RK to the Vienna Convention for the Protection of the Ozone Layer», 30 October 1997.
9	Montreal Protocol on Substances that Deplete the Ozone Layer	Law of the Republic of Kazakhstan «About Joining of RK to the Montreal Protocol on Substances that Deplete the Ozone Layer», 30 October 1997.
10	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	The Law of the Republic of Kazakhstan «About Ratification of the Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 27-29 June 1990» No.191–II, 7 May 2001.
11	Energy Charter Agreement and Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects	President's Decree «About Ratification of Energy Charter Agreement and Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects» of 18 October 1995.
12	Convention on the International Trade of Endangered Wild Flora and Fauna Species under CITIEC	President's Law «About Joining of the Republic of Kazakhstan to the Convention on the International Trade of Endangered Species of Wild Fauna and Flora» of 6 April 1999. Ratified on 19 April 2000.

13	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques	Resolution of the Supreme Soviet of 20 February 1995 «About Joining of RK to the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques» 13 April 1993.
14	Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters	Law of the Republic of Kazakhstan about Ratification No. 92-II of 23 October 2000.
15	Convention on Environment Impact Assessment in a Transboundary Context	Law of the Republic of Kazakhstan about the Joining No. 86-II of 21 October 2000, ratified on 10 April, 2002
16	Convention on Transboundary Impact of Industrial Accidents	Law of the Republic of Kazakhstan about Joining No. 91-II of 23 October 2000, ratified on 10 April, 2002
17	Convention on the Protection and Use of Transboundary Watercourses and International Lakes	Law of the Republic of Kazakhstan about Joining No. 94-II of 23 October 2000, ratified on 10 April, 2002.
18	Kyoto Protocol to the UN Framework Convention on Climate Change	Presidential Decree of March 12, 1999
19	Stockholm Convention on Persistent Organic Pollutants	Resolution of the Government of the RK dated May 18, 2001
20	Convention on Long-Ranged Transboundary Air Pollution	Law of the Republic of Kazakhstan about Joining No. 89-II of 23 October 2000. Ratified on 10 April, 2002
21	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Law of RK "About Kazakhstan's Acceding to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal». February 15, 2003

Table 2.

Conventions and Agreements Joint by Kazakhstan

No.	Name of Convention, Agreement	Date of a decision to join	Status
1	Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention)	1997	Being considered
2	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	1979	Set of ratification documents is being prepared
3	Agreement on the Conservation of Afro-Eurasian Migratory Wetland Birds	1997	Being considered

Table 3.

Conventions and Agreements of Importance to Kazakhstan

Convention/Agreement
Convention on Biodiversity: The Cartahen Protocol on Biological Security (2000)
Convention on Conservation of European Wildlife and Natural Habitats (1979), Bonn Convention
Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer: Copenhagen Amendment (1992), Montreal Amendment (1997)
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (1998)
Convention on the Protection and Use of Transboundary Watercourses and International Lakes: Water and health Protocol (1998)
Protocols and Conventions on Long-Range Transboundary Air Pollution: 1. Protocol on Heavy Metals (1998)
2. Protocol on Long-Term Financing of the European Monitoring and Assessment Program (1984).
3. Protocol on Volatile Organic Compounds (1991)
4. Protocol on Persistent Organic Pollutants (1998)
5. Protocol to Abate Acidification, Eutrophication and Tropospheric Ozone(1999)
6. Protocol on Regulation of Nitrogen Oxide Emissions (1988)
7. Protocol on Reduction of Sulfur Emissions (1985)
8. Protocol on Further Reduction of Sulfur Emissions (1994)
Convention on Preparedness in case of Oil Pollution, Response Measures and Cooperation (London, 1990)
Convention on Establishment of the International Fund to Compensate for Oil Pollution Damage /with amendments/ (Brussels, 1971)

Table 4.

Allocation of Funds for Implementation of Multilaterial Environmental Conventions, as of March 1, 2003

Convention, Agreement Year of ratification	Kazakhstan's annual fee, USD	Project Actions	Grants Received '000 USD
Convention on Biodiversity, 1994	12,126	GEF Project «Preservation of Biodiversity of the Western Tien Shan», World Bank, TACIS GEF Project «Integrated Conservation of Wetlands in Kazakhstan» GEF Project «In-situ Mountain Agrobiodiversity Conservation» GEP Project "Strategy on Biodiversity" Workshop on Legal Aspects of Implementation of Biodiversity Conventions (UNEP). GEF Project «Conservation and Sustainable Use of the Biodiversity in the Kazakhstani Sector of the Altai–Sayan Ecoregion» Caspian Environmental Program (Azerbaijan, I.R.Iran, Ryssia, Tyrkmenistan)'	 2,700 8.710 137.2 252.9 307.7 60 4,976 Total 17,143.8
Montreal Protocol on Substances that Deplete the Ozone Layer, 1998	N/a	Preparation of the National Program of the RK on Withdrawal from the Use the Ozone Depleting Substances Workshop «Alternative Technologies on Solvents». Regional Consultative Meeting of Central Asian and Caucasian Countries.	25 3 2 Total 30
London Amendment to the Montreal Protocol, 2001	85,000 voluntary	Withdrawal of Substances that Deplete the Ozone Layer	3,987.3
CITIEC Convention, 2000	3,000	Implementation of the Country's Right for Independent Trade of Flora and Fauna Species	
The Aarhus Convention, 2000	N/a	Kazakhstan-Denmark Implementation Project	213.6
		Assessment of the Country's Potential to Implement Provisions of Environmental Conventions	228.6

UN Framework Convention on Climate Change, 1995	16,207	GEF/UNDP Project « Wind Energy Development in Kazakhstan». GEF/UNDP Project «Removing Barriers to Energy Efficiency in Municipal Heat and Hot Water Supply» Project «Light Generated by Wind» (Construction of a wind facility in Aralsk). Project «Reduction of Greenhouse Gas Emissions in Kazakhstan» (2 workshops and a study tour).	375 261,9 52 100 Total 788.9
Stockholm Convention on Persistent Organic Pollutants (POPs)		Initial Assistance to Kazakhstan to Meet Its Obligations under the Stockholm Convention on POPs	500
UN Convention to Combat Desertification, 1997	4,710	Development of National Preparatory Activities to Combat Desertification Development of a National Action Plan to Combat Desertification UNSO/UNDP Project on Rehabilitation of Pastures in the Aral Sea Region Development of a National Report to Combat Desertification Workshop on Preparation of National Reports for the Countries of Central Asia, Europe, and the Caucasus Development of a National Strategy and a National Action Plan to Combat Desertification Completion of the National Action Plan and Identification of Investment Projects (ADB project) WB/GEF Project «Drylands Management»	25 60 90 4 20 25 50 350 Total 624
		Grand total	22,544,000 USD

Table 5.

Applicability of MEC Provisions for Regional Programs and Conventions

Convention name	Cooperation areas	Regional documents using the convention provisions
UN Convention to Combat Desertification	Creeping sands Transboundary pollution of water courses Desertification monitoring Rented pastures Prevention of droughts	Regional program to Combat Desertification in Central Asia REAP projects under the thematic area: Land Degradation. In REAP, there is an intent to establish a regional office to combat desertification
Convention on Biodiversity Cartahena Protocol	Transboundary protected territories	Regional pattern of CA protected territories The Red Book of the CIS
Convention on Conservation of Migratory Species	Migratory mammals and birds	CA regional projects for conservation of saiga and wetlands The Red Book of the CIS
Convention on Conservation of the World Cultural and Natural Heritage	Natural and cultural monuments, common for the CAR	A preparation of CA program for preservation of natural and cultural monuments, funded by UNESCO, is under consideration
CITES Convention	Cooperation of CA countries in preventing smuggling and unification of laws	CA protected territories pattern CIS Convention of Environmental Safety
UN Framework Convention and the Kyoto Protocol on Climate Change.	Cooperation in development and unification of regulatory and methodological base	The projects under the section of Air Pollution CA REAP
Vienna Convention on Protection of the Ozone Layer Montreal Protocol London amendments Copenhagen amendments	Cooperation in development and unification of regulatory and methodological base Exchange of implementation practices	The projects under the section of Air Pollution CA REAP Intentions to establish a regional office funded by GEF/ UNEP have been discussed
The Aarhus Convention on Access to Environmental Information	Cooperation with NGOs, governmental bodies, regional organizations in the area of environmental protection and sustainable development	IFAS Public Council CA REC Consultative Council ICSD Public Council A project is being prepared on supporting Aarhus Convention in the Central Asian countries
Convention of EIA in a Transboundary Context	Adjustment to the Sub-regional activities is required	GEF project on «CA Water Resource Management». Projects under CA REAP sections of Air Pollution, Water Contamination EIA Instructions for the CIS countries
Convention on Transboundary Impact of Industrial Accidents	As above	Projects under CA REAP sections of Air Pollution, Water Contamination Framework Convention on the Caspian Sea region CIS Convention on Environmental Safety
Convention on the Protection and Use of Transboundary Watercourses and International Lakes	As above	GEF project on «CA Water Resource Management». SPECA Project of «CA Water and Energy » CIS Agreement on Transboundary Water Facilities Framework Convention on the Caspian Sea region
Convention on Long-Range Transboundary Air Pollution	As above	Projects under CA REAP section of Air Pollution A project is being prepared on supporting the Convention in the Central Asian CIS Agreement on a Uniform Monitoring System

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	As above	Projects under CA REAP section of Waste Management CIS Agreement on the Control of Transboundary Movements of Hazardous and Other Wastes CIS Agreement on a Unified System of Classification and Coding of Industrial Waste CIS Convention on Environmental Safety
Stockholm Convention on Persistent Organic Pollutants (POP)	Inventory and control over the Circulation and Transportation of Persistent Organic Pollutants	Subregional Program on Fighting Desertification in CA Projects under CA REAP section of Degradation of Land CIS Agreement on a Uniform Monitoring System A project is being prepared on supporting the Convention on POP in the Central Asian
UN Rotterdam Convention on the Procedure… of Hazardous Chemicals and Pesticides in International Trade в	Information and control over the circulation and transboundary transportation of Hazardous Chemicals and Pesticides and Persistent Organic Pollutants	Subregional Program on Fighting Desertification in CA Projects under CA REAP section of Degradation of Land Framework Convention on the Caspian Sea region CIS Convention on Environmental Safety

Table 6.

Information on Multilateral Environmental Conventions and Agreements Ratified by the CAR Countries

No.	Convention/Agreement	Kazakhstan	Kyrgyzstan	Uzbekistan	Tajikistan	Turkmenistan
1	Convention on Biodiversity	06.09.1994	26.07.1996	17.10.1995	29.01.1998	14.06.1996
2	UN Framework Convention on Climate Change	17.05.1995	Joint on 25.05.2000	21.03.1994	Joint on 07.01.1998	01.11.1999
3	UN Convention to Combat Desertification	09.07.1997	19.12.1997	31.08.1995	12.08.1997	18.09.1996
4	Vienna Convention on Protection of the Ozone Layer Montreal Protocol London Amendments Copenhagen Amendments	30.10.1997 30.10.1997 23.05.2001	31.05.2000 31.05.2000	18.05.1993 16.10.1997 01.05.1998 01.05.1998	06.05.1996 07.01.1998 07.01.1998	18.11.1993 18.11.1993 15.03.1994
5	Aarhus Convention	23.10.2000	2001		09.06. 2001	25.06.1999
6	Convention of EIA in a Transboundary Context	21.10.2000				
7	Convention of Transboundary Impact of Industrial Accidents	23.10.2000				
8	Convention on the Protection and Use of Transboundary Watercourses and International Lakes	23.10.2000				
9	Convention on Long-Range Transboundary Air Pollution	23.10.2000	25.05.2000			
10	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	24.09.97 15.02.2003 joining	18.01.1996	07.02.1996		18.06.1996
11	Bonn Convention on Conservation of Migratory Species	02.12.1994 13.12.1998		01.09.1998		13.12.1998
12	Convention on Conservation of the World Cultural and Natural Heritage	29.07.1994	03.07.1995	22.12.1995	28.08.1992	30.09.1994
13	Convention on International Trade of Endangered Wild Fauna and Flora Species (CITES)	19.04.2000		08.10.1997		
14	Stockholm Convention on Persistent Organic Pollutants					
15	UN Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade		25.05.2000		28.09.1998	

Table 7.

Implementation of Environmental Projects in Kazakhstan, 1996-2003 (as of March 1, 2003)

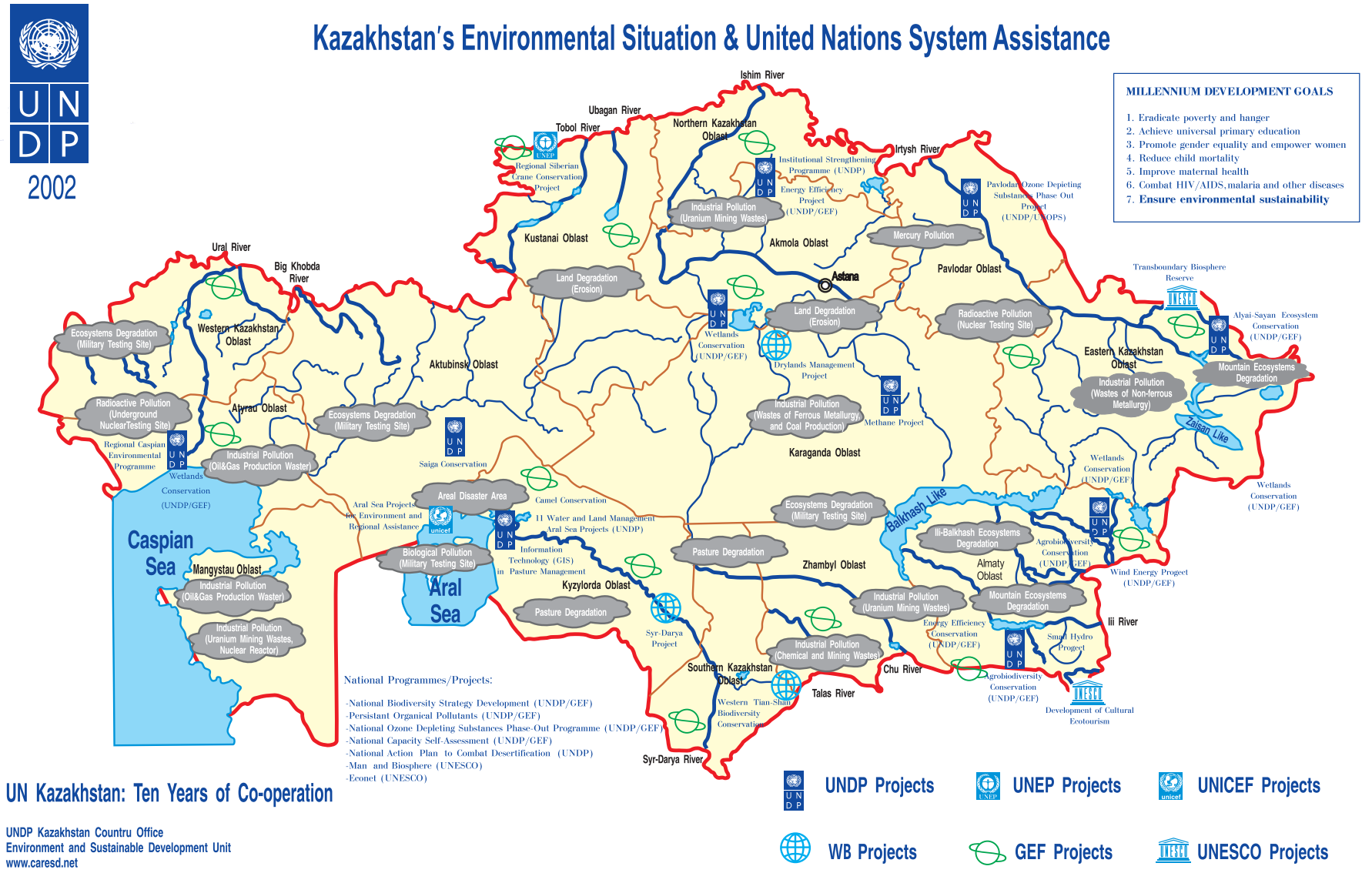
No.	Programs and Projects	Terms	Actual financing, thousand USD	Perspective financing until 2005, thousand USD	Source of financing
1.	Wind Energy Development in Kazakhstan	1998-2001	350.0	2,100.0	UNDP/GEF
2.	Removing Barriers to Energy Efficiency in Municipal Heat and Hot Water Supply	1999-2001	261.9	3,000.0	UNDP/GEF
3.	Integrated Conservation of Priority Wetlands in Kazakhstan	1998-2001 2003-2010	137.2	 8,710.0	UNDP/ GEF
4.	In-situ Conservation of Kazakhstan's Mountain Agrobiodiversity	1999-2001	252.9	3,000.0	UNDP/ GEF
5	Conservation of the Western Tian-Shan Biodiversity	1999-2004	1,288.0 1,000.0	1,412.0 500.0	WB/GEF TACIS
6	National Strategy for Biodiversity Conservation	1996-2003	307.7		GEF/UNDP
7	Conservation and Sustainable Use of Biodiversity of the Kazakhstani Sector of the Altai-Sayan Ecoregion	2002-2006	60.0	1,000.0	GEF/UNDP
8	Reduction of Adverse Impacts of Automobile Transport on the Environment and Health of the Population in Almaty	1999-2001	920.0	16,000.0	TACIS
9	Prevention of Air Pollution from Heating and Power Enterprises in Pavlodar, Ekibastuz and Aksu	1998-2000	20		Japan
10	Elimination of Pollution Caused by Mercury at KhimProm JSC	1999-2003		8,000.0	France
11	Transboundary Management of the Irtysh River Basin	1999-2002	920.0		France
12	Establishiment of the Water Resources Management of the Nura-Ishim River Basin	1999-2004		50,000.0	WB

13	Clean-up of Mercury in the Nura River and Rehabilitation of Water Reservoirs of the Nura-Ishim River Basin	1999-2004	696	5,000.0	WB
14	Water supply, sanitation and healthcare of settlements in the Kyzylorda Oblast	2000-2004	14,099.0		Kuwait Fund
15	Regulation of the Syr Darya River Bed and the Northern Part of the Aral Sea	2000-2007	66,015.0		WB
16	Pilot project of Water Supply for Kazalinsk/Novokazalinsk, Kyzylorda Oblast	2000-2004	5,000.0	5,000.0	Germany
17	Drylands Management	2000-2005	350.0	7,000.0	WB/GEF
18.	Pilot project of Water Supply for Kyzylorda Oblast	1997-2000	7,000.0	-	WB
19	Rehabilitation of Ground Waters Contaminated by Industrial Wastes in the area of Ust-Kamenogorsk	1999-2000	136.0		Germany
20	Central Asian Regional Environmental Action Plan	2000	29.5	-	ADB
21	Technical Assistance on Strengthening Environmental Capacities	2000	700.0	-	ADB
22	Development of Rural Water Supply and Sewage Systems in Kazakhstan	2001	600.0	49,500.0	ADB, ISDB
23	Water Supply and Sanitation in Karaganda, Temirtau, and Kokshetau	2001	482.0	77,000	WB
24	Building Capacities of Water Users Associations for Sustainable Development of the Aral Sea Basin	2000-2002	233.7		UNDP, IFAS
25	Caspian Environment Program	1999-2002	25.0	19,000.0	UNDP, TACIS
26	Institutional Strengthening for Sustainable Development Program	2001-2004	932.0	932.0	UNDP
27	Program for Rehabilitation of the Semipalatinsk region Ecology, Environment, and Agriculture	1999-2003	6.2	750.0	WB/UNDP
28	Project on Support for Implementation of the Aarhus Convention in Kazakhstan	2001-2003	230.0	-	DEPA (Denmark)
29	National Programme for Recovery/ Recycling of Refrigerants	2001-2003	2,356.7		UNDP, GEF

30.	Phasing out the Use of Chlor-Ftor-Carbon (CFC)-11 in the Manufacture of Polyurethane Foam for Thermal Insulation	2001-2003	1,068.8		UNDP/GEF
31	Phasing out the Use of Chlor-Ftor-Carbon (CFC)-11 in the Manufacture of Flexible Foam	2001-2003	264.0		UNDP/GEF
32.	Elimination of CFC-113 as solvents in Pavlodar Chemical Production Facility	2001-2003	99.0		UNDP/GEF
33.	National Halon Management Scheme Programme	2001-2003	151.1		UNDP/GEF
34.	Gradual Elimination in the Production and the Use of the Ozone Depleting Substances in Kazakhstan (Institutional strengthening)	2001-2004	1,091.3		UNEP/GEF
	TOTAL, thousand USD		106,083.0	302,904.0	

ANNEX 5.

Figure 1.



GLOSSARY

Aerosol – particles of solid or liquid matter suspended in a gaseous medium. Aerosol with liquid particles is a mist; with solid particles a smoke. The radius of solid particles of Aerosol is $10^{-8}/10^{-2}$ cm, radius of droplets $10^{-5}/10^{-1}$ cm.

Air (atmospheric) pollution – emission into the air or formation in the air of physical agents, chemicals and organisms that unfavorably influence the habitat and the property.

Anthropogenic factors – forces of processes occurring in nature, whose origins are related to human activity and human influence on the environment.

Aridity – dryness of climate that results in lack of moisture for survival of living organisms.

Atmosphere – a gaseous cover of the Erath that consists of a mixture of different gases, water vapor and dust. Modern Atmosphere is to the significant extent a product of living matter of the biosphere. Full regeneration of the planet's oxygen by the living matter takes 5200 to 5800 years. The full mass of oxygen is taken up by the living organisms within approximately 2 thousand years; and carbon dioxide within 300 to 395 years.

Biocoenosis – any community of interrelated organisms living in an area of land or a water reservoir.

Biosphere – the lower part of the Earth's atmosphere, entire hydrosphere and upper part of lithosphere populated by living organisms, the "area of subsistence of the living matter" (V.I. Vernadsky); the coat of Earth where aggregate activity of living organisms is manifested as a geochemical factor of a planetary scale.

Biosphere reserve – a representative landscape unit allocated for preservation, research and/or monitoring as part the UNESCO "Humans and Biosphere" program. 243 biosphere reserves with the total area of more than 120 million hectares have been set up in more than 60 countries of the world. There are no biosphere reserves in Kazakhstan.

Carcinogen – a substance or physical agent that promotes emergence or development of cancer. Most carcinogens have anthropogenic origin.

Deflation – blowing, grinding and polishing of rocks and soils by mineral particles carried by the wind, as well as transfer of fine products of erosion (dust, sand etc.) Deflation is most intensive in deserts. Synonym: winnowing; partial synonym: blowing (only carrying-out of particles).

Desertification – 1. loss by an area of vegetation cover due to natural extinction or elimination to the point of loss of the ability of self-reproduction. 2. elimination or decrease in economic potential of land, which leads to emergence of desert conditions.

Drinking water – water in which indicators of bacterial and organoleptic properties and the level of toxicity of chemical elements are within the standards of drinking water supply.

Environmental catastrophe – an irreversible phenomenon, 1) a natural anomaly (long drought, massive deaths of livestock, etc.), which often occurs as a result of a direct or indirect human influence on natural processes results in unfavorable economic consequences or massive deaths in the population of a certain region; 2) a breakdown

of a technical device (a nuclear power station, tanker etc.) that leads to unfavorable changes in the environment and, as a rule, massive deaths of living organisms and economic damage.

Environmental crisis – strained state of relations between humankind and nature, characterized by lack of correspondence between the development of productive forces and production relations in the human society and the resource and ecological capacity of the biosphere.

Ecosystem – environmental system. Any community of living organisms and its habitat, united as one whole that comes into existence on the basis of mutual dependence and the cause-effect lins between individual ecological components.

Endemic – local species that inhabits one given region (with no limit on area; it can be a continent, an island, the top of a mountain, etc.)

Environmental capacity – the quantitatively expressed capacity (number of individuals per unit of area, limits of capacity during economic development), of a habitat that allows the ecosystem to exists without damage to its constituent components.

Environmental monitoring – monitoring the condition of the natural environment surrounding humans and warning of emergency situations harmful and dangerous for the health of the people and other living organisms.

Environmental safety – 1) a set of actions, conditions and processes that do not lead, directly or indirectly, to vital damage (or threat of such damage) of natural environment, individuals and the humankind; 2) a complex of conditions, phenomena and actions that ensure an ecological balance on Earth and in any of its regions of a level the society is ready for (can adjust to without serious damage) physically, socio-economically, technologically an politically. Environmental safety may be examined within the global, regional local framework.

Erosion – the decay of rocks, soils or any surfaces with loss of their integrity and a change in their physical and chemical properties, usually accompanied by transfer of particals from one place to the other.

Extinction – disappearance of a group of living organisms (plants, animals) as a result of evolution or human activity. The speed of Extinction increases due to disappearance of natural habitats (disafforestation, ploughing of steppes, regulation of rivers). Modern rate of extinction is approximately 10 thousand times higher than in the era of extinction of dinosaurs.

Herbicide – a substance used for selective or total elimination of unwanted herbaceous plants (and sometimes shrubs and woody plants). As a rule, high concentrations of Herbicides are harmful to human health and lives of animals.

Health – the objective state and subjective feeling of total physical, psychological (mental) and social comfort (as defined by the World Health Organization).

Hydraulic power engineering – extraction of energy from flowing water, with or without building a dam. In spite of relative inexpensiveness of water power, in the future it will account for no more than 5% of the total world power due to limited resources and territorial capacity of the power plant (water reservoir).

Hydrosphere – the sum of all water on Earth, including inland water (internal water, ground water, surface water) oceanic and atmospheric water. Only waters located on the surface of the planet (inland and oceanic) are treated as a separate Earth coat.

Industrial water – water with structure of components and composition sufficient for extraction of the components on an industrial scale.

Insecticide – substances used to eliminate the insects unwanted in economic activity or in natural communities.

Isolation – exposure of the Earth's surface to solar radiation of all types, providing thermal, luminous and radiation influence. Measured by the number of units of energy per unit of area per unit of time. Depends on solar activity, season, time of day and geographical coordinates.

Landscape – a relatively homogeneous territory in terms of genesis, with observed set pattern of areas identical in geological structure, landform, hydrology, microclimate, biocoenosis and soils. Landscape is the lowest category of geographical mapping.

License – a permission (usually paid) issued by specially authorized government agencies for the right to conduct economic activity or an activity that impacts the nature (shooting game, fishing, release of polluting substances, felling, commerce etc.)

Living matter – the aggregate of bodies of living organisms that populate the Earth, regardless of their belonging to a system. The total (dry) weight is estimated at 2.4 to 3.6×10^{12} tons.

Maximum Permissible Concentration (MPC) – a specification of quantity of harmful substance in the environment that does not influence human health and does not result in unfavorable consequences in the offspring during either constant contact or influence over a certain period of time. Set legislatively or recommended by competent institutions (committees etc.) Recently, not only the influence of a pollutant on human health, but also the influence on entire natural communities is measured.

Mineral fertilizer – mined or industrially produced chemical compound containing large amount of one or several major plant nutrients (nitrogen, phosphorus, potassium), as well as important microelements (copper, boron, manganese, etc.) or natural products like lime, plaster, ash, etc. that can improve chemical or structural properties of soil.

Mutation – an abrupt hereditary change in organisms that influences their anatomical or physiological-behavioral characteristics. Related to the change in number and structure of a gene or a group of genes.

National Park – established to protect the natural complexes that have special ecological, historical and esthetic value by way of favorable combination of natural and cultivated landscapes and to use them for recreational, educational scientific and cultural purposes. The national parks have special administration that manages either the entire land area of the park or just its specially protected section. There is a total of 2 thousand national parks in the world with the total area of more than 4 million km^2. There are 7 national parks in Kazakhstan with the total area of 1.4 million hectares.

Nature Monument – natural objects of small size (barings, a relic ash-tree grove, the Charyn canyon, the Turgen fir-grove with their immediate surroundings . There are 25 natural monuments in Kazakhstan.

Background pollution – pollution of the environment, where the pollution source is a natural process or phenomenon not directly related to human activity (e.g., a volcanic eruption, dust storm, floods, spontaneous fires, etc.)

Natural resources – natural goods are used by humans as instruments of labor (land, waterways, water for irrigation), sources of energy (hydraulic energy, oil, coal), raw materials (minerals, forests, water), articles of consumption (drinking water, plants, flowers, poultry and seafood), for recreation, gene pool. There are recoverable and non-recoverable, renewable and non-renewable, replaceable and irreplaceable natural resources.

Nature management – the use of natural resources in the public production to satisfy the material and cultural wants of the society. Nature management consists of: extraction and processing of the natural reserves, their renewal or reproduction; usage and protection of the natural environmental living conditions; and preservation, reproduction (restoration) and rational altering of the environmental balance.

Nature reserve – a territory (water area) under legal protections where all economic activity, including visits by people, is banned completely in order to preserve the virginal condition of the natural complexes (natural standards), protect the living species and monitoring of natural processes. There are 9 State Nature Reserves in Kazakhstan.

Non-waste technology – an ecological strategy of industrial production that includes a complex of measures to ensure minimal waste of natural resources at maximum economic efficiency.

Organic fertilizer – mould, peat, manure, bird dung, composts, green manure, bacterial fertilizers, all products

of half-disintegration of vegetation, animal excrement (often together with litter and remainder of feed), used for increasing the fertility of soil, or biological additives that facilitate the development of useful microflora in the soil.

Pasture – an area of herbaceous (grassy) vegetation (meadows, steppes or grasses under the cover of the forest trees) used and maintained for grazing of domestic animals.

Pesticide – a chemical compound used to protect plants, agricultural products, wood, wool, cotton and leather products, to eliminate animal ectoparasites and fight the carriers of dangerous diseases.

Plough land – an area of soil that is systematically cultivated and used for sowing crops, including perennial row crops, but not necessarily frequently sowed, for example, with zero tillage method. There are irrigable, drained, and erosion-susceptible plough lands, and others.

Pollutant(s) – a polluting substance, any (natural or anthropogenic) physical or information agent, a chemical or biological species (mostly microorganisms), that get into or appear in the environment in quantities that exceed the limits of normal natural fluctuations or natural background levels during at the given time.

Pollution index – the qualitative and quantitative assessment of polluting origin (substance, radiation, etc.). This term has takes very numerous meanings, including the notion of volume (quantity) of the polluting substance (pollutant) in the environment and the degree of its impact on objects including humans, correlated with time and intensity.

Population – an aggregate of individuals of the same species that populate the same areas throughout many generations. Separated from other similar aggregates by a certain degree various isolation factors (biol.). Every population is capable of developing (in theory, indefinitely) given the appropriate environmental conditions.

Purified water – water treated to contain the level of impurities at or below the natural background level (or maximum permissible level).

Radiation safety – measures aimed at protecting personnel and the population from ionizing radiation. The annual norms of radiation load are 5 Roentgen (5 rem) for personnel and 0.5 Roentgen (500 mrem/year) for people who live near nuclear power or similar plants.

Recreation – recovery of one's health and ability to work by resting in the nature.

Recycling of atmospheric pollution – using energy or substances (gaseous, pulverized, vaporized) present in the used air of the industrial plants. E.g. extracting sulphuric acid from sulphurous gases in the non-ferrous metallurgy.

Recycling of Household Waste – entails extraction from the waste of valuable components (mostly metals) and incombustible components (glass) with subsequent burning or fermenting or organic substances in order to extract energy (either directly or indirectly through biogas) and raw materials for production of construction materials, composts, etc.

Recycling of Industrial waste – converting industrial waste into recycled raw materials, fuel, fertilizers, or for other purposes.

Recycling of wastewater – utilization of useful components present (either diluted or suspended) in household, rain or industrial wastewater and further use of such water, after purification, for irrigation of fields and/or forests.

Reservoir – a natural or artificial accumulation of flowing and quiescent water (a lake, river, pond, etc.) A Reservoir in the narrow sense (as a place of accumulation of quiescent water) is distinguished from a watercourse (a river, canal, and stream).

Service water – water, except drinking, mineral and industrial, that is suitable for economic use.

Soil – a special organic-mineral natural historic formation, product of action of living organisms upon the mineral understratum, decomposition of dead organisms, influence of natural water and atmospheric air on surface horizons of rocks in various terrain and climatic conditions in the Earth's gravitational field. Soil is characterized by fertility and is one of the most important natural resources. The thickness of soils may reach 2 to 3 meters.

Soil pollution – an injection into the soil and appearance in the soil of new, usually uncharacteristic physical, chemical or biological agents or exceeding, within a given time period, of the average annual level of concentration of numerous agents (within its extreme fluctuations).

Suspended solid particle – every solid volatile particle. This category is comprised of soil dust, volatile ashes of coal thermal power stations, various aerosols, including salt aerosols (marine salts, volatile saline soils), solid particles of automotive exhaust emission, exhaust from other engines, aerosols form metallurgic and other plants.

Sustainable development – a concept first described by Gru harlem Brutland in her speech entitled "Our Common Future". Sustainable development entails a development of society that will satisfy the wants of the current generation without depriving the generations to follow of the same opportunity.

The Red Book – the list of organism that are rare or face extinction; an annotated list of species and subspecies with information on past and present spreading, quantity and reasons for its reduction, peculiarities of reproduction, already taken and sill necessary measures to protect the species.

Waste - raw materials not suitable for production of a given product, its unusable leavings or substances (solid, liquid and gaseous) that appear throughout the technological process, as well as energy, that were not cannot subjected to utilization. Waste from one production process could be the raw material for another production process. As a rule, not included in the category of waste are natural substances implicitly used in production, like air, its oxygen, "transiting" water, etc. Unused waste becomes refuse.

Wastewater – 1) water that was in industrial/household or agricultural use, as well as water that passed through a polluted area, including populated areas (industrial waste, agricultural wastewater, communal wastewater, storm wastewater, etc.) 2) water disposed of after household or industrial use

Water erosion – the process of decay of soils, rock matter and construction materials by melt-water, rainwater and flowing water. There are many types of water erosion, among them lateral erosion, vertical erosion, river-bed erosion, irrigation erosion, droplet erosion, gully erosion, surface erosion, underground erosion, etc.

Water pollution -- an injection into the water or formation (synthesis, reproduction etc.) in the water of physical agents, chemical or biological agents that unfavorably influence the habitat and damage property.

Watercourse – water moving along a course (riverbed). E.g., river, stream. There are temporary and permanent watercourses.

Zapovednik – an area where certain types of economic activity are (temporarily or permanently) banned in order to protects one or several species of living organisms. Often and as a rule, the Game reserve itself is not the main user of land it occupies. There are 54 national zapovedniks in Kazakhstan.

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